From: "Strosnider, Kimberly" <kstrosnider@cov.com>
To: "'tmooney@bis.doc.gov'" <tmooney@bis.doc.gov>
Date: Thu, Feb 10, 2011 11:36 AM
Subject: RE: Comments in Response to "Notice of Inquiry - CCL"(BIS-2010-0039)

Dear Mr. Mooney:

In follow up to our call of yesterday, I confirm that Oceaneering understands these comments will be posted for public review and that it does not object to that posting.

Please let me know if you have any questions.

Regards,

Kim Strosnider

Covington & Burling LLP
Washington, D.C.
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From: Strosnider, Kimberly
Sent: Monday, February 07, 2011 4:22 PM
To: 'publiccomments@bis.doc.gov'
Cc: 'tmooney@bis.doc.gov'
Subject: Comments in Response to "Notice of Inquiry - CCL" (BIS-2010-0039)

Dear Mr. Mooney:

On behalf of our client Oceaneering International, Inc., please find attached comments in response to the Advance Notice of Proposed Rulemaking regarding revisions to the Commerce Control List, which was published December 9, 2010 in the Federal Register (75 Fed. Reg. 76,664) (Reference "Notice of Inquiry - CCL"). A hard copy of these comments, along with their enclosure, is being delivered to you today by courier.

If you have any questions about these comments, please let me know.

Regards,

Kim Strosnider
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Washington, D.C.
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This message is from a law firm, Covington and Burling LLP, Washington, D.C., and may contain information that is confidential or legally privileged. If you are not the intended recipient, please immediately advise the sender (Kim Strosnider, kstrosnider@cov.com<mailto:kstrosnider@cov.com>) by reply e-mail that this message has been inadvertently transmitted to you and delete this e-mail from your system. Thank you for your cooperation.

<< File: Notice of Inquiry--CCL, Comments of Oceaneering International, Inc..pdf >>

CC: '"David Lawrence"' <DLawrence@oceaneering.com>

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February 7, 2011

Via Hand Delivery and
E-Mail (publiccomments@bis.doc.gov)

Mr. Timothy Mooney
Office of Exporter Services
Regulatory Policy Division
Bureau of Industry and Security
Department of Commerce
1401 Constitution Avenue, N.W.
Room 2705
Washington, DC 20230
Attn: Notice of Inquiry—CCL

Re: Oceaneering International, Inc.: Comments in Response to *Federal Register* Notice Regarding Revisions to the Commerce Control List (ECCNs 8A001.c.2, 5A001.c.2, 6A001.a.1.d, and 6A001.b.2)

Dear Mr. Mooney:

Oceaneering International, Inc. ("Oceaneering") is pleased to submit these comments in response to the advance notice of proposed rulemaking published in the *Federal Register* on December 9, 2010, entitled "Commerce Control List: Revising Descriptions of Items and Foreign Availability" ('the Notice").[1] These comments focus on the controls imposed by the Commerce Control List ("CCL") of the Export Administration Regulations ("EAR") on items classified in the following Export Control Classification Numbers ("ECCNs"):

- 8A001.c.2 remotely operated subsea vehicles ("ROVs");
- 5A001.c.2 armored umbilical cables; and
- Certain Category 6 ROV components, such as transponders (ECCN 6A001.a.1.d) and doppler velocity logs and acoustic doppler current profilers (both ECCN 6A001.b.2).

[1] 75 Fed. Reg. 76,664 (Dec. 9, 2010).

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The primary focus of this submission is on the broad foreign availability of 8A001.c.2 ROVs, which Oceaneering respectfully submits indicates that such items should be controlled in Tier 2 or Tier 3 of a proposed three-tier system for the CCL.

Oceaneering designs, manufactures, and operates unmanned, tethered ROVs classified under ECCN 8A001.c.2 that are deployed on oil rigs and drill vessels worldwide, providing critical support to the oil and gas industry. As is more fully explained below, these ROVs are available from many non-U.S. sources, including from countries both within and outside the group of 37 countries listed in the Notice as representing the United States' regime partners and close allies. Moreover, these tethered submersibles, which have become widespread in industry, do not appear to provide a "critical" military or intelligence advantage to the United States. Accordingly, they do not merit control in Tier 1, as we understand the Department of Commerce is considering, but rather merit placement in a lower tier. We also address herein the placement in the proposed three-tier system of certain ROV components that are available abroad.

Below, we set forth background on Oceaneering and its ROV operations, and then we discuss potential control levels for ROVs and ROV parts (specifically, fiber-optic armored umbilical cables, transponders, doppler velocity logs, and acoustic doppler current profilers) in light of the criteria set forth in the Notice.

I. Background on Oceaneering and Its ROV Business Operations

Oceaneering, headquartered in Houston, Texas, was founded in 1964 as an air and mixed-gas diving business operating in the Gulf of Mexico. The company has since grown to be a global provider of diversified engineered products and services, primarily to the offshore oil-and-gas industry.

Oceaneering's ROV business unit focuses on manufacturing and operating ROVs to support deepwater oil and gas exploration and production. Oceaneering designs and manufactures its ROVs principally in Morgan City, Louisiana, and is the largest U.S. manufacturer of ROVs. These items are controlled for export purposes pursuant to ECCN 8A001.c.2 because they (a) are unmanned and tethered, (b) are designed to operate at depths exceeding 1,000 meters, and (c) have a fiber-optic data link between the ROV and a control system aboard the rig or vessel from which the ROV is operated.

The ROVs are used to perform a variety of drill support and underwater construction services for oil and gas companies (and their contractors/subcontractors) in the U.S. Gulf of Mexico and offshore of numerous other oil-and-gas producing countries. To support those operations, Oceaneering receives dozens of BIS export licenses per year.

Oceaneering competes with numerous foreign suppliers of ROV services. Many of these foreign suppliers, including some of the companies discussed below, build their own ROV systems or purchase systems from ROV manufacturers outside the United States, including some of the non-U.S. manufacturers discussed below. Moreover, many of these foreign companies appear to face less stringent export-related restrictions on their ROVs than does Oceaneering. In short, Oceaneering faces a highly competitive international marketplace for its ROV services, and thus it is especially important to the company—and to its ability to maintain its U.S. manufacturing base—to be able to

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comment on the CCL controls that apply to its ROVs and related items, as the level of control influences Oceaneering's ability to deploy ROVs in a timely fashion and respond to increasing requirements for the employment of indigenous labor, and thus to remain competitive.

II. CCL Tier Placement of Unmanned, Tethered Remotely Operated Subsea Vehicles and Related Items

The Notice seeks comment on how items on the CCL should be divided among three tiers in a manner consistent with certain control criteria. To determine the proper tier for an item, BIS has indicated it will consider (a) the degree to which the item provides the United States with a "critical," "substantial," or "significant" military or intelligence advantage, and (b) the availability of the item outside the United States, as follows:[2]

- Tier 1: Items almost exclusively available from the United States and which provide a critical[3] military or intelligence advantage to the United States, as well as weapons of mass destruction ("WMDs"); WMD-capable unmanned delivery systems; and plants, facilities, or items specially designed for producing, processing, or using WMDs, special nuclear materials, or WMD-capable unmanned delivery systems;

- Tier 2: Items almost exclusively available from regime partners or adherents, and which provide a substantial[4] military or intelligence advantage to the United States, or make a substantial contribution to the indigenous development, production, use, or enhancement of a Tier 1 or Tier 2 item; and

- Tier 3: Items that are more broadly available and provide a significant[5] military or intelligence advantage to the U.S. or which make a significant contribution to the indigenous development, production, use, or enhancement of a Tier 1, 2, or 3 item or are otherwise controlled for national security, foreign policy, or human rights reasons.

A parallel *Federal Register* notice, also published on December 9, 2010, proposes to add a new license exception to the EAR, called Strategic Trade Authorization ("STA"). That notice indicates that BIS is considering placing in Tier 1 ECCN 8A001, 5A001, and 6A001 items; however, it is unclear from the notice whether BIS is considering placing the entirety of these ECCNs into Tier 1, or only certain subsections.

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[2] The Notice also seeks comments on how ECCNs could be made more clear and "positive," such as through the addition of technical parameters. This submission does not address that part of the request for public comment.

[3] "Critical" means "providing a capability with respect to which the United States cannot afford to fall to parity and that would pose a grave threat to U.S. national security if not controlled (*i.e.*, a 'crown jewel')."

[4] "Substantial" means "providing a capability with respect to which the United States must maintain parity and that would pose a serious threat to U.S. national security if not controlled."

[5] "Significant" means "providing a capability that could be reasonably expected to cause damage to U.S. national security if not controlled."

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For example, with respect to 8A001 items, it is unclear whether or not BIS is focused on Tier 1 controls applying only to the most sensitive items in that ECCN, such as untethered submersibles (manned or unmanned; *see* ECCN 8A001.b and 8A001.d) or whether BIS may be contemplating the placement of other items controlled by this ECCN into Tier 1. To the extent BIS may be considering including in Tier 1 8A001.c.2 unmanned, tethered submersibles, we respectfully submit that this is inconsistent with the control criteria set forth in the Notice for the various tiers, as further explained below. In summary, these unmanned, tethered ROVs:

(a) neither provide the U.S. with a "critical" military or intelligence advantage, nor are they WMDs or related items, and

(b) are widely available abroad, including being developed and/or manufactured in at least ten (10) countries other than the United States—among them India, Russia, and three southeast Asian nations that are not part of the group of 37 countries listed in the Notice.

Accordingly, unmanned, tethered submersibles that meet the control criteria of ECCN 8A001.c.2 should be placed in Tier 2 or 3, as described below.[6]

In addition, as also described below, certain ECCN 5A001 and ECCN 6A001 items that are critical parts of ROV systems are available from countries other than the U.S. and do not appear to merit control in Tier 1, but rather should be placed in Tier 2 or even Tier 3.

Below, we focus in Section III on ROVs, and then turn in Section IV to these related ROV items.

III. Unmanned, Tethered ROVs Merit Control in Tier 2 or Tier 3, Not Tier 1

A. Unmanned, Tethered Submersibles Do Not Meet the Criteria for Tier 1 Because They Do Not Convey a "Critical" Military/Intelligence Advantage

Tier 1 is proposed to include weapons of mass destruction (WMDs) and certain items related to WMDs, such as unmanned WMD-capable unmanned delivery systems and certain plants, facilities, and items specially designed for producing, processing, or using WMDs, special nuclear materials, or WMD-capable unmanned delivery systems. It also includes other items but only if they: (1) are "almost exclusively available" from the United States and (2) provide a "critical" military or intelligence advantage to the United States.

As an initial matter, ROVs controlled under 8A001.c.2 are not WMDs or WMD-related items. Nor are ROVs—more than 500 of which are deployed worldwide at any given point in time[7]—a "crown jewel" of U.S. technology that would pose a "grave threat to U.S. national security" if not tightly controlled.

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[6] Oceaneering is simultaneously submitting a separate comment in response to the *Federal Register* notice on the proposed License Exception STA explaining why these items should be fully eligible for export/reexport under that license exception.

[7] International Marine Contractors Association Press Release, "ROVs in Focus with Greater Stats and a Dedicated Workshop" (Oct. 2010), *available at*: http://www.imca-int.com/news/press/1035.html.

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While unmanned, tethered ROVs likely merit some level of control for export purposes, especially in light of the United States' commitments through the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies, even the U.S. and its regime partners have acknowledged through Wassenaar that tethered submersibles are not "very sensitive" items, as are untethered submersibles[8] and active underwater noise reduction and cancellation systems, which these work-class ROVs do not feature. While it is difficult for a company to assess how the U.S. government would evaluate the national security importance of various technologies, Oceaneering respectfully submits that unmanned, tethered ROVs do not convey a "critical" military or intelligence advantage, for several reasons.

First, 8A001.c.2 ROVs are tethered underwater vehicles, which means that they are physically connected to installed equipment on the rig or vessel from which they are operated by a pilot. The tether provides the medium for the ROV to receive power and instructions on where to move and how to operate. The tether typically has an "excursion length" (how far the ROV can travel from its "cage" or "garage," which is suspended vertically from the rig or vessel via an umbilical cable) of only 600 to 1,000 meters. These ROVs cannot be remotely-operated through a wireless link, and they do not have any onboard battery or power source. These ROVs are thus not autonomous underwater vehicles ("AUVs"). Moreover, they are not capable of being programmed before deployment, which might convey more of a military or intelligence advantage; they must be operated in real time by a pilot and support team.[9] The ROV is thus physically and electronically connected to its host rig or vessel by a tether and lacks the mobility or autonomy that would be required for it to pose a serious threat to U.S. national security.

Second, use of an 8A001.c.2 ROV requires a long list of expensive, exceedingly heavy equipment that together forms the "ROV system" and which makes it impractical to contemplate use or diversion of energy-industry ROVs in or to military purposes. In a typical Oceaneering deployment, this equipment, necessary for an ROV's operation, includes a deployment cage (approximately 10,900 lbs.), a winch (86,200 lbs. with cable), and an A-frame (52,220 lbs.). This is in addition to the ROV itself, which often weighs 8,000 to more than 10,000 lbs. The total topside weight of the ROV system, including the ROV, thus may approximate 240,000 lbs. (120 tons) or more. Just installing an ROV system takes weeks or even months, as the necessary parts of the system are carefully loaded onto and welded to the rig or vessel. Modifications of the rig or vessel are often required. And at the end of the deployment, additional weeks are required to uninstall and remove the system. In short, an ROV is not a nimble, easily deployable system, is not amenable to diversion, and has little utility beyond working closely with the rig or vessel to which it is attached.

Finally, it is important to note for this Tier 1 analysis that the United States already has fallen to parity in ROV technology with a host of other countries, as described below.

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[8] *See* Wassenaar Arrangement "Very Sensitive List," entries 8.A.1.b and 8.A.1.d (controlling manned and unmanned untethered submersible vehicles).

[9] An 8A001.c.2 ROV must be controlled by a pilot working on the surface vessel or rig onto which the ROV-related infrastructure has been installed. In a typical oil and gas deployment, the ROV is piloted by an individual seated at a surface control console within a "control van" (a 20-foot container) welded to the surface of a rig or vessel.

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Accordingly, ROVs meeting the control criteria for 8A001.c.2 are not WMDs or WMD-related items and do not convey a "critical" military or intelligence advantage. Moreover, such ROVs should not be controlled in Tier 1 because, as is described in detail below, they are currently being widely designed and manufactured in at least ten (10) countries other than the United States.

B. ECCN 8A001.c.2 ROVs Should Be in Tiers 2 or 3 Because of Their Broad Foreign Availability

ROVs that meet the control criteria of 8A001.c.2 are available—that is, indigenously developed, produced, and/or enhanced—in at least ten countries other than the United States. Such ROVs thus are not "almost exclusively available"[10] from the United States, as is required for Tier 1 control. Rather, they are, at a minimum, "almost exclusively available" from regime partners and adherents, so as to merit Tier 2 control, and they appear to be of broad enough availability outside that circle of 37 regime partner and adherent countries to merit Tier 3 control, especially given the significant base of ROV manufacturing that has developed in Singapore and several other southeast Asian countries.

Attached are two documents that summarize the foreign availability information below: first, a chart showing the countries where ROVs meeting the control criteria for 8A001.c.2 are developed and/or manufactured, the name of the manufacturer, and the ROV models from that manufacturer that are comparable to those controlled under ECCN 8A001.c.2 (Attachment A); and second, a map illustrating foreign development and manufacturing locations for these ROVs (Attachment B).

1. Development and Production outside Key Allied Countries

It is significant to note that ROVs meeting the control criteria of 8A001.c.2 are currently being developed, produced, and/or enhanced in at least five countries outside the group of 37 countries identified in the Notice, which suggests a lower level of control (Tier 3, or at least Tier 2) should apply to these ROVs. These countries are Singapore, Thailand, India (with assistance from Russia), and Malaysia. Foreign availability of ROVs in these countries is discussed in depth below, with reliance on documentary evidence as requested by BIS,[11] all of which is available in the public domain.

Singapore

Publicly available information confirms what is well known in the ROV industry: a significant ROV manufacturing and technology base is well-established in Singapore, where several ROV manufacturers are producing unmanned, tethered ROV systems with fiber optic data links capable of operating below 1,000 meters which are comparable to those being produced by Oceaneering and other U.S. companies. (These ROVs are, like Oceaneering's, considered by the industry to be "work-

[10] "[A]lmost exclusively available" is defined in the Notice as being available from "a very small number of other countries that have in place effective export controls on the item."

[11] Oceaneering has submitted a hard-copy set of these attachments. Upon request, Oceaneering will provide BIS with a CD or e-mail an electronic copy of these attachments.

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class" ROVs.[12]) This capacity in Singapore may be due to a number of factors, including: the proximity of Asian oil and gas industry customers; a vessel port and bunker in Loyang, Singapore; the presence of major shipyards (where ROV systems are mobilized onboard rigs or vessels); the low cost of steel in the region; a well-educated population; low taxes; and a business-friendly climate.

Oceaneering is aware of at least three major ROV manufacturers designing and manufacturing in and exporting from Singapore work-class ROVs that are identical in key respects to those the United States is controlling through ECCN 8A001.c.2:

Fugro Subsea Technologies Pte Ltd. ("Fugro").[13] Fugro designs and builds in Singapore ROVs for its own use around the world. These include a wide range of ROV models comparable to the ROVs manufactured in the United States that are being controlled through ECCN 8A001.c.2. In particular, the comparable models include the FCV 2000D, FCV 3000, Sealion 3000, and Sealion MK II models of ROVs.[14] (FCV stands for the "Fugro Core Vehicle" family.)

The Remote Technology Support Unit ("RTSU") is a design department of Fugro, based in Singapore, that "designs, manufactures and refurbishes ROV systems for Fugro" and "provides technical support to the Fugro ROV fleet worldwide" (Attachment 1.A).[15] The RTSU's ROV design track record includes the G3/G4 125-hp. work-class ROVs with a depth rating of 3,000 to 4,000 meters and the Sea Serpent, a 200/250-hp. ROV with a depth rating of 2,500 meters of sea water ("msw"), as well as the following ROVs that are comparable to existing Oceaneering ROV models:

- **FCV 3000**. The FCV 3000 is a heavy work-class ROV, depth rated to 3,000-msw, and designed with single mode fibers in the main lifting umbilical. A data sheet for the FCV 3000 is provided at Attachment 1.B. The Winter 2008 issue of *Aquasphere* (Attachment 1.C), a subsea services publication of the Fugro Group, describes Fugro's development of the FCV 3000 in Singapore. In particular, the article describes how "[i]n the first quarter of 2006, a Team of experienced Fugro ROV Managers and Engineers met in Singapore to put the final touches to the specifications for what would be the flagship FCV 3000 and a cornerstone of our Work Class Fleet into the future." Moreover, the article continues, "[w]ith a team of only 10 people . . . in Singapore, we began the process to not only design our vision but also to recruit the additional people and skills that would assist us to reach our ambitious goal of an in-house design AND build, of not just the vehicle, but the complete System." The article includes a photograph showing members of the Singapore team. A separate article in the same Winter 2008 issue (Attachment 1.D) notes that 12 FCV 3000 systems had been completed as of the

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[12] The International Marine Contractors Association ("IMCA") Code of Practice for Safe and Efficient Operation of ROVs identifies five classes of ROVs. Class III (Work-Class Vehicles) are generally larger, heavier, and more powerful than Class I (Observation ROVs) and Class II (Observation ROVs with Payload Option). "Work-class" ROVs may be used to provide a range of services, including inspection services, surveys, drilling support, and construction support.

[13] Fugro's parent company, Fugro N.V., is based in the Netherlands.

[14] Oceaneering has not been able to confirm whether Fugro continues to manufacture these models of Sealion ROVs.

[15] Attachments 1-17 are enclosed, separately bound and indexed.

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Winter 2008 publication and were "fully operational in Brazil, Europe, Asia Pacific and West Africa." The Autumn 2009 issue of *Aquasphere* (Attachment 1.E) notes that training courses for the FCV 3000 would become available "from our technical support group in Singapore" later in 2009.

- **FCV 2000D**. The FCV 2000D is the 2,000-msw iteration of the Fugro FCV ROV. A data sheet for the FCV 2000D is available at Attachment 1.F. The Summer 2010 issue of *Aquasphere* (Attachment 1.G) includes an extensive article on Fugro's development of a 2,000-msw variation of the FCV by the Design and Build Team at Fugro Subsea Technologies in Singapore.

- **Sealion 3000**. The Sealion 3000 is a 125-hp., work-class ROV with a 3,000-msw depth capability and a fiber-optic data link (Attachment 1.H). As indicated above, Attachment 1.A identifies this ROV as one that was designed by the RTSU Department in Singapore.

- **Sealion MK II (4-Vert)**. This heavy work-class ROV has the option of 1,000-msw or 2,000-msw depth ratings, 100 hp., and telemetry and video transmission via copper or fiber-optic link. The data sheet (Attachment 1.I) provides contact information for Fugro Subea Services Pte Ltd in Singapore.

Eastar Offshore Pte Ltd. ("Eastar") Eastar, which is based in Singapore, is a second company manufacturing comparable ROVs outside the group of 37 nations identified in the Notice. Eastar is 75% owned by Alam Maritim Group (Attachment 2.A), a Malaysian subsidiary of Alam Maritim Resources Berhad, a Malaysian investment holding company (Attachment 2.B).

Eastar designs and manufactures ROVs, including the Phoenix and the Deep Swift, out of a 50,000-square-foot factory facility in Singapore (Attachment 2.A). The Deep Swift (Model: SWIFT 3000 MSW) has 150-hp., is depth-rated to 3,000 msw, and its video and telemetry system performs transmission via single mode fiber optics. A data sheet for the Deep Swift is available at Attachment 2.C. The Phoenix has a 3,000-msw standard depth rating, optional fiber-optic video and telemetry transmission, and 175 hp. A data sheet for the Phoenix is available at Attachment 2.D.

The fact that Eastar is manufacturing ROVs in Singapore is confirmed by a January 2010 profile of Eastar in *Energy Digital* (Attachment 2.E). In the article, Chief Design Engineer John Clark explains how Eastar custom designs each ROV to its client's requirements, then sources parts and components from suppliers in Singapore or other countries. According to the article, Eastar then "undertake[s] final assembly and testing here, in our new 50,000-square-foot factory" in Singapore's Industrial Zone. The article states that Eastar has delivered eight work-class ROVs in the two years up to January 2010.

Eastar sells its ROVs to various ROV companies for them to operate. According to the Company Profile (Attachment 2.A), Eastar ROVs (including work-class and two smaller models) have performed work for Exxon Mobil, Shell, BP Conoco, Agip, Chevron, Petro Vietnam, Korea National Oil Corporation, ONGC India, China National Offshore Oil Corporation (CNOOC), Petronas (Malaysia), and other companies, suggesting the capability and broad exportability of Eastar ROVs.

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Hallin Manufacturing Services Pte Ltd. Hallin Manufacturing Services is a wholly-owned subsidiary of Hallin Marine Subsea International Ltd., itself a subsidiary of Superior Energy Services, Inc. (Attachment 3.A). According to the "Manufacturing" tab on the company's website (Attachment 3.B), Hallin Manufacturing Services "designs, engineers and builds subsea intervention assets for both Hallin Companies and for third parties."

The website highlights the company's Singapore Manufacturing Facility, which builds ROVs as well as portable and fixed saturation diving systems (Attachment 3.C). The website includes a video showing the Singapore Manufacturing Facility, available at: http://www.hallinmarine.com/Manufacturing/subsea-international-assets-production.html. A press release, entitled "Hallin Shows Commitment to Singapore with Opening of New, Purpose Built Facility," also describes the opening of the 11,000-square-meter facility, built on the marine jetty in Loyang (Attachment 3.D). Dave Dunlap, CEO of Superior Energy Services, explains in the press release that the facility "gives Hallin Marine the best possible facilities: it's a great operational base next to where our vessels will tie up; a first class maintenance and storage centre; an outstanding manufacturing facility for our dive and ROV systems; and a wonderful environment in which to work for our design engineers."

A February 2008 article in *Vessel & ROV News* (Attachment 3.E) confirms that Hallin designs and manufactures its C-ROV at Hallin's Singapore Manufacturing Facility. The C-ROV is a hydraulic/electrical work-class ROV, depth rated to 1000 msw,[16] with data transmission via fiber optics or copper. A data sheet for the C-ROV, which lists Singapore contact information (including a "manufacturing@hallin.com.sg" e-mail address), is available at Attachment 3.F.

The *Vessel & ROV News* article describes how demand for Hallin's "in-house designed and built" C-ROVs and saturation diving systems was so great that Hallin had to increase the size of its Singapore manufacturing facility by 50 percent. In addition, the article explains how, "given the current and projected sales values and scale of the company's manufacturing," the Hallin board decided to form the stand-alone manufacturing division. A later (September 2008) article in *Vessel & ROV News* (Attachment 3.G) describes Hallin's decision to build the first six C-ROVs, and that number is only as of September 2008.

Thailand

Sub Dimension Engineering Co. Ltd. ("Sub Dimension"). Sub Dimension is British-owned company based in Thailand with design and manufacturing facilities in Thailand and Singapore (Attachment 4.A). Sub Dimension describes itself in its profile on Alibaba.com (Attachment 4.B) as "the premier subsea manufacturing facility in Thailand" whose "core business is the design, manufacture & maintenance of: ROVs [and other products]." It also describes itself as "[b]orne of more than 70 years

[16] It is not clear if the C-ROV was designed to operate at depths "exceeding" 1,000 m, which is one of the key control parameters for the ROVs discussed herein. Even if it was not, however, the technology behind the vehicle (and the vehicle itself) would be virtually the same for a deeper-diving ROV. Hallin could design and build an ROV to exceed 1,000 m simply by using a larger, different density foam block, a different pressure vessel, and a longer umbilical cable.

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cumulative experience with manned submarines, diving systems, ROVs & remote intervention tooling."

The attached posting on the Alibaba.com website (Attachment 4.C) shows that Sub Dimension manufactures the 150-hp. Odyssea work class ROV in Thailand (see its "Place of Origin") and that this ROV is available for sale for approximately $2.4 million. The Odyssea is a heavy-duty work-class ROV that has a fiber-optic data link and is available in 2,000- and 3,000-meter variations. An Odyssea data sheet is available at Attachment 4.D. Sub Dimension indicates in the advertisement that it can supply four "sets" (presumably this refers to ROV systems) per year. The site includes a similar posting for the Pulsar ROV (Attachment 4.E), a 125-hp., all-electric work-class ROV, depth rated to 3,000 msw, with fiber-optic telemetry transmission. A data sheet for the Pulsar is available at Attachment 4.F.

Sub Dimension describes its factory, located in Chonburi, Thailand, as comprising 1,000 to 3,000 square meters, with an "Export Percentage" of 81-90% (Attachment 4.B). The company explains that it has "in house machining capabilities" and "a team of highly skilled designers, machinists, engineers & technicians." Because the facility is located in a Thai Board of Industry (BOI) registered industrial complex, the company claims that it "enjoy[s] expedited import & export benefits, enabling us to operate globally without restrictions" (Attachment 4.B).

India and Russia

National Institute of Ocean Technology ("NIOT"). The ROSUB-6000 was developed by NIOT (Attachment 5.A) in collaboration with the Experimental Design Bureau of Oceanological Engineering ("EDBOE"), which is part of the Russian Academy of Sciences (Attachment 5.B).[17] According to one recent article, NIOT's successful trial of the ROSUB-6000 to the bottom of the Central Indian Ocean Basin (5,289 m) puts India in "an elite league of nations like [the] US, Japan and China" (Attachment 5.F).

The ROSUB-6000 has an operating depth of 6,000 m and twelve optical fibers for data and video transmission, according to the data sheet (Attachment 5.G). Photos of the ROSUB-6000 and related equipment are available at Attachment 5.H and 5.I. This ROV meets (and in terms of depth rating, far exceeds) the control criteria for 8A001.c.2 ROVs.

According to the Introduction page of the NIOT website (Attachment 5.B), the development of this deepwater work-class ROV was initiated by the Polymetallic Nodule Management (PNM) Board of the

[17] EDBOE RAS was established in 1970 by a decree of the Presidium of the USSR Academy of Sciences (now the RAS) "in accordance with the Regulations of the State Committee on Science & Technology of Council of Ministers USSR" (Attachment 5.C). Attachment 5.D shows that the customers and partners of EDBOE include a range of Russian research institutes and private companies. In addition, the webpage notes that "EDBOE RAS collaborates with foreign research and design institutes and companies from the USA, India, Japan, Greece, Germany, France, England, Spain, Taiwan, Norway, Poland, Denmark, and others." Moreover, EDBOE has decades of experience in the design, construction, trial, and operation of manned underwater vehicles, including the "Argus" (1975), "Osmotr" (1986), "Rift-1" and "Rift-2," "Pisces," and others (Attachment 5.E).

Ministry of Earth Sciences, Government of India. Further information on the ROSUB-6000 project and its achievements can be found on this NIOT webpage: http://www.niot.res.in/projects/submer/submersibles_introduction.php. Attachment 5.J shows the project achievements, ranging from "infrastructure and capacity building" through a series of shallow and deepwater sea trials off Chennai, India and Kakinada, India. Finally, Attachments 5.K and 5.L indicate that a "mandate" and "Future Vision" of the project are the development of a "shallow water work class" ROV. While it is not clear what depth constitutes "shallow water," this indicates that the technology developed for a 6,000-msw ROV can be applied toward the development of lower-depth ROVs.

Malaysia

Subsea Explore Services (M) Sdn Bhd. Subsea Explore Services is a Malaysian entity that manufactures the Satria 101 ROV and appears to be developing a Satria 102 ROV. The company appears to manufacture the Satria 101 (and Satria 102, if in production[18]) at the company's location in the SME Bank Factory Complex in Selangor, Malaysia since this is the only facility/location listed (Attachment 6.B). The Satria 101 has a 1,500-msw depth rating and fiber-optic and copper coax video and telemetry (Attachment 6.C). Attachment 6.D shows pictures of the Satria 101 manufacturing process.

In 2010, SME Corporation Malaysia, an agency of the Malaysian Ministry of International Trade and Industry, awarded the Small and Medium Enterprise Innovation Award in the manufacturing sector to Subsea Explore Services (Attachment 6.E).

2. Manufacturers Within the Group of 37

Outside of Southeast Asia, India, and Russia, ROVs also are broadly manufactured by the United States' regime partners and adherents. In particular, the United Kingdom has a long history of developing, manufacturing, and using ROV technology, with the Aberdeen, Scotland area serving as a particular base for ROV technology. Oceaneering itself has been designing and manufacturing ROVs out of its Aberdeen facility since 1978.

In total, this section lists more than a dozen companies outside the United States manufacturing and/or developing work-class ROVs that meet the control criteria of 8A001.c.2. These companies are located in five countries: the United Kingdom, Italy, Australia, Canada, and Norway.

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[18] A National Oceanography Data Centre webpage (Attachment 6.A) indicates that Subsea Explore Services was (at the time of the posting, which appears to be from 2010) in the pre-commercialization stage for the Satria 102 work class ROV. According to the posting, Subsea Explore Services gets most of its funding from Malaysia's Ministry of Science, Technology, and Innovation (MOSTI) "Techno Fund."

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United Kingdom

Soil Machine Dynamics Ltd. ("SMD"). SMD manufactures ROVs, including the Quantum and the Quasar, on the banks of the River Tyne in the United Kingdom (Attachment 7.A).

According to a November 2010 article in *The Manufacturer* (Attachment 7.B), SMD signed a contract in July 2010 with Subsea 7, another UK-based company, to supply 20 ROVs to Subsea 7, with an option for a further 10. The article explains that SMD production processes aim to produce two to three ROVs per month. In addition, SMD has supplied Quantum and Quasar work class ROVs to Hallin Marine in Singapore, as evidenced by Hallin data sheets (Attachment 7.C and 7.D) featuring Quantum and Quasar ROVs built by SMD. Both the Quantum and Quasar (Attachments 7.E and 7.F) are depth-rated to 3,000 msw and appear to have fiber-optic data links. A July 2010 press release from SMD (Attachment 7.G) announced a contract for SMD to supply two additional Quantum XP ROV systems to Hallin Marine. The press release notes that this award represents the ninth and tenth work-class ROV purchased by Hallin.

Perry Slingsby Systems, Ltd. ("PSS"). PSS, which is part of the Aberdeen, United Kingdom-based Triton Group, appears to manufacture ROVs at a 48,000-square-foot Kirbymoorside facility near York, England (Attachment 8.A). PSS also has a service facility in Singapore. The Triton XLX and XLS (Attachments 8.B and 8.C) are heavy-duty work-class ROVs with 3,000-/4,000-msw depth ratings. A PSS brochure (Attachment 8.D) notes that more than 60 Triton XLS ROVs have been delivered as of the date of publication. In addition, PSS manufactures the Triton XLR, which it says is similar to the XLX in that it "offers a common design basis with common components," but for applications in the 75-hp. to 125-hp. range (Attachment 8.D). The XLR is available in 2,000-, 3,000- and 4,000-msw versions (Attachment 8.E).

Sub-Atlantic Ltd. According to the company's website (Attachment 9.A), Sub-Atlantic designs and manufactures small to medium-sized electric ROV systems — including the Comanche, a small work-class ROV — in Aberdeen, United Kingdom. This light work-class electric ROV has a 2,000-msw standard depth rating (with options for 3,000 and 6,000 msw) and fiber-optic telemetry. A data sheet for the Comanche is available at Attachment 9.B.

Italy

Sonsub AS. Sonsub AS, based and incorporated in Norway, operates as a subsidiary of Saipem SpA of Italy (Attachment 10.A and 10.B), which is a subsidiary of Eni SpA (Attachment 10.C). Sonsub appears to build its Innovator Leviathan in Houston, Texas but "under the guidance of Sonsub's research and development team in Venice, Italy, and with special features driven by [Sonsub's] Aberdeen [UK] and Stavanger [Norway] divisions" (Attachment 10.D). The Innovator Leviathan (which appears also to be referred to as the Innovator 250) is a 250-hp. heavy work-class ROV with a 3,000-msw depth rating (Attachment 10.E). Sonsub also may manufacture ROVs in Italy (Attachment 10.F). In addition to the Innovator Leviathan, Sonsub also developed and manufactures the heavy duty work-class Innovator, a 200-hp. ROV with a 3,000-msw depth rating (Attachment 10.G). (It is not clear what role the Italy, UK, and Norway teams played in the development of the Innovator.)

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Australia

Total Marine Technology Pty Ltd ("TMT"). TMT is a private company that designs and manufactures work class ROVs in West Australia (Attachment 11.A). According to the company website (Attachment 11.A), the TMT team has built at least 12 work-class ROVs that have worked in many Asian countries, "from China to New Zealand and Australia." The Nomad is a 150-hp. ROV depth rated to 1,500 msw and includes fiber-optic video and data transmission in the main umbilical (Attachment 11.B); the Typhoon is a 150-hp., heavy work-class ROV, depth rated to 3,000 meters (Attachment 11.C); and the Navigator is a work-class ROV depth rated to 3,000 meters, which has a fiber-optic armored umbilical cable for video and data transmission (Attachment 11.D).

Canada

International Submarine Engineering Ltd. ("ISE"). ISE, founded in 1974, designs, fabricates, and tests ROVs at a facility in Port Coquitlam, east of Vancouver, British Columbia (Attachment 12.A). As of a March 2009 press release, ISE had built and delivered over 215 underwater vehicles, including autonomous and remotely operated underwater vehicles, which it provided to clients in 20 countries (Attachment 12.B).

ISE appears to have significant ROV technology and the ability to design and manufacture ROVs that meet the criteria for 8A001.c.2. According to an October 13, 2010 press release (Attachment 12.C), ISE delivered a 150-hp. HYSUB ROV, rated to an operational depth of 3,000-msw, to SNK Ocean Co. Ltd., a Japanese marine services company. In 2008, ISE designed and manufactured a 130-hp. HYSUB ROV, depth rated to 4,000-msw, for the Guangzhou Marine Geology Survey, a division of China's Ministry of Land and Resources (Attachment 12.D).

In November 2009, ISE's president, Dr. James McFarlane, was honored as a Technology Pioneer by the Offshore Energy Center's Hall of Fame in Houston, Texas. According to ISE's press release, Dr. McFarlane was one of the industry's key individuals whose innovation had formed the basis of the technology and engineering behind ROVs (Attachment 12.E).

Norway

KYSTDESIGN AS. KYSTDESIGN is an independent company that designs and fabricates two work-class ROVs (the SUPPORTER and the INSTALLER) (Attachment 13.A) presumably in Norway, since the company does not mention having any other facility (Attachment 13.B). The webpage at Attachment 13.A notes that these work vehicle designs "are derived from experience gained through leading benchmark ROV development projects [over] the last 15 years." The company consists of "multi-discipline engineering teams, with specialists in mechanical design, hydraulic systems, electronics and software development" (Attachment 13.C).

A work-class ROV product brochure for this company is included at Attachment 13.D. In addition, two particular KYSTDESIGN models bear mention as being comparable to ECCN 8A001.c.2 ROVs. The INSTALLER is a work-class hydraulic ROV system for intervention down to 2,500 meters (Attachment 13.E). The INSTALLER was first delivered in 2001 and there were four in operation as of 2008 (Attachment 13.F). A data sheet for the Installer is available at Attachment 13.G. The SUPPORTER

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is a 125-hp., work-class hydraulic ROV for interventions down to 2,000- or 3,000-meter water depths (Attachment 13.H). It was first delivered in 2006 and there were 10 in operation as of 2008 (Attachment 13.F). A data sheet for the SUPPORTER is available at Attachment 13.I and a video on the SUPPORTER is available at the webpage shown at Attachment 13.H.

IKM Subsea AS. IKM Subsea, a subsidiary of the Norwegian IKM Group, manufactures internally developed Merlin work-class ROVs (Attachment 14.A). Both the Merlin WR200 and LR120 are designed and built at IKM Subsea's production facilities in Bryne, Norway (Attachment 14.B and 14.C). The Merlin WR200 is a 200-hp., electrical work-class, fiber-optic ROV depth rated to 3,000 msw. A data sheet for this ROV is available at Attachment 14.D. The Merlin LR120 is an electrical, light work-class, fiber-optic ROV with 120 hp., designed to operate in depths up to 3,000 meters. A data sheet for this ROV is available at Attachment 14.E.

Sperre AS. Sperre manufactures and sells electrical work-class ROV systems manufactured at workshops in Notodden, Eastern Norway (Attachment 15.A). As shown on the comparison chart of Sperre's SUB-fighter ROVs (Attachment 15.B), all of these work-class ROVs have an optional depth of 3,000 msw and have a fiber-optic tether cable and a fiber-optic telemetry system. The ROVs that this company manufactures in Norway are the SUB-fighter 30k (Attachment 15.C), SUB-fighter 15k survey (Attachment 15.D), SUB-fighter 10k (Attachment 15.E), SUB-fighter 7500 fiber (Attachment 15.F), and SUB-fighter 4500 (Attachment 15.G).

Argus Remote Systems ("Argus"). Argus, located in Norway (Attachment 16.A), was established in 1992 and is currently 73 percent owned by Mohn Drilling AS (Attachment 16.B), another Norwegian company (Attachment 16.C). Argus designs, manufactures, and operates electrical ROV systems (Attachment 16.D). These include the Argus Worker, a 174-hp., work-class ROV with a maximum operating depth of 4,000 msw and fiber-optic video transmission (Attachment 16.E), and the Argus Bathysaurus XL, with a 4,000-msw maximum operating depth and fiber-optic video transmission (Attachment 16.F).

AAK Subsea AS. AAK Subsea designs, develops, and produces its proprietary Elsub electric ROV in Stavanger, Norway (Attachment 17.A). AAK Subsea is part of the AAK Group AS group of companies (Attachment 17.B). The Elsub I is a work-class ROV that has been in commercial operation since December 2009 providing drill support services offshore of Venezuela, according to AAK Subsea's website (Attachment 17.C). Further information on the Elsub I is available at Attachment 17.D. The Elsub II, the second-generation Elsub work class ROV, is "now ready for production," according to an undated AAK Subsea webpage (Attachment 17.E).

In summary, as noted above, unmanned tethered ROVs meeting the control criteria set forth in ECCN 8A001.c.2 are widely available from manufacturers/developers outside the United States, including companies in Asia, Australia, Russia, India, Canada, and Western Europe (the United Kingdom, Italy, and Norway). These items thus should not be controlled in Tier 1, but should be Tier 2 or even Tier 3 items on the CCL.

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IV. ROV Parts in ECCNs 5A001 and 6A001 Should Be in Tier 2 or Tier 3, Not Tier 1

Oceaneering understands that in addition to ECCN 8A001 items, the Administration is considering placing into Tier 1 certain items classified pursuant to ECCNs 5A001 and 6A001. These two entries on the CCL contain (among many other items) certain critical ROV components—namely, fiber-optic armored umbilical cables classified under ECCN 5A001.c.2, transponders classified under ECCN 6A001.a.1.d, and doppler velocity logs and acoustic doppler current profilers, both classified under ECCN 6A001.b.2—upon which Oceaneering relies, and which it respectfully suggests do not merit control under Tier 1.

Oceaneering does not manufacture these items, but rather purchases them from vendors located abroad, which evidences the foreign availability of these items. Moreover, we believe BIS is aware that these items are not so sensitive as to merit Tier 1 control. This is evidenced by the fact that in the parallel *Federal Register* notice published on December 9, 2010, relating to proposed License Exception STA, BIS has proposed to make items classified under ECCNs 5A001.c.2, 6A001.a.1.d, and 6A001.b.2 fully eligible for that license exception.[19] Accordingly, for this reason and because of the availability of these items outside the United States, Oceaneering submits that these items should be placed in a lower CCL tier, such as Tier 2.[20]

Armored Umbilical Cables: ROVs meeting the control criteria of 8A001.c.2 (including many of those manufactured by Oceaneering) often use a fiber-optic, armored umbilical cable to communicate with a pilot at the surface. When subject to the EAR, we understand that such cables are classified pursuant to ECCN 5A001.c.2.[21]

Armored umbilical cables are available from numerous foreign sources, including: Nexans, which manufactures these cables in Norway; Norddeutsche Seekabelwerke GmbH (known as "NSW"), which develops cable technology in Germany; Lapp Muller, whose head office and manufacturing plant appear to be in France; and Cortland Fibron BX Ltd. based in the United Kingdom.

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[19] In particular, the new "STA exclusion paragraphs" that would be added to 50 ECCNs, including ECCNs 5A001 and 6A001, and which restrict the ability to rely on two parts of License Exception STA for exports, reexports, and in-country transfers of items abroad, are limited in scope and do not extend to items classified under 5A001.c.2, 6A001.a.1.d, and 6A001.b.2. The "STA exclusion paragraph" that BIS proposes to add to ECCN 5A001 states: "*STA*: Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2)) of the EAR may not be used for any commodity in 5A001.b.3 or b.5." This exclusion paragraph does not reference or extend to 5A001.c.2. Similarly, the "STA exclusion paragraph" proposed to be added to ECCN 6A001 states: "*STA*: Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2)) of the EAR may not be used for commodities in 6A001.a.1.b, 6A001.a.1.e or 6A001.a.2." This exclusion paragraph does not reference items controlled by 6A001.a.1.d or 6A001.b.2. Accordingly, items controlled by ECCNs 5A001.c.2, 6A001.a.1.d, and 6A001.b.2 appear to be fully eligible for License Exception STA, assuming the other conditions of the use of the exception are met.

[20] Oceaneering has more limited foreign availability information about the items described in this section than it does about ROVs. Accordingly, it is possible that these items are even more broadly available than is described herein and thus that they may merit control in Tier 3.

[21] ECCN 5A001.c.2 controls (for NS2/AT1 reasons) "[o]ptical fiber cables and accessories, designed for underwater use," but excepting standard civil telecommunication cables and accessories.

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Transponders: Transponders are items incorporated within the ROV that are used to determine the ROV's position underwater. When subject to the EAR, we understand these items are classified pursuant to ECCN 6A001.a.1.d.[22] ROV transponders are available from various companies in the United Kingdom (including Sonardyne, which appears to manufacture transponders in the UK) and Norway (including Simrad/Kongsberg).

Doppler Velocity Logs ("DVLs"): DVLs, also incorporated within the ROV, generate velocity and other data that are used to navigate the ROV. When subject to the EAR, we understand that these items are classified pursuant to ECCN 6A001.b.2.[23] DVLs are available from companies in Norway.

Acoustic Doppler Current Profilers ("ADCPs"): ADCPs, which may be incorporated within the ROV or attached to the ROV's "cage," measure the strength and direction of the ocean current through the water column. Oil and gas customers use these data to adjust to the effects of the current on drilling operations. When subject to the EAR, we understand that ADCPs are classified pursuant to ECCN 6A001.b.2. ADCPs are available from Aanderaa Data Instruments (headquartered in Norway) and Nortek AS (which does development and product assembly in Norway). According to the Nortek website (http://www.nortek-as.com/en/about-nortek), Nortek ships nearly 1,000 water velocity instruments per year and the company's instruments are in use in more than 75 countries around the world.

Other ROV components, such as syntactic foam buoyancy modules, also are widely available outside the United States. (When subject to the EAR, syntactic foam buoyancy modules are classified pursuant to 8C001, which is not one of the ECCNs targeted for Tier 1, and this item should certainly not be placed in Tier 1.) Syntactic foam buoyancy modules are available from non-U.S. sources, including Trellborg Offshore (based in Sweden and which appears to manufacture syntactic foam modules in the U.K.), which acquired UK-based CRP Group Ltd.; BlueWay Marine Solution Co. Ltd., a Chinese company which appears to design and manufacture the buoyancy modules in China; Balmoral Offshore Engineering, headquartered in Scotland; and Matrix Composites & Engineering Ltd., based in Australia.

V. Conclusion

For the reasons set forth above, ECCN 8A001.c.2 unmanned, tethered ROVs should be placed in Tier 3—or at least in Tier 2—of the three-tier CCL structure being considered by BIS because these items are not "almost exclusively available" from U.S. (or, indeed, from the 37 listed regime partners or adherents). Rather, these ROVs (1) are developed, produced, and/or enhanced in more than a "very small number" of countries outside the group of 37, including Singapore (where at least three major companies develop and manufacture ROVs), Thailand, Malaysia, Russia, and India, and (2) do not

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[22] ECCN 6A001.a.1.d controls (for NS2/AT1 reasons) "[a]coustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles, designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m."

[23] ECCN 6A001.b.2 controls (for NS2/AT1 reasons) "Doppler-velocity sonar log equipment [designed to measure the horizontal speed of the equipment carrier relative to the sea bed] [h]aving speed accuracy better than 1% of speed[.]"

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convey a "critical" military or intelligence advantage. Accordingly, at the very least, ECCN 8A001.c.2 items should be placed in Tier 2 because these ROVs meet neither the foreign availability nor the military/intelligence requirement for Tier 1; there also is a strong argument that given the breadth of their foreign availability, they should be placed in Tier 3.

In addition, fiber-optic umbilical cables classified under ECCN 5A001.c.2, transponders classified under ECCN 6A001.a.1.d, DVLs classified under ECCN 6A001.b.2 and ADCPs (also classified under 6A001.b.2) do not provide a "critical" military or intelligence advantage to the United States and are not "almost exclusively available" from the United States. These items thus should be placed in Tier 2 or Tier 3.

* * * * *

Please do not hesitate to contact the undersigned, by telephone at (713) 329-4500 or by e-mail at kkerins@oceaneering.com, if you have any questions or need any additional information. You also may contact our outside counsel on export control matters at Covington & Burling LLP: Kim Strosnider (kstrosnider@cov.com; 202-662-5816) or Gabriel L. Slater (gslater@cov.com; 202-662-5159).

Thank you very much for considering these comments.

Respectfully submitted,

OCEANEERING INTERNATIONAL, INC.

Kevin F. Kerins
Senior Vice President - ROVs

cc: Stephen Hall, Office of Exporter Services

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6.E	List of SME Corporation Malaysia Innovation Awards for 2010 *Available at* http://www.smeinfo.com.my/index.php?option=com_content&view=article&id=1209&Itemid=1175
	Soil Machine Dynamics
7.A	"Soil Machine Dynamics, Delivering through dynamism," *The Manufacturer* (September 2008) *Available at* http://www.themanufacturer.com/uk/profile/8994/Soil_Machine_Dynamics
7.B	"Soil Machine Dynamics, Digging your scene," *The Manufacturer* (November 2010) *Available at* http://www.themanufacturer.com/uk/profile/11301/Soil_Machine_Dynamics

Tab	Description
7.C	Data Sheet for Hallin Marine Quantum built by SMD Hydrovision *Available at* http://www.hallinmarine.com/Downloads/Quantum%20Dec%202010.pdf
7.D	Data Sheet for Hallin Marine Quasar built by SMD *Available at* http://www.hallinmarine.com/Downloads/rov/Quasar%20Compact%20Oct%202010.pdf
7.E	Data Sheet for Quantum *Available at* http://www.smd.co.uk/includes/downloadfile.php?file=/downloads/quantum_workclass.pdf
7.F	Data sheet for Quasar *Available at* http://www.smd.co.uk/includes/downloadfile.php?file=/downloads/quasar_workclass.pdf
7.G	Press Release, "SMD to supply Hallin Marine with Quantum XPs and new Hanger LARS" (July 2010) *Available at* http://www.smd.co.uk/news/view.php?id=78
	Perry Slingsby Systems, Ltd.
8.A	Perry Slingsby Systems Locations webpage *Available at* http://www.perryslingsbysystems.com/contact.html
8.B	Data sheet for Triton XLX *Available at* http://www.perryslingsbysystems.com/assets/pdf/datasheets/vehicles/Triton_XLX.pdf

Tab	Description
8.C	Data sheet for Triton XLS *Available at* http://www.perryslingsbysystems.com/assets/pdf/datasheets/vehicles/Triton_XLS.pdf
8.D	Description of Triton XLS and Triton XLR in Perry Slingsby Systems ROVs and Trenchers brochure *Available at* http://www.perryslingsbysystems.com/assets/pdf/brochures/rovs_and_trenchers.pdf
8.E	Data sheet for Triton XLR *Available at* http://www.perryslingsbysystems.com/assets/pdf/datasheets/vehicles/Triton_XLR_100_125%20hp-1.pdf
	Sub-Atlantic Ltd.
9.A	"About Sub-Atlantic" webpage *Available at* http://www.sub-atlantic.co.uk/about
9.B	Data sheet for Comanche (February 25, 2008) *Available at* http://www.sub-atlantic.co.uk/media/products/downloads/Data_Sheet_4.pdf
	Sonsub AS
10.A	Sunsub AS profile in *Business Week* *Available at* http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=27204450

Tab	Description
10.B	List of Eni's subsidiaries for year 2009 (Exhibit 8 to Annual Report on Form 20F 2009) *Available at* http://www.eni.com/en_IT/attachments/publications/reports/reports-2009/Annual-Report-On-Form20F-2009.pdf
10.C	"Subsidiary of Eni S.p.A." webpage footer *Available at* http://www.saipem.com/site/Home.html
10.D	"Construction vehicles engineered for fast deployment in heavy seas," *Offshore* (April 2009) *Available at* http://www.offshore-mag.com/index/article-display/359643/articles/offshore/volume-69/issue-4/subsea/construction-vehicles-engineered-for-fast-deployment-in-heavy-seas.html
10.E	Innovator 250 webpage *Available at* http://www.saipem.it/site/article.jsp?idArticle=5461&instance=2&node=2012&channel=2&ext=template/37DueColonne&int=article/1DefaultArticolo
10.F	Sonsub "Company Background" on AZoRobotics.com website *Available at* http://azorobotics.com/Suppliers.asp?SupplierID=718
10.G	Innovator webpage *Available at* http://www.saipem.it/site/article.jsp?idArticle=5462&instance=2&node=2012&channel=2&ext=template/37DueColonne&int=article/1DefaultArticolo
Total Marine Technology Pty Ltd.	
11.A	Total Marine Technology "Company Overview" webpage (2010) *Available at* http://www.tmtrov.com.au/company.htm

Tab	Description
11.B	Data sheet for Nomad *Available at* http://www.tmtrov.com.au/nomad.html
11.C	Data sheet for Typhoon *Available at* http://www.tmtrov.com.au/tmtPics/Typhoon/TYPHOON_SPECS.pdf
11.D	Data sheet for Nomad Navigator *Available at* http://www.tmtrov.com.au/nomadnav.html
	International Submarine Engineering Ltd.
12.A	International Submarine Engineering "Facilities" webpage *Available at* http://www.ise.bc.ca/Services.html
12.B	Press Release, "Recovering an Alternate Source of Energy with a High Pressure Recovery Vessel" (March 26, 2009) *Available at* http://www.ise.bc.ca/News/GMGS%20HPRV%20Release.pdf
12.C	Press release, "ISE Delivers New HYSUB ROV" (October 13, 2010) *Available at* http://www.ise.bc.ca/News/SNK%20ROV%20Release%200910.pdf
12.D	Press release, "ISE Launches GMGS ROV for Trials" *Available at* http://www.ise.bc.ca/News/GMGS%20Launch%20Release%20121908.pdf
12.E	Press Release, "ISE Inducted as Technology Pioneer into Offshore Energy Center Hall of Fame" (November 20, 2009) *Available at* http://www.ise.bc.ca/News/Offshore%20Technology%20Pioneer%20Award%20Release%20Nov09.pdf
	KYSTDESIGN AS

Tab	Description
13.A	KYSTDESIGN homepage *Available at* http://www.kystdesign.no/pls/apex/f?p=10213:7120:2827614010709442::::p:home
13.B	"Contact us" webpage *Available at* http://www.kystdesign.no/pls/apex/f?p=10213:7120:1423023718548082::::p:contact-us
13.C	"This is KYSTDESIGN" webpage *Available at* http://www.kystdesign.no/pls/apex/f?p=10213:7120:2707666678043181::::p:this-is-kystdesign
13.D	KYSTDESIGN Work Class ROV brochure *Available at* http://www.kystdesign.no/f/632_kystdesign-brosjyre200508.pdf
13.E	INSTALLER Work Class ROV webpage *Available at* http://www.kystdesign.no/pls/apex/f?p=10213:7120:1605217729901272::::p:installer-work-class-rov
13.F	KYSTDESIGN ROV Design page from Work Class ROV brochure *Available at* http://www.kystdesign.no/f/632_kystdesign-brosjyre200508.pdf
13.G	Data sheet for INSTALLER *Available at* http://www.kystdesign.no/f/275_kystdesign-installer.pdf
13.H	KYSTDESIGN "ROV Technology" webpage (with SUPPORTER video) *Available at* http://www.kystdesign.no/pls/apex/f?p=10213:7120:2655882260330228::::p:rov-technology

Tab	Description
13.I	Data sheet for SUPPORTER *Available at* http://www.kystdesign.no/f/507_kystdesign-supporter.pdf
	IKM Subsea AS
14.A	IKM Subsea "ROV Sale" webpage *Available at* http://www.ikm.no/modules/module_123/proxy.asp?iDepartmentId=210&D=2&C=322&I=6011
14.B	Merlin WR200 ROV webpage *Available at* http://www.ikm.no/modules/module_123/proxy.asp?iDepartmentId=210&D=2&C=322&I=6006
14.C	Merlin LR120 ROV webpage *Available at* http://www.ikm.no/modules/module_123/proxy.asp?iDepartmentId=210&D=2&C=322&I=6007
14.D	Data sheet for Merlin WR200 *Available at* http://www.ikm.no/stream_file.asp?iEntityId=3433
14.E	Data sheet for Merlin LR120 *Available at* http://www.ikm.no/stream_file.asp?iEntityId=3431
	Sperre AS
15.A	"About Sperre" webpage *Available at* http://www.sperre-as.com/en/about

Tab	Description
15.B	SUB-fighter ROV Comparison Chart *Available at* http://www.sperre-as.com/en/products/sammenligningsoversikt/frontpage/ROV-sammenligning-REG-MAR-003-.pdf
15.C	Data sheet for SUB-fighter 30k *Available at* http://www.sperre-as.com/en/products/1078495175/1201097042/SUB-fighter-30k.pdf
15.D	Data sheet for SUB-fighter 15k survey *Available at* http://www.sperre-as.com/en/products/1078495175/subfighter15k/SUB-fighter-15k-_1_.pdf
15.E	Data sheet for SUB-fighter 10k *Available at* http://www.sperre-as.com/en/products/1078495175/1079614443/SUB-fighter-10k-_1_.pdf
15.F	Data sheet for SUB-fighter 7500 fiber *Available at* http://www.sperre-as.com/en/products/1078495175/1207812646/SUB-fighter-7500-fiber.pdf
15.G	Data sheet for SUB-fighter 4500 *Available at* http://www.sperre-as.com/en/products/1078495175/1078498438/SUB-fighter-4500.pdf
	Argus Remote Systems
16.A	Argus "Contact" webpage *Available at* http://www.argus-rs.no/contact
16.B	Argus "Company Structure" webpage *Available at* http://www.argus-rs.no/company-structure

Tab	Description
16.C	"Hidden depths," *European Oil & Gas* (April 30, 2007) *Available at* http://www.europeanoilandgas.co.uk/article-page.php?contentid=1808&issueid=85
16.D	Argus "Electrical ROVs" webpage *Available at* http://www.argus-rs.no/electrical-rovs
16.E	Argus Worker webpage *Available at* http://www.argus-rs.no/worker
16.F	Argus Bathysaurus XL webpage *Available at* http://www.argus-rs.no/xl
	AAK Subsea AS
17.A	AAK Subsea "About Subsea Technology & Operations" webpage *Available at* http://www.aak.no/en/about-subsea-technology-a-operations.html
17.B	"About AAK Group" webpage *Available at* http://www.aak.no/en/about-aak-group.html
17.C	"Operations" webpage *Available at* http://www.aak.no/en/operations.html
17.D	Elsub I webpage *Available at* http://www.aak.no/en/elsub-i.html
17.E	Elsub II webpage *Available at* http://www.aak.no/en/the-way-forward.html

Attachment A

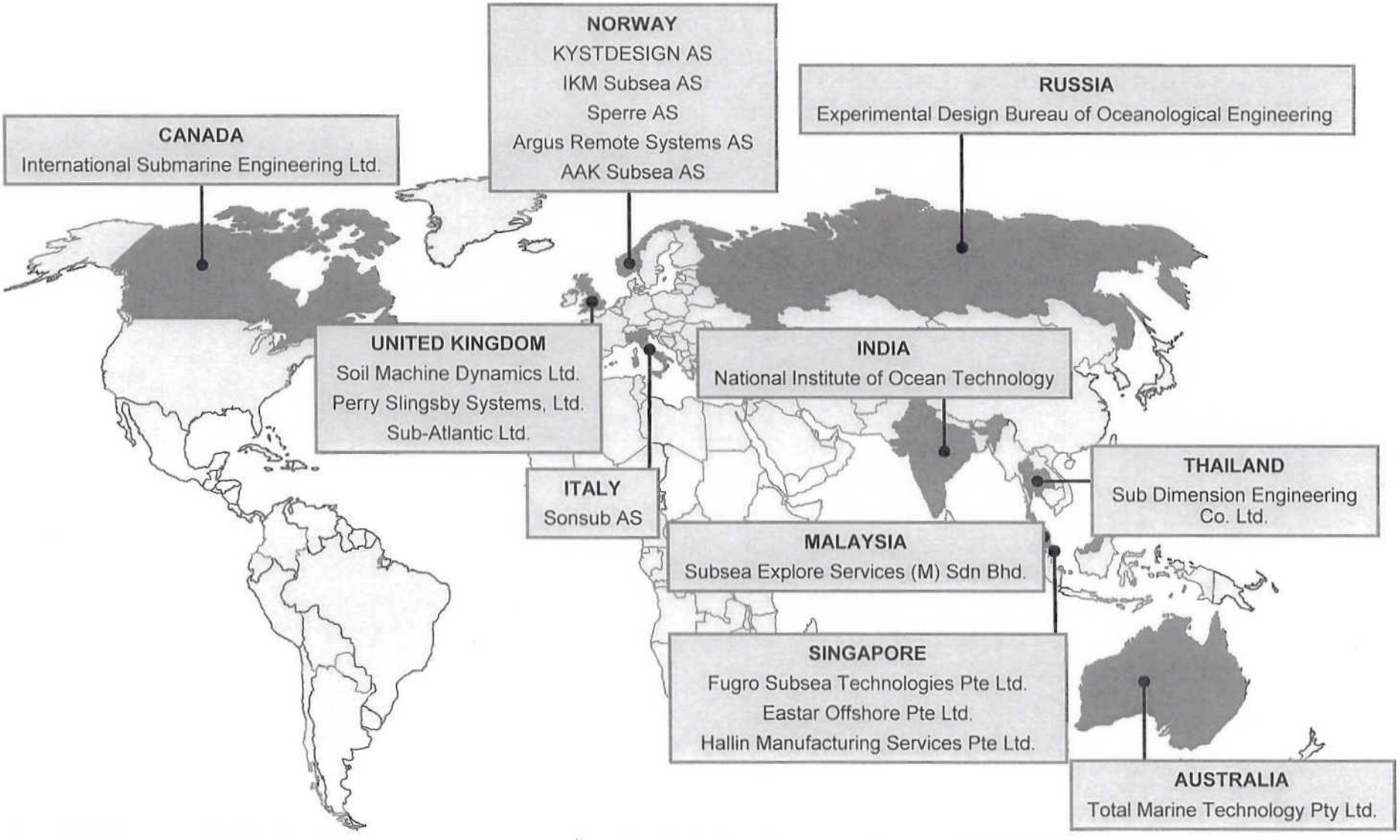
Foreign Sources of ROVs Comparable to ROVs Controlled under ECCN 8A001.c.2

Country of Development and/or Manufacture	Manufacturer	Comparable ROV Model(s)
Outside Group of 37		
Singapore	Fugro Subsea Technologies Pte Ltd.	FCV 3000
		FCV 2000D
		Sealion 3000
		Sealion MK II (4-Vert)
	Eastar Offshore Pte Ltd.	Phoenix
		Deep Swift/ SWIFT 3000 MSW
	Hallin Manufacturing Services Pte Ltd.	C-ROV
Thailand	Sub Dimension Engineering Co. Ltd.	Odyssea
		Pulsar
India and Russia	National Institute of Ocean Technology, in collaboration with Experimental Design Bureau of Oceanological Engineering, Russian Academy of Science	ROSUB-6000
Malaysia	Subsea Explore Services (M) Sdn Bhd.	Satria 101
		Satria 102
Within Group of 37		
United Kingdom	Soil Machine Dynamics Ltd.	Quantum
		Quasar
	Perry Slingsby Systems, Ltd.	Triton XLR
		Triton XLS
		Triton XLX

Country of Development and/or Manufacture	Manufacturer	Comparable ROV Model(s)
	Sub-Atlantic Ltd.	Comanche
Italy	Sonsub AS	Innovator Leviathan
Australia	Total Marine Technology Pty Ltd.	Navigator
		Nomad
		Typhoon
Canada	International Submarine Engineering Ltd.	HYSUB
Norway	KYSTDESIGN AS	SUPPORTER
		INSTALLER
	IKM Subsea AS	Merlin WR200
		Merlin LR120
	Sperre AS	SUB-fighter 30k
		SUB-fighter 15k survey
		SUB-fighter 10k
		SUB-fighter 7500 fiber
		SUB-fighter 4500
	Argus Remote Systems AS	Argus Worker
		Argus Bathysaurus XL
	AAK Subsea AS	Elsub I
		Elsub II

Attachment B

Development and Production of Work Class ROVs



TAB 1.A

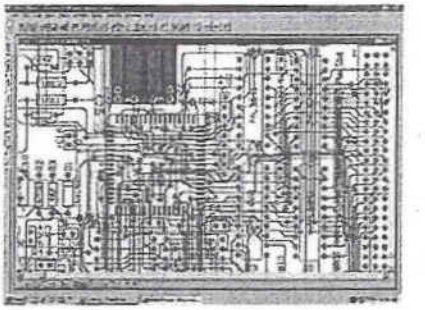
Fugro Survey is a member of:

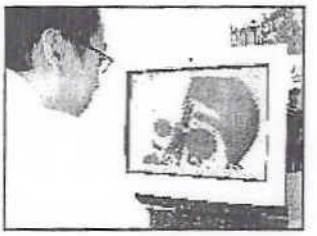
International Federation of Hydrographic Societies

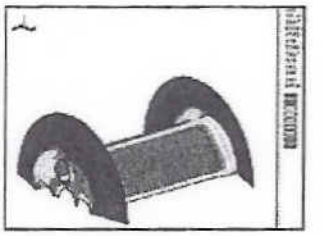
Remote Technology Support Unit (RTSU)

RTSU is a design department of Fugro based in Singapore. RTSU designs, manufactures and refurbishes ROV systems for Fugro. It also provides technical support to the Fugro ROV fleet worldwide.

- Design and Manufacturing Experience
- ROV Design Track Record
- Other Track Record





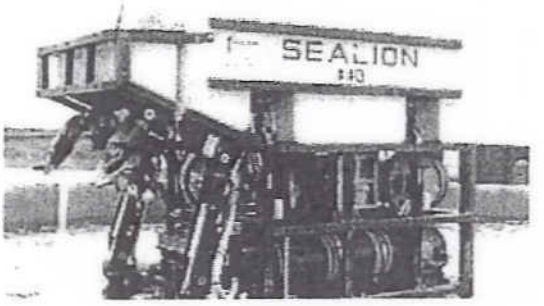


Design and Manufacturing Experience

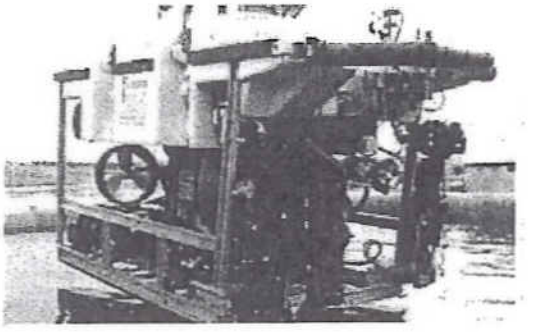
• ROV System Design / Upgrade	• Surface Control System
• Special Purpose Subsea System	• Umbilical & Tether Cable
• ROV Tooling Design	• High Voltage Subsea Motor
• Mechanical Structural Analysis / FEA	• Buoyancy Modules
• Winches, Launch and Recovery System	• Windows-based Control Software
• Subsea Control System	• Embedded Control System
• Hydraulics System Design	• PLC System / SCADA Software
• Subsea Housing / Pressure Vessel	• Analogue & Digital Circuitry / PCB Design
• DNV 2.7.1 DNV2.7.2 A60 Ex-Proof Container	• Video Overlay System

ROV Design Track Record

Vehicle Type	Description
Sea Pup	Single lift package, 20Hp, depth rating 600m
Seal	Light workclass, 75Hp, depth rating 600m
Sealion MKII	Vectored workclass, 100Hp, depth rating 1000-2000m
Sealion 3000	Vectored workclass, 125Hp, depth rating 3000m
Sea Serpent	Vectored workclass, 200/250Hp, depth rating 2500m
G3 / G4	High performance workclass ROV, 125Hp, depth rating 3000m / 4000m
FCV	High performance workclass ROV, 125HP, depth rating 3000m



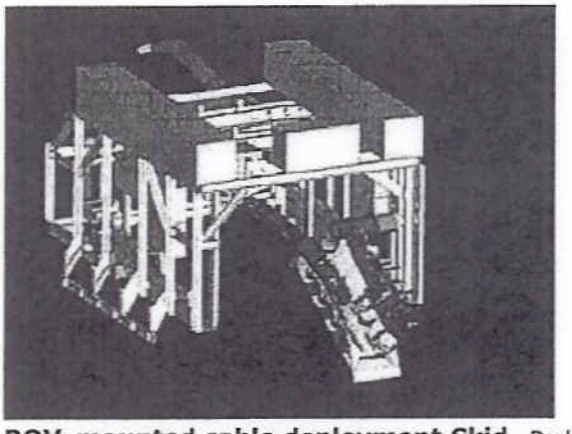
Deep Water Sealion



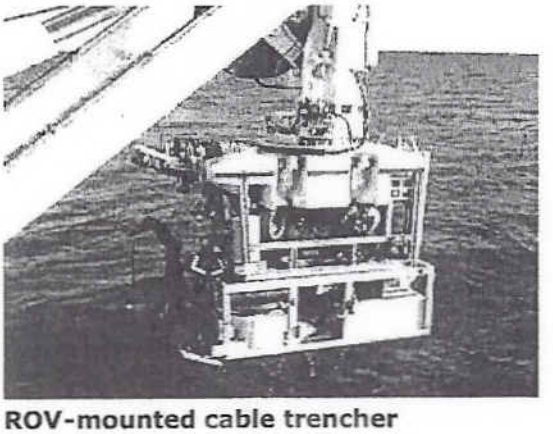
G3 ROV

Other Track Record:

- ROV-mounted cable deployment Skid
- ROV-mounted cable trencher
- Flying Lead Orientation Tool

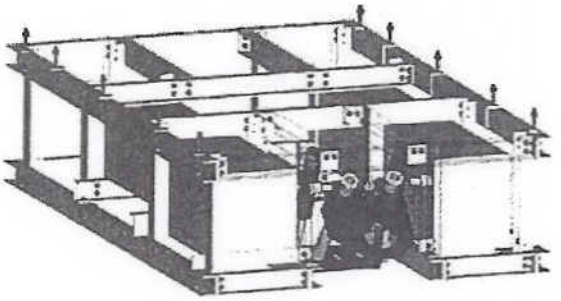


ROV-mounted cable deployment Skid - Deploys up to 12km of cable on seabed



ROV-mounted cable trencher

- ROV Deployed
- Trench depth – up to 1m
- Trenching speed – up to 600m/hour @25KPA soil condition



Flying Lead Orientation Tool

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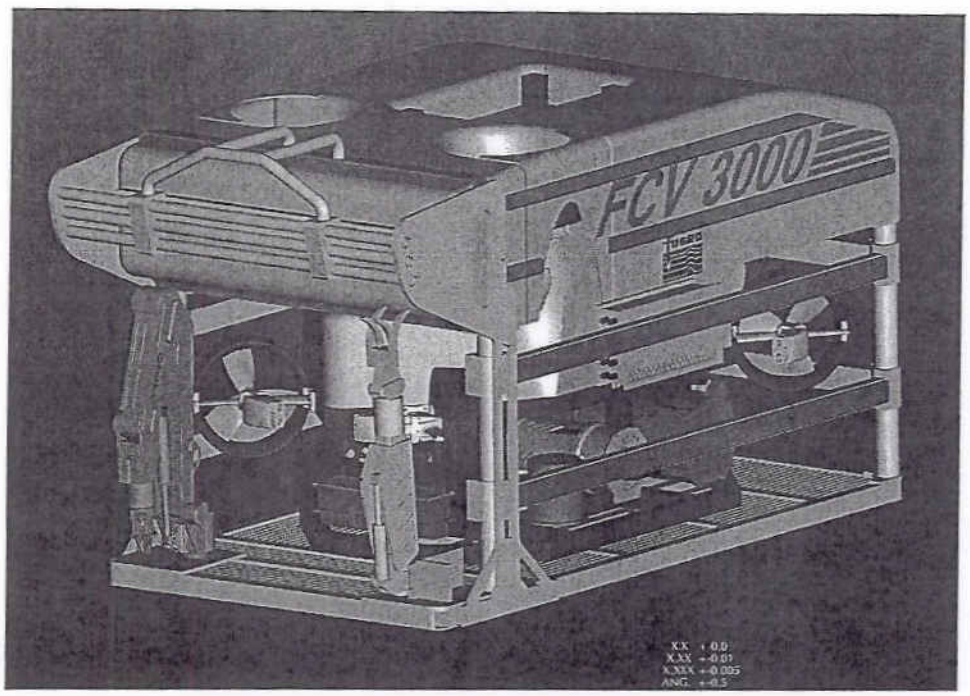
TAB 1.B

FCV 3000 - Next Generation of Work Class ROV



The *FCV 3000* is being designed and built in-house by Fugro to offer the next generation of performance and capability to our world-wide customer base, reflecting the Fugro commitment to a future in Remote Technology Solutions and incorporating internally developed expertise to help us deliver information from collected data, faster, better and with enhanced accuracy.

Over the years Fugro has developed a wide range of innovative technology and solutions to better address our customers' needs, so it is logical that when we turn our attention to the objectives of our ROV Business Line, we build the new generation of capability on a stable platform of field proven components and include our own particular brand of innovation.

Like its predecessors, the *FCV 3000* is part of an evolving system design that provides the customers with all of the essential demands of the deep water ROV System. Such as a 3.5 knot forward and 3.4 knot lateral speed capability, delivered by its 125hp hydraulic power system, through an 800kgf high power, vectored thrust design. This base level of standard capability, combined with the industry leading Sonar, Camera and Manipulator Systems of the 3,000msw rated *FCV 3000* will immediately allow the unit to be recognised as an acceptable solution to the rigours of deep water intervention and support.
However, it is in the implementation of the "hidden capability" that will distinguish the Fugro contribution to Remote Technology.

The Fugro view is to "*collect and interpret data related to the earth's surface and the soils and rocks beneath*", however customers are looking for more than just "*data*", they are looking for "*advice or information*" and the *FCV 3000* has been designed to allow that information to be available faster and with enhanced accuracy, through the inclusion of in-house developed technology that allows the original data to be time-stamped at the point of origin – the ROV Sensor. This provides the "*data set*" at the surface requiring only minimal manipulation to translate it to "*information*".

Other key capabilities that are incorporated into the *FCV 3000* are designed to improve the efficiency of the operations and address the needs to provide greater spatial awareness to the Operations Team. The *FCV 3000* will offer:

- Real time visualisation of the local subsea environment – helicopter view
- Mission rehearsal tools – Simulation and Planning
- Semi autonomous functionality
- 3 Dimensional Dynamic Positioning

Fugro N.V.
Veurse Achterweg, PO Box 41, 2260 AA Leidschendam, The Netherlands
Tel: +31 70 311 1422 Fax: +31 70 320 2703

www.fugro.com

FCV 3000 Next Generation of Work Class ROV

Primarily targeted at the deep water areas of the world, the *FCV 3000* has been designed to be scaled both upwards, shallower, and downwards, deeper, to cater for the varying demands of the Fugro global customer base. Initially there will be the *FCV 3000* and *FCV 1000* variants, but already we have plans, and potential customers, for a 4,000msw variant. All will share a common technology platform, making it simpler to move them from Region to Region and to support the Operations Teams on a world-wide scale. The *FCV* has been developed specifically so as to be easily configured, or re-configured, for all types of tasks, not only in the oil and gas support sector, but also in the areas of science and salvage. In all of these operations, the other Fugro capabilities can be incorporated to produce a complete package for Integrated Service Provision to the customers.

Typical operations can range from Drill Rig Support, to Flowline Connection, to Field Support – Choke changeout, without the need for any modifications to the Core Vehicle or System. This is accomplished by the fitting of a variety of Tooling Packages that can be rapidly installed to the ROV, by means of "standard interfaces", both mechanical and control, which maps any new sensors to the surface without the need to open Pods and complete a re-wiring exercise. These interfaces ensure that operational changes can be implemented safely and efficiently, with the minimum of fuss, in a limited space environment as typically found on even the fifth generation of Drilling Units.

Typical operations for the *FCV 3000* are:

Construction Support Services

- Pipeline route surveys
- Multibeam surveys
- Route and crossing preparation
- Flowline connection
- As-laid, as-trenched and as-built surveys
- Touch down monitoring
- Pipeline and Flowline Commissioning

Field Support

- Choke / SCM changeout
- Emergency Intervention – Valve override
- Facilities enhancement
- Downhole intervention – valve opening

Inspection, Repair and Maintenance (IRM)

- Pipeline and structures inspection
- Marine growth surveys and removal
- CP / CD surveys
- Freespan correction, including the use of mechanical supports

Drill Rig Support

- Exploration, Development and Completions Drilling support, with Tooling
- Wellhead, Manifold and Subsea Tree intervention
- Subsea Facilities abandonment / recovery
- Well Completion and Workover support
- Choke and / or SCM changeout
- Debris clearance surveys

***FCV 3000* SPECIFICATIONS**

Depth rating	3,000msw
Load Rating	3g

DIMENSIONS

Length	3,000mm
Width	1,700mm
Height	1,700mm
Weight	3,600kg inc payload
Payload	400kg of lead

POWER

Motor	1 x 2850vac @ 94kW (125hp)
Hydraulic pump flow	220lpm @ 60 Hz
Hydraulic pump pressure	225 bar
Single phase electrical supply	10KVA providing 24vdc & 115vac

SPEED

Forward / aft	3.5 knots
Lateral	3.4 knots
Vertical up / down	2.7 knots

THRUSTERS

4 x 15" vectored	Fwd: 800kg / Lateral: 800kg
3 x 12" vectored	Vertical: 800kg

MANIPULATORS

Manipulator 1	Schilling TITAN 4
Manipulator 2	Schilling RigMaster

CONTROL SYSTEM

Vehicle Control	Fugro proprietary ERA-004
FO Multiplexer	Commercial in Confidence
Survey Module	Fugro proprietary StarPort

SENSORS

Heading	Commercial in Confidence
Pitch and Roll	Commercial in Confidence
Depth	Digiquartz 8CB4000-I
Altimeter	Simrad 1007 digital altimeter
Sonar	Commercial in Confidence
Cameras	Minimum of 8 x separate Video channels
Lights	4 x 600W switch and dim channels

TOOLING

Mechanical Interface	Fugro proprietary – 4 point
Through frame lift	3,000kg
Bi-directional solenoid	20 x solenoid valve channels
Servo valves	2 x additional drive channels available

POWER REQUIREMENTS

System (typical) 600kVA, 380 – 500vac 3-ph supply 50 / 60 Hz

MAIN LIFTING UMBILICAL

Optimised design with single mode fibres in robust steel tube

UMBILICAL WINCH

Winch capacity	4,800m of 37mm diameter umbilical
Line Pull – top layer	7,646kg
Certification	DNV design and manufacture

LAUNCH AND RECOVERY SYSTEM

A-Frame outreach	4,000mm
Telescope range	1,965mm
SWL	8,000kg to DNV Rules

TETHER MANAGEMENT SYSTEM

Type	Side entry or Top Hat as required
Tether	600m of 30mm diameter tether

Fugro N.V.
Veurse Achterweg, PO Box 41, 2260 AA Leidschendam, The Netherlands
Tel: +31 70 311 1422 Fax: +31 70 320 2703

www.fugro.com

TAB 1.C

Winter 2008

AQUASPHERE

In this issue...

04 Fugro Egypt - a new ROV organisation
Expanding our team, services and fleet in Egypt.

05 Fugro Brasil
Brazilian ROV training program goes from strength to strength.

10 Innovative subsea repair
Specialist tools, designed, built and used to repair an offshore pipeline.

11 From conception to reality
Our experienced team put the final touches to the flagship FCV 3000 ROV.

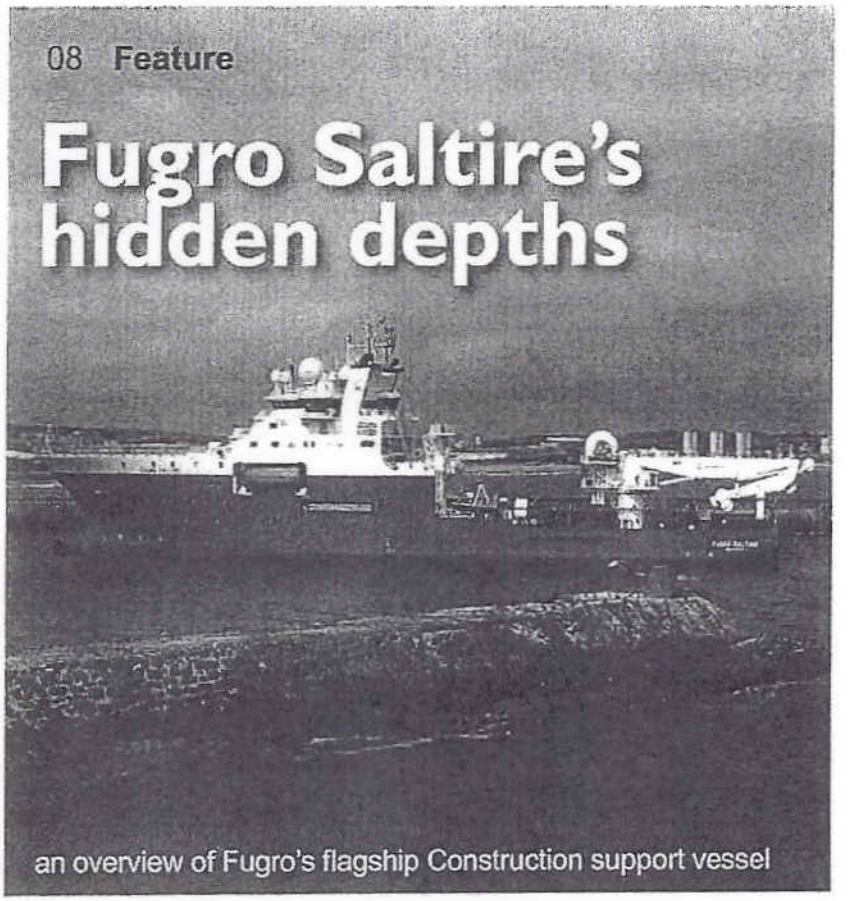
12 Fugro Brasil - diving division
A unique service to the offshore hydrocarbon industry.

13 Return to the wreck of the Prestige
A survey of the tanker 3,850m under the ocean.

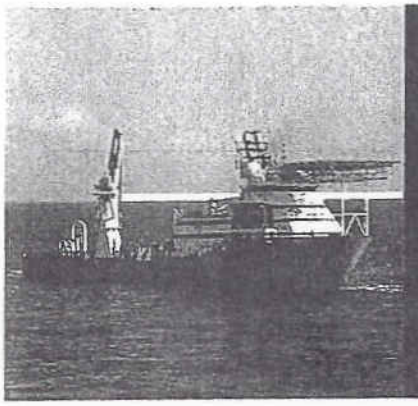
AQUASPHERE is also available online at www.fugro.com

08 **Feature**

Fugro Saltire's hidden depths

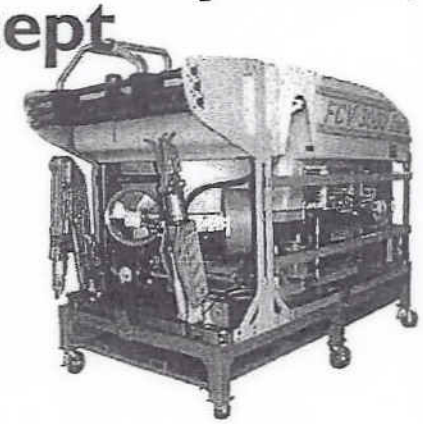


an overview of Fugro's flagship Construction support vessel



07 **Skandi Carla's Indian Adventure**
read about the Skandi Carla's operations in the Krishna Godavari Basin, Bay of Bengal

FCV 3000 ROV System; From Concept to Reality



Those who have been following the rise of the Fugro ROV capability, will know that in late 2005 we finalised the strategic decision to build up our Work Class ROV Fleet based on an in-house design and build solution and that since then we have been working towards that goal. This article provides the latest update on the "Concept to Reality".

The concept from Q1 2006 has matched the realisation very closely, with the photograph on the right being of the first production vehicle, taken in Q3 2006, although admittedly it has taken us a little longer to actually create the whole System, see later.

From Small Beginnings:

In the first quarter of 2006, a Team of experienced Fugro ROV Managers and Engineers met in Singapore to put the final touches to the specifications for what would be the flagship FCV 3000 and a cornerstone of our Work Class Fleet into the future, conceived and designed to serve our customers, by doing better, what Fugro do, which is to collect and interpret data from which to provide advice and information to that global customer base.

With the concept "frozen" we very quickly produced a 1:3 scale model with which to launch the FCV 3000 at OI06 in London and as one might imagine from Fugro, who have a long track record of technology development to match the customers' expectations, the FCV 3000 was very well received when we took the covers off. However; the detailed design would take us a little longer than the rush production of the exhibition model.

With a team of only 10 people within GROV / RTSU in Singapore, we began the process to not only design our vision but also recruit the additional people and skills that would assist us to reach our ambitious goal of an in-house design AND build, of not just the vehicle, but the complete System.

By September 2008 the headcount of the Fugro GROV / RTSU Team had grown from that original Team of 10 to now number 61 men and women, with a tremendous mix of skills experience and enthusiasm and, possibly, the highest morale of any Team within Fugro as they see the vision become reality from their labours.

▼ *The photograph below shows members of the Singapore Team, together with Handover / Acceptance Team from Fugro-Rovtech (UK), who were to take delivery of the first Production System with Kobi Ruegg, COO of OSD and Jim Mann, the Fugro Global ROV Manager.*

Instrumentation for Floating Production Systems

Introduction

The exploitation of deep-water oil and gas reserves has lead to the wide-spread use of floating production systems. This method is also often very attractive as a low cost means of developing marginal fields in shallower water depths. However, little is known about the actual performance of Floating Production Systems in-situ.

The use of structural instrumentation on fixed structures has shown that in-situ measurements can demonstrate significant conservatism in design. Using a similar approach it may be possible to demonstrate that the critical components of FPSs are not as heavily loaded as assumed in design. The instrumentation packages for Floating Production Systems can be split into three distinct areas:

Moorings

Mooring tension can be monitored using load cells or instrumented pins. Instrumentation such as Fibre Optic sensors are also being developed for deployment within the tether systems to enable long term measurements of strain at remote locations to be obtained. Scanning sonar can also be used to continuously monitor the position of anchor chains or cables relative to the vessel turret to warn of breaks.

Vessel Instrumentation

An array of different parameters can be offered in support of vessel operations. These include:

- Six degree of freedom Motion Measurements
- Environmental Measurements including wave height, wind, temp atmospheric etc
- Current Measurements using Acoustic Doppler Current Profiling Systems (ADCPs)
- Vessel absolute position using DGPS
- Structural Loading and fatigue using appropriate strain gauge technology suited for extreme environment

Riser Instrumentation

The instrumentation of risers can provide detailed information regarding the response, which can then be analyzed to evaluate loads, vortex shedding etc. Fugro Structural Monitoring (FSM) has produced a subsea instrumentation system, DeepData, to enable performance data to be readily obtained at depth. Data can either be cabled back to the surface, downloaded subsea by ROV or accessed via hydro-acoustic telemetry.

For further information contact:
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Business Development Manager
Fugro Structural Monitoring
Tel: 0141 774 8828

TAB 1.D

Winter 2008

AQUASPHERE

The Global Subsea Services Publication of the Fugro Group

In this issue...

04 Fugro Egypt - a new ROV organisation
Expanding our team, services and fleet in Egypt.

05 Fugro Brasil
Brazilian ROV training program goes from strength to strength.

10 Innovative subsea repair
Specialist tools, designed, built and used to repair an offshore pipeline.

11 From conception to reality
Our experienced team put the final touches to the flagship FCV 3000 ROV.

12 Fugro Brasil - diving division
A unique service to the offshore hydrocarbon industry.

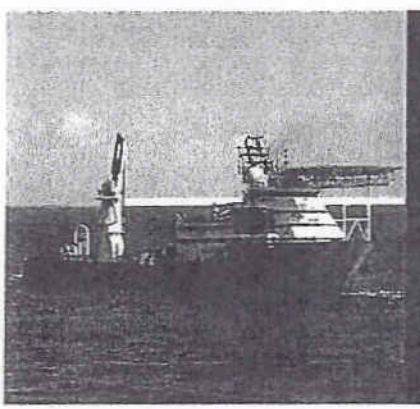
13 Return to the wreck of the Prestige
A survey of the tanker 3,850m under the ocean.

AQUASPHERE is also available online at www.fugro.com

08 **Feature**

Fugro Saltire's hidden depths

an overview of Fugro's flagship Construction support vessel



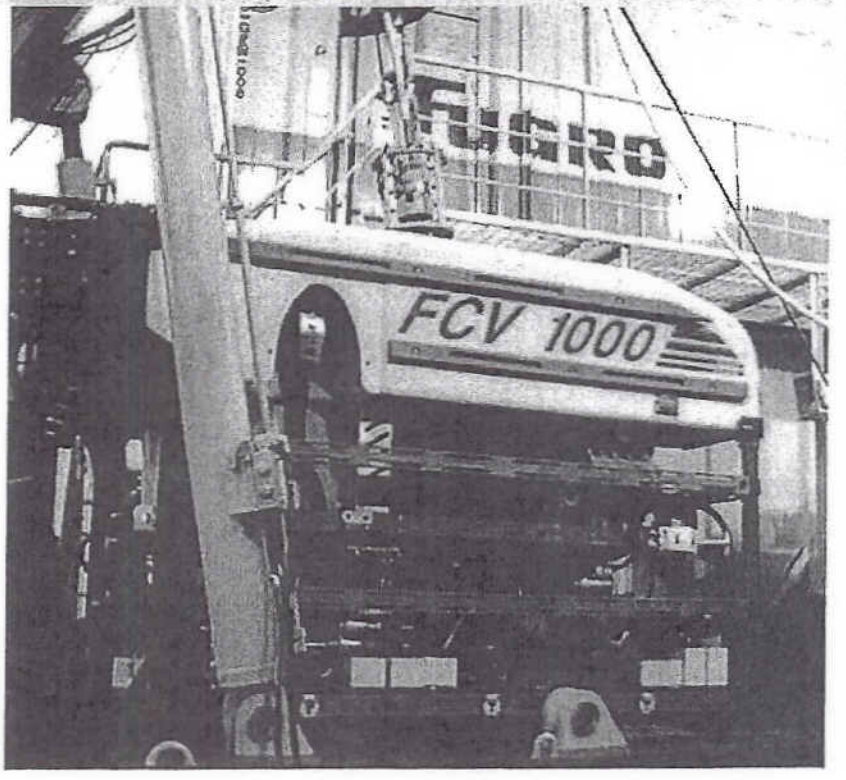
07 **Skandi Carla's Indian Adventure**

read about the Skandi Carla's operations in the Krishna Godavari Basin, Bay of Bengal

ROV Fleet Expansion Continues at Fugro

The development and expansion of the Fugro ROV Fleet continues to gather pace with the delivery of the first of the FCV 1000 ROV Systems to Fugro Singapore, where the new ROV System has been installed onboard the Fugro owned DP 1 ROVSV Setouchi Surveyor.

▼ *Fugro's FCV 1000 ROV Mobilising onboard ROVSV Setouchi Surveyor*



FCV 1028 is the first of the FCV 1000 ROV Systems to be delivered from the Fugro, in-house Design and Build Team, and follows the successful introduction of the FCV 3000 Systems in 2007, 12 of which have been completed to date and are now fully operational in Brazil, Europe, Asia Pacific and West Africa. The delivery of FCV 1028 and its 7 sister Work Class Systems outputted from the Fugro Singapore facility through 2008, combined with the 15 Electric ROV Systems that Fugro is taking delivery of from Saab Seaeye Limited this year, brings the global Fugro ROV Fleet numbers close to 130 Systems, with possibly the lowest average age of an ROV Fleet anywhere in the commercial world.

The Fugro FCV Program was designed from the outset to offer 3,000msw and 1,000msw variants as standard, with scope to also produce deeper solutions if there was a client generated requirement and a 4,000msw option is being planned.

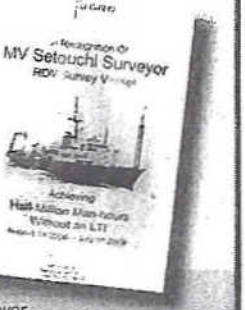
Fugro Provides Integrated ROV Services from bases in Australia, Azerbaijan, Brazil, Egypt, Norway, Singapore, UAE and the UK.

Setouchi Surveyor

▼ *The Setouchi Surveyor with ROV deployed to work-site*

The Fugro Survey Pte's ROV support vessel Setouchi Surveyor based in S.E. Asia, has recently achieved 500,000 man hours without an LTI. This has been over a period from 14th August 2006 up till 4th July 2008. During this period she completed a number of contracts for various clients in the SEA region on a variety of tasks such as pipeline survey, free-span rectification and construction support.

In September 08 we have changed out the ROV systems onboard, taking off Sealion 21 and replacing this with the first of Fugro's new FCV1000 series ROV system.
The vessel and ROV has just returned from a successful series of sea trials offshore Singapore.



▼ *The FCV1000 on the deck of the Setouchi Surveyor*

TAB 1.E

Autumn 2009

AQUASPHERE

The Global Subsea Services Publication of the Fugro Group

In this issue...

02 **Message from the Chief Operating Officer**
Jim Sommerville's overview of the year so far.

06 **Skandi Carla Returns to Europe**
The successful completion of a construction support project.

08 **'Life of Field' Contract Award**
Fugro win contract for the provision of ROV, Diving and Intervention Engineering Services on the Bonga Field.

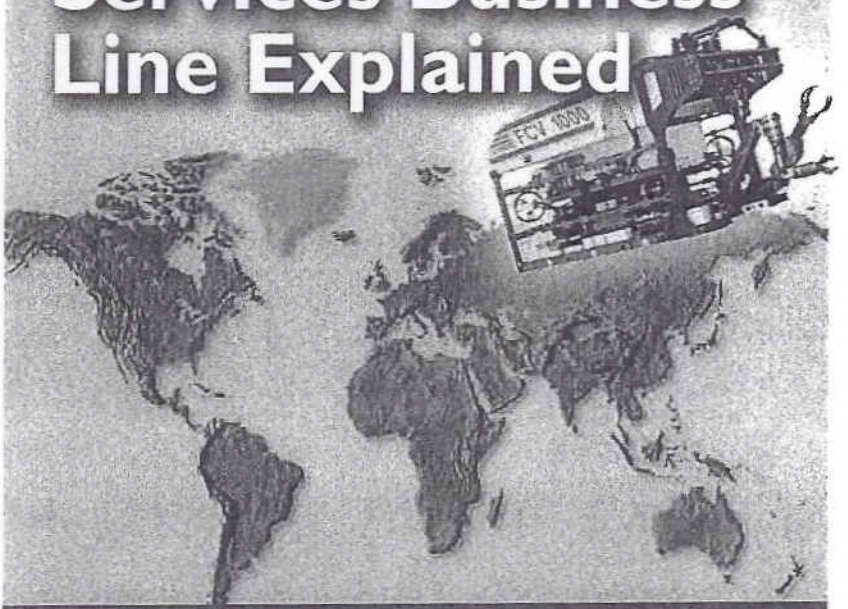
10 **Fugro Saltire continues to impress**
Celebrating one year in service.

11 **Re-discovery**
The wreck of the Danton re-discovered in the South Mediterranean Sea.

16 **Highland Eagle Soars**
New work class ROV enhances the capability of our inspection vessel.

▸▸ **AQUASPHERE** is also available online at www.fugro.com

Fugro Subsea Services Business Line Explained



an insight into the organisational structure ▸▸ 03

New World Class Facility for Fugro-impROV

▸▸ 15

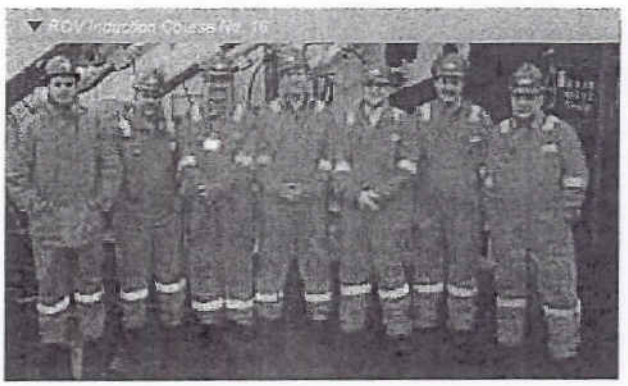
Golden SAM Award

Fugro Brasil awarded the first Golden SAM Award of 2009

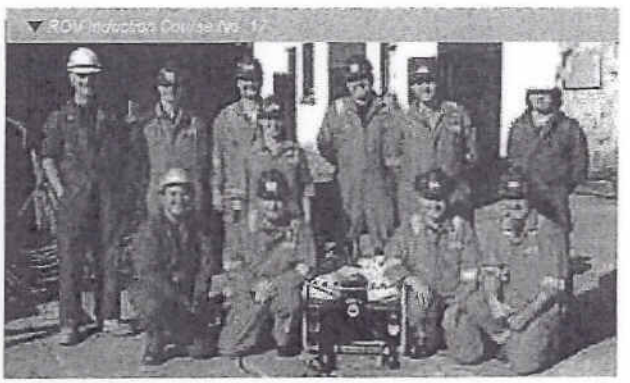
▸▸ 07

Fugro Academy launches in-house production of ROV technical e-learning and classroom courses

Fugro's commitment to quality training for all its staff is nowhere better demonstrated than the existence of the Fugro Academy. Fully aware of the need to deliver a consistently high standard of training on a global basis the Fugro Academy was formed to help develop and train staff and ensure that this need was met.



▼ ROV Induction Course fig. 16



▼ ROV Induction Course fig. 17

A new range of e-learning and classroom courses being produced by the Fugro Academy for the Subsea Services Business Line demonstrates the commitment being made by Fugro in this critical area. Making full use of in-house produced animated graphics, supplemented by photographs and videos for course presentations, these state-of-the-art courses will be delivered via a mixture of online e-learning, CD based and classroom sessions. The first of these, an Introduction to Fibre Optics, is currently being finalised for release and this will be available via the Fugro Academy Website.

A *further series of e-learning and classroom course production is underway* and efforts will concentrate initially on the following courses:

- Introduction to ROV Electronics
- Introduction to ROV Hydraulics
- Introduction to ROV Electrical Systems
- Working with High Voltages
- Fault Finding Techniques
- Introduction to Control Systems
- Basics of Piloting
  (for use in conjunction with our training simulators)

These courses will be made available via the Fugro Academy website as soon as each is completed and approved. These courses are being authored in the main by Alan Payne with assistance in the production of animated graphics from Scott Murray. Both of them joined Fugro in 2009.

Alan is a former technical teacher recruited for his classroom skills and proven capability of producing courses with animated content. Alan has the unusual hobby of "Kiting" with a cart at the end of the kite strings. He represents the sport at national level and is a member of the Scottish Kiting Team.

Scott is a recent graduate of Robert Gordon's University in Computer Graphics and his addition to the team has enhanced the high quality of the animations we can produce and the speed of production. His hobby is photography and this will prove useful when we need quality shots of equipment to include in our courses.

In addition, a series of externally provided *online Safety, Lifting and Logistics courses* have been sourced by the Fugro Academy and are currently being used as a pilot to evaluate them further. The courses included in the pilot are:

- Rigging and Lifting Awareness
- An Introduction to LOLER
- Safe Use of Grinders
- Transportation of Dangerous Goods

If the pilot proves successful we will arrange to have more of these made available and list them on the Fugro Academy website.

Courses and modules delivered in Q2 2009 were:

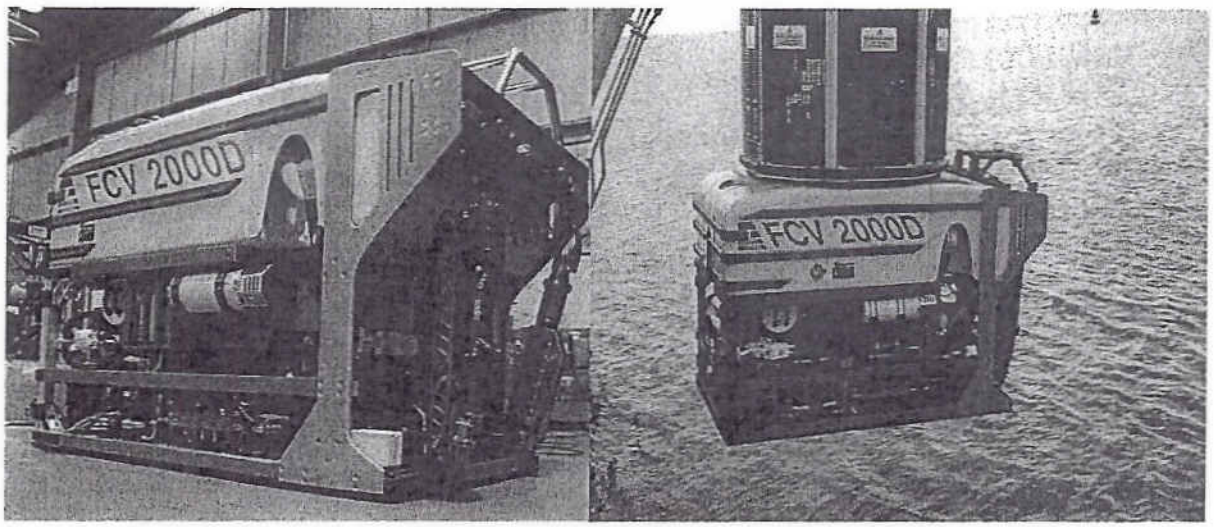
- Fort William Induction Courses
- Saab Seaeye Vehicle Courses
- FCV 3000
- Safe Working with Electricity and High Voltage
- Offshore Safety Awareness
- Working with Tools and Hand Safety
- Introduction to ROV Subsea Activities
- Introduction to ROVs
- Introduction to Piloting (Simulator)
- Portable Appliance Testing Awareness

FCV 3000 and 1000 courses will become available from our technical support group in Singapore later this year. These will be managed by the Fugro Academy who will handle course requests. Also included in the classroom course production schedule for this year will be a new in-house ROV Supervisor's course.

Dates of when these new courses could be run will be advertised on the Fugro Academy website.

TAB 1.F

FCV® 2000 – Next Generation Work Class ROV



The FCV 2000D is the 2,000msw rated iteration in the Fugro Core Vehicle family of 5th Generation Work Class ROV Systems. It has been designed and built in-house by Fugro, specifically to cater for the rigours of Drilling and Completion Support to the medium water depth semi submersible drilling rigs and drill ships. As with all of the FCV Systems, it offers high levels of performance and capability, but in a more compact package. It incorporates a host of internally developed, proprietary technologies combined with the "best in class sensors and peripherals" to help us deliver the performance that is necessary for the high levels of service demanded. FCV2000D System is fitted with explosion protection equipment and compliant for operation in Zone 2 hazardous environment.

Over the years Fugro has developed a wide range of innovative technology and solutions to better address our customers' needs, so it is logical that when we turn our attention to the objectives of our ROV Business Line, we build the new generation of capability on a stable platform of field proven components and include our own particular brand of innovation.

Following the successful introduction of the FCV 3000 in 2006 and the FCV 1000 in 2008, each with similar capabilities to deliver world class IRM and Construction Support to our clients, Fugro now has available the FCV 2000D to provide that same level of performance in a rugged, compact System, designed to counter the conflicting needs of the subsea support requirements and deck space limitations of existing, medium water depth drill rigs and drill ships.

The FCV 2000D is capable of over 3 knots forward speed and develops >600kgf of bollard power in all directions, seamlessly delivered by its onboard 125hp electro hydraulic power pack and vectored thrust design. With its base level of enhanced standard capability and outfit, combined with the industry leading Sonar, Camera and Manipulator Systems, the 2,000Msw rated FCV 2000D will immediately be recognisable as an industry work horse for all manner of subsea tasks and not just the Drill Support that its design is focussed on.

Drilling and Completions Support demands that the System be capable of enhanced tool carrying capability; both for underslung and rear mounted tooling packages and the System is particularly well specified in these areas, e.g. the LARS is designed to allow the TMS, ROV and underslung module to have a total stack-up height of 5m, meaning that underslung packages of 2,745 long x 1,560 wide x 1,100 high and weighing up to 3,000Kg can be accommodated.

The LARS has also been designed to offer maximum flexibility with regard to the layout that can be configured. Understanding that some installations may not require the A-Frame, but always need the umbilical winch, the "smarts" to control the functionality of the launch and recovery sequence are all contained within the confines of the winch. Similarly, the deck HPU has been simplified to allow hydraulic power to be delivered by an alternative source, which could even be a hydraulic ring main in some circumstances.

Despite being a focussed design for Drilling and Completions Support, the FCV 2000D shares many of the attributes of its siblings in the FCV series; accordingly the FCV 2000D incorporates Fugro "Starport" technology that allows original data to be time-stamped at the point of origin – the ROV Sensor, which increases the accuracy of collected data. This provides the "data set" at the surface requiring only minimal manipulation to translate it to "information".

As the FCV 2000D and FCV 3000 share a common technology platform, the following advanced features available to the FCV 3000 are also to be found on the FCV 2000D when required.

- Mission rehearsal tools – Simulation and Planning
- Semi autonomous functionality
- 3 Dimensional Dynamic Positioning
- Real time visualisation of the local subsea work environment – helicopter view

FCV® 2000 – Next Generation Work Class ROV

Primarily targeted at the expanding market for in-depth ROV Support around the developing, as well as mature, oil and gas areas of the world, the FCV family caters for all working water depths and task environments. Besides the FCV 3000, FCV 1000 and FCV 2000D Systems, there is also an option for a 4,000msw variant. All share a common technology platform, making it simpler to move them from Region to Region and to support the Operations Teams on a worldwide scale. The FCV has been developed specifically so as to be easily configured, or reconfigured, for all types of tasks principally, but not exclusively, in the oil and gas support sector, and can transfer easily to the areas of science and salvage. In all of these operations, the extensive range of the overall Fugro capabilities can be combined to produce a complete package for Integrated Service Provision (ISP) to the customers.

The FCV 2000D has been designed to target the increasingly demanding scope of Drilling and Completions Support, but given its overall capability and "Modular Concept", it can equally be aligned to provide Field Support, Construction Support or IRM operations when required. This is accomplished by the fitting of a variety of Tooling Packages that can be rapidly installed to the ROV, by means of "standard interfaces", both mechanical and control which maps any new sensors to the surface without the need to open Pods and complete a re-wiring exercise. These interfaces ensure that operational changes can be implemented safely and efficiently, with the minimum of fuss, in a limited space environment as typically found on even the fifth generation of Drilling Units.

Typical operations for the FCV 2000D are:

Drill Rig Support
- Exploration, Development and Completions Drilling
- Support, with both standard and specialist / bespoke Tooling
- Wellhead, Manifold and Subsea Tree Intervention
- Subsea Facilities abandonment / recovery
- Well Completion and Workover support
- Choke and / or SCM Change-out
- Debris clearance surveys

Construction Support Services
- Pipeline route surveys
- Multibeam surveys
- Route and crossing preparation
- Flowline connection
- As-laid, as-trenched and as-built survey
- Touch down monitoring
- Pipeline and Flowline Commissioning

Field Support
- Choke / SCM Change-out
- Emergency Intervention - valve override
- Facilities enhancement
- Downhole intervention - valve opening

Inspection, Repair and Maintenance (IRM)
- Pipeline and structures inspection
- Marine growth surveys and removal
- CP / CD surveys
- Free-span correction, including the use of mechanical supports

FCV 2000D SPECIFICATIONS

Depth rating	2,000msw
Load rating	3g

DIMENSIONS

Length	2,720mm
Width	1,560mm
Height	1,815mm
Weight	3,250kg including Payload
Payload	200 - 250kg of steel ballast

POWER

Motor	1 x 2,850Vac, 125HP
Main Hydraulics Pump	157 lpm @ 60Hz
Tooling Hydraulics Pump	70 lpm @ 60Hz
Single phase power	5KVA providing 24Vdc & 110Vac

SPEED

Forward	In excess of 3 knots
Lateral	Typically 2.2 knots

THRUSTERS

4 x 12" Vectored	Lateral Thrust >600Kgf
3 x 12" Vertical	Vertical Thrust >600Kgf

MANIPULATORS

Manipulator	1 Schilling Orion 7P
Manipulator 2	Schilling Rigmaster 5F Grabber

CONTROL SYSTEM

Vehicle Control	Fugro Proprietary
FO Multiplexer	24Gps capable CWDM Based
Survey Module	Fugro proprietary Starport

SENSORS

Heading	Octans III, Fugro ROV FOG
Pitch and Roll	Octans III
Depth	Digiquartz 8CB4000-I
Altimeter	Kongsberg 1007 digital altimeter
Sonar	Kongsberg 1071 Sonar
Camera (channels)	12 x PAL / NTSC; 3 x HDT
Light (channels)	4 x 600W Halogen Dimmers; 3 x 100W HID; 2 x 24V LED

TOOLING

Mechanical Interface	Fugro proprietary – 4 point
Through frame lift	3,000kg underslung, 1,000kg aft
Bi-directional solenoid	14 x solenoid valves
Servo valves	1 x spare drive
IVP	10 x solenoid, 1 x proportional

POWER REQUIREMENTS

System (Typical)	400kVA, 380 – 500Vac 3-ph 50/60 Hz
TMS Type	Top Hat PSSL Type 4
Tether Capacity	Up to 600m of 30mm dia; 200m fitted

UMBILICAL

37mm diameter steel armoured design with optimised single mode fibres in robust steel tube

UMBILICAL WINCH

Winch capacity	2,400m of 37mm diameter umbilical
Pull – top layer	10,000kg Line Pull – at core 21,000kg
Lift Winch	8,000kg SWL @ 3g

LAUNCH AND RECOVERY SYSTEM (LARS)

Compact A-Frame launch system, illustrated at left

Offshore Lifting	DNV 2.7.1 and DNV 2.7.3 Certified
Hazardous Environment	Zone 2 Rated

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TAB 1.G

Summer 2010

AQUASPHERE

The Global Subsea Services Publication of the Fugro Group

In this issue...

02 New Brazilian Facilities
Fugro Subsea Services opens new facility in Rio das Ostras.

03 Fugro Symphony Update
New preview.

04 New vehicle joins FCV family
The all new FCV 2000 completes its build in Singapore.

11 New "Dog House" Tooling System
Taking a look at Fugro ImpROVs new running tool.

12 Skandi Carla's Caribbean Adventure
The Skandi Carla handles a variety of projects through the winter months.

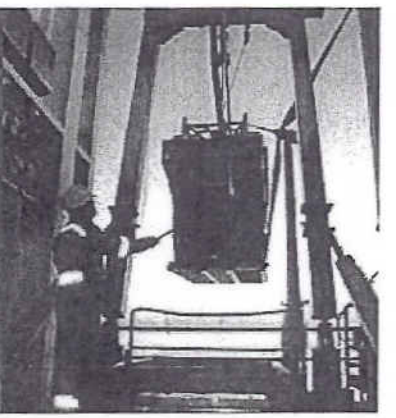
15 Safety Award for ROV Team
A proactive approach to safety onboard the Kan Tan IV in Australia.

▸▸ **AQUASPHERE** is also available online at www.fugro.com

Skandi Olympia goes from strength to strength ▸▸ 08

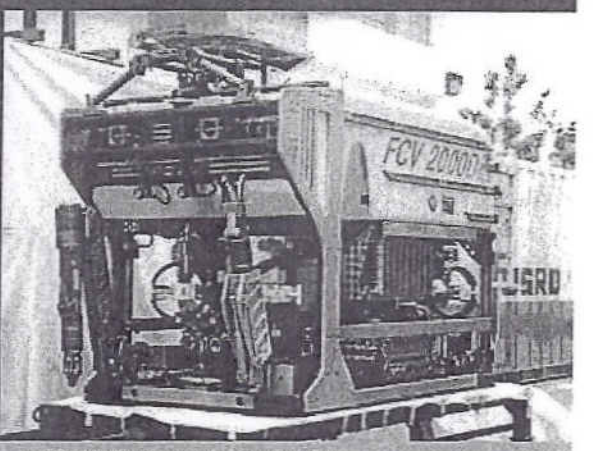
Fugro Subsea Services awarded ROV and vessel contracts in the Offshore Renewables Market

▸▸ 06



The FCV Family Continues to Grow

Having successfully introduced the high specification FCV 1000 and flagship FCV 3000 ROV Systems, it was determined that we needed to develop an intermediate depth solution for 2,000msw, but within a tighter, more compact package and so we went to the drawing board with a clean sheet of paper and target weights and dimensions for the FCV 2000 System.



▲ FCV 2000D prior to delivery to first client

The challenges were to develop a 2,000msw rated vehicle that had all of the capabilities that are now a trademark of the FCV, but to comply with a substantially smaller space envelope; plus design and build an armoured umbilical LARS (Launch and Recovery System) that would offer a neater footprint aboard the support platform AND provide a spacious working arrangement for the ROV Crew. These challenges have been successfully met, largely due to the total design control philosophy that Fugro adopted for the FCV Program, whereby we are able to develop the interdependent design solutions wholly in-house. The Design and Build Team at Fugro Subsea Technologies in Singapore were up to the challenge and by the time you read this article, at least 3 x FCV 2000D will be delivered and in-service.

The vehicle

The FCV 2000D started from the premise that it had to deliver the performance and capabilities that are synonymous with its larger brothers, the FCV 1000 and FCV 3000, but within an envelope that was substantially tighter and still be accessible for maintenance. It also had to be outfitted with the "best in class" sensors and peripherals so as to be a capable work solution to the rigours of Drilling and Completion operations which was its main target market – although those same specification attributes would allow it to work in all of the Fugro Subsea Services Core Market areas of Construction Support, Drill Support and IRM.

Firstly the core frame of the FCV 2000D was reconfigured in a manner that would allow the vehicle to shrink its external dimensions but retain the full 3,000Kg through frame lift plus 1,000Kg backpack payload capability, and be substantially more rigid to better withstand the "grunt" work aboard a drilling rig. It should be noted that the mechanical interface for the underslung modules on the FCV 2000D was retained, ensuring full compatibility between all of the FCV in regard to the fitting of these large work packages. The hydraulic power pack was rated to deliver 125HP, which allows the 7 x 300mm Sub Atlantic thrusters to deliver a >600Kg bollard pull in all directions, whilst the buoyancy specification provided a minimum of 200Kg of ballast / payload on the core vehicle when outfitted with all of its base-case tools and sensors. Manipulators from Schilling Robotics, cameras, altimeter and sonar from Kongsberg Maritime, Octans Gyro from IXSEA, depth sensor from Digiquartz and a DVL from RDI ensured that we would have the standardisation we were seeking across the full FCV Program. These latter sensors also combine to provide inputs to the Fugro proprietary control system, which includes for 4DP – three dimensional Dynamic Positioning, which has received very favourable responses from those crews who have experienced this supervisory control solution. The FCV servo valve pack provides for 1 spare outlet, whilst the general purpose solenoid valve pack has a minimum of 6 spare outlets, plus a high flow solution for standard consumers such as "Zip Pump". The spare hydraulic functions can be further enhanced by the fitment of a Fugro IVP (Intelligent Valve Pack), designed in conjunction with Wandfluh, and which has the full functionality to support a backpack mounted TDU that can, in turn, be relatively "dumb".

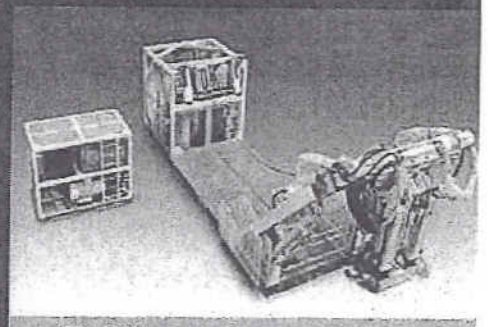
Installing all of this equipment on such a compact frame was obviously going to compromise accessibility for maintenance, which was a core demand of the design brief. The Team took their cues from the ubiquitous "Swiss Army Knife" and built-in the ability to swing out parts of the periphery mounted equipment, e.g. the general purpose valve pack, so as to allow access to the parts that were mounted within the central core. This was achieved with no requirement to disconnect any base hydraulic functions, or break any connectors, plus be accomplished in less than 1 minute – quite a feat. Overall, the developments incorporated to the FCV 2000D vehicle will be able to feed back into the other parts of the FCV Program and the initial feedback from the crews would indicate that we have another "winner".

The LARS

Developing a telescoping A-Frame plus umbilical winch holding 2,400m of 37mm diameter armoured umbilical to meet the design brief was another challenge set to the in-house engineers in Singapore and, as can be seen in the illustration and photograph accompanying this article, the result is quite an achievement. Working with our fabricator and suppliers, we were able to use height to compensate for the restricted plan view (footprint) of the umbilical winch, resulting in a compact winch design that uses the advances in armoured cable design / specification to increase the number of layers on the winch drum, yet still remain within the design parameters. By using a duplex ram arrangement, the A-Frame has a very minimalist pedestal / fulcrum, which allows the landing area for the ROV + TMS

to be clear of intrusions and therefore offer a clear working environment for the ROV crew. Flexibility in terms of the area required by the structural base of the A-Frame is provided by the use of a non structural "pup piece" that can be used to install a package LARS, or allow alternative separation solutions should the host platform not be able to provide the area to site the package. Remote control capability to operate the LARS functions are incorporated; with all of the "smarts" fitted to the umbilical winch, where the reasoning is that in many mobilisations, the A-Frame or the deck HPU may not be required, but the umbilical winch will always be needed.

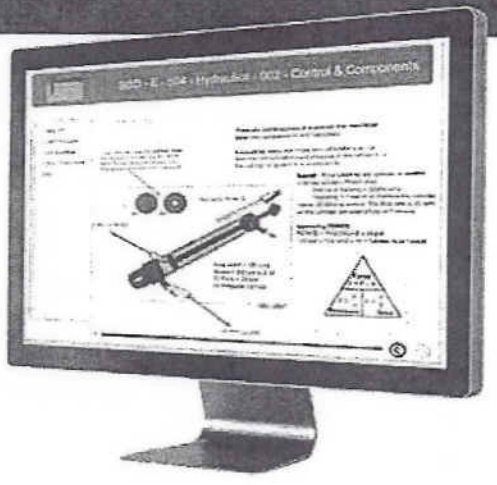
The FCV 2000 ROV System is completed by incorporating the Type 4 TMS from PSSL, fitted as standard with 200m of tether but with the option to increase this to the standard FCV length of 600m and by the provision of the Fugro FCV style Workshop and Control Cabins. The full System is finished to be Zone 2 Hazardous Area / ATEX compliant.



▲ FCV 2000 Launch and Recovery System

Fugro Academy begins Train the Trainer...

and starts testing of Fugro Academy Mobile



The Fugro Academy has had a busy 12 months developing and publishing HSE & technical e-learning and classroom courses. The Academy also initiated a series of presentations to promote greater awareness of the Academy's services within the Subsea Services Division (SSD). So far there have been presentations to Fugro Subsea Services and Fugro Subsea Technologies in Singapore and to Fugro-Rovtech and Fugro ImpROV in Aberdeen with a visit planned to Fugro in Macae, Brazil in August. Visits to other Opcos are planned for later in 2010.

During these visits electrical and electronic classroom courses and "Train the Trainer" courses and coaching sessions have been carried out to improve the presentational skills of local Operating Company trainers so that they too can conduct these classroom courses locally.

The Academy has also carried out training and coaching sessions on the use of "Mohive" its chosen e-learning software package. This initiative is to encourage and enable local subject experts to develop e-learning courses for their own Opcos on a wide range of topics including, Technical, Administrative, Logistics and IMS subjects. The Academy will provide further help with developing these local courses by giving assistance when required by producing interactive graphics and 3D models to accompany these courses.

Earlier in the year the Academy completed and presented a new ROV Supervisors Course to Fugro-Rovtech in Aberdeen and this was well received by all participants. It is planned to schedule more of these at the end of Quarter 3 through Quarter 4 and on into 2011.

▲ SM4 Motor Maintenance Course to launch in Q3 2010

Fugro Subsea Technologies have produced a revised FCV 3000 course and the first of these, organised by the Academy, was presented in Aberdeen in February. The 6 day course consisted of modules on the electronics and control systems, the electrical systems, the hydraulics systems and a one day hands-on session on operations.

The Academy Subsea Services Group have completed the first 3 modules of the 'Introduction to Hydraulics Course' and these have been published on the Academy's website. The group is currently working on the 4th module titled, "An Introduction to Hydraulic Fault Finding" and this should be available in the next few months.

The use of interactive animations to explain the technical concepts in a simplified and easy manner has been well received and course uptake has increased across all Subsea Services Operating Companies as awareness of these courses grows.

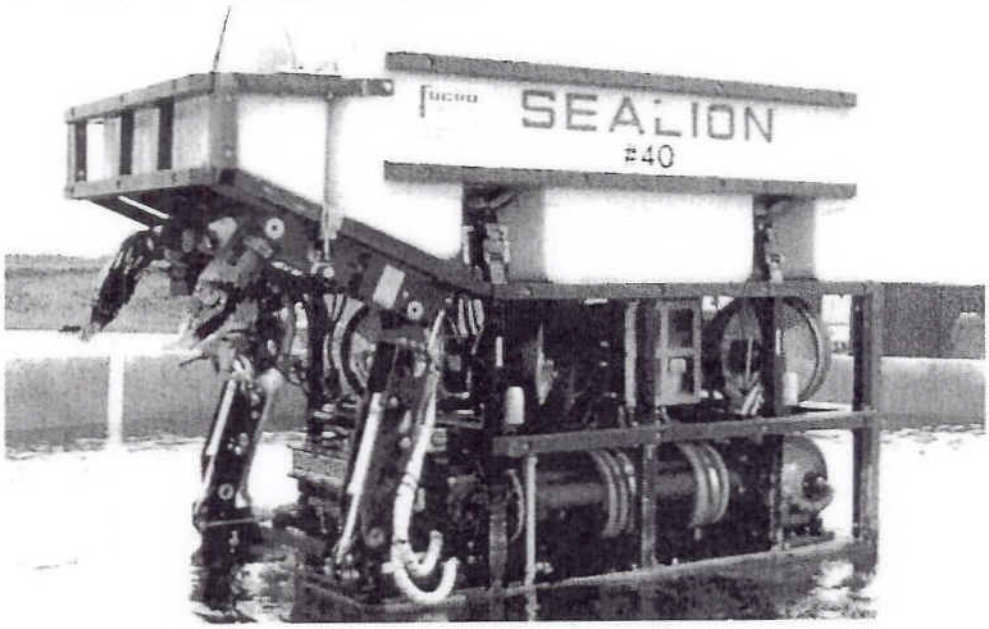
The first of a series of SAAB Seaeye Motor Maintenance e-learning courses is in production. The course on the SM4 motor will be published in Quarter 3 2010.

The Academy is to introduce a system called "Mobile Fugro Academy". This will allow students to gain access to courses which could not otherwise be delivered due to lack of a reliable internet connection. Academy students will, in future, be able to download, onto a memory stick, courses from the Academy Learning Management System (LMS) website at www.fugroacademy.com. They only need reliable access to the website, e.g. from the office server, or at home, for the few minutes it would normally take to download the courses onto a memory stick. Students can then complete the courses at their own convenience and location on any available computer. Results of any courses taken and completed remotely would then be uploaded whenever a student is next connected to the LMS website. New courses can then be downloaded from the LMS to continue the learning process. Tests of the system are underway and, if all goes well, the system will be introduced later in 2010.

TAB 1.H

Sealion 3000

Work Class Remotely Operated Vehicle



Sealion 3000 is an innovative 125hp work class ROV system with a full 3000m depth capability. It incorporates a number of enhanced operational and engineering features, which specifically address the demands of deepwater operations.

Key Tasks:

- **Deepwater Drill Support**
  - General drill support and wellhead intervention
  - Hot stabs
  - High pressure water jetting
  - Dredging cuttings removal
- **Construction Support**
  - Deepwater touch-down monitoring
  - As-laid as-built surveys
- **Intervention/Workover Support**
  - TDS operations
  - Umbilical pull-ins
  - Jumper installation
- **Inspection and Salvage Activities**

System Features:

- 3000m depth capability
- Industry leading TMS with 150m excursion capability
- Fibre optic multiplexer
- Fully configured for survey as standard

Sealion 3000

SEALION 3000 SPECIFICATIONS

Depth rating	3000m

DIMENSIONS

Length	2700mm
Width	1400mm
Height	1950mm
Weight	2400kg
Through frame lift	1000kg
Payload	150kg

POWER

Motor	2700VAC@94kW(125hp)
Hyd. pump output	214LPM@60Hz 203LPM@50Hz
Hyd. pump max output	225 bar
Electrical supply	6 kVA providing 24 and 115VAC

SPEED

Forward/aft	>3.5 / 2.8 knots
Lateral	>2.8 knots
Vertical up/down	1.5 / 2.2 knots

THRUSTERS

4 x 15" vectored fwd/lateral Min. 550kg thrust
4 x 9" vectored vertical 350kg thrust

AUTO FUNCTIONS

Auto depth control	± 100mm
Auto altitude control	± 100mm
Auto heading control	± 1.5 degree

PAN & TILT

Hydraulic Pan travel	± 135 degrees
Tilt travel	± 135 degrees
Torque	Adjustable up to 50Nm
Speed	Adjustable up to 20 degrees/sec

SURFACE CONTROL SYSTEM

Microprocessor	Intel Pentium
Operating system	Microsoft ® Windows
Display output	SVGA 800 x 600 256 colours

CAMERAS

Standard	10 / 12

MANIPULATORS

Rigmaster Orion – 7 Function Manipulator

SENSORS

Heading - gyro compass	Bendix King KCS 305
Pitch and roll	CDL MiniTilt
Depth	Digiquartz 8CB4000-I
Altimeter	Kongsberg 1007
Sonar	Kongsberg MS1071

LIGHTS

System capacity	1.8kW
Standard capability	6
Max. capability	9

TELEMETRY	Fibre optic multiplexer Nexus MKZ

INTERFACES

The unit provides the ability to fit:

- 10 cameras, 2 with focus and zoom. (12 cameras can be fitted with an additional multiplexer board)
- Up to 16 switchable industry standard sensors utilising
- RS232 communications protocol
- 4 industry standard sensors using RS485
- communications protocol
- 2 x Reson 8125
- Tritech Arcnet communications protocol

POWER REQUIREMENTS

System	300kVA 380V – 500V @ 50Hz /60Hz
ROV	200kVA
Surface control system	10Kva

TETHER MANAGEMENT SYSTEM (OPTION)

Type	TopHat
Depth	3000m
Excursion	150m (45mm tether OD)
Comms	Fibre optic with redundancy

CONTROL VAN

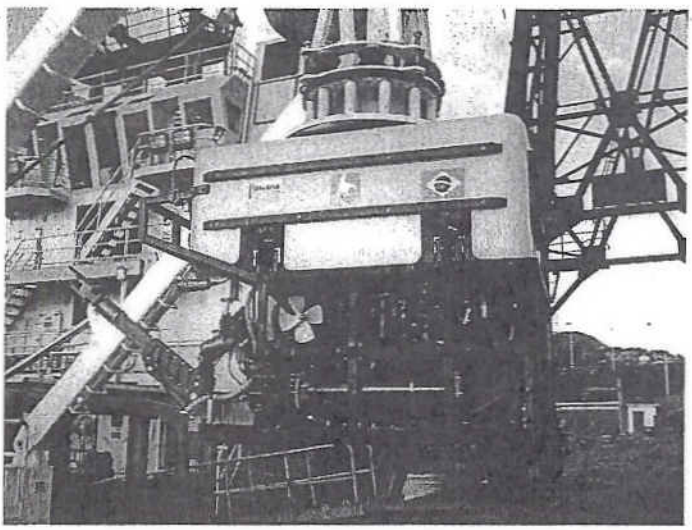
A completely new design of A60 control van provides an excellent environment with features including:

- All new 3000V power train, fully remote controlled from the control racks
- State of the art diagnostic capability for the power system and data lines using SCADA system
- Transformer cabinet specially designed for ease of field maintenance

Fugro Subsea Services Limited
Fugro House,
Denmore Road, Bridge of Don
Aberdeen, AB23 8JW
Telephone : +44 (0) 1224 257600
Email: info@fugrosubsea.co.uk

TAB 1.I

Sealion MK II (4-Vert) Heavy Work Class ROV



Designed and manufactured by Fugro, the Sealion MK II (4-Vert) is a multi-function heavy work class ROV system intended for rapid deployment on any appropriate vessel of opportunity. It is suitable for drill support, construction support, inspection repair maintenance (IRM), survey and subsea intervention tasks. Some of the typical tasks are listed below:-

- General drill support
- Hot stabbing
- Torque/ linear override tools operation
- Lift lines attachment
- Steel, fibre cables or ropes cutting
- Guide wire replacement
- Operation of disc grinders/cutters
- Debris removal/dredging
- Water jetting & wire brush cleaning
- Removal of cuttings from wellheads
- Installation and removal of AX/VX rings
- Placement & recovery of acoustic beacon
- Flow line pull-in operation
- General/close visual inspection
- Flooded member detection
- Wall thickness measurement/crack detection
- Still photography
- Cathodic potential measurement
- Bathymetric survey
- Multibeam swathe bathymetry survey
- Sub-bottom profiler & side scan survey
- Trench profile survey
- General construction support
- Pre-lay & Post-lay survey
- Touch down monitoring
- Grout bag operation
- Boom cameras/profilers/undercarriage pipeline survey
- Sub-bottom pipe/cable detection/tracking

The Sealion MK II (4-Vert) is rated at 100HP and designed for operating at depth up to 2000MSW. The horizontal thrusters on this ROV follow the vectored arrangement which enables high forward/lateral thrust and there are four vertical thrusters (4-Vert) which result in superb vertical manoeuvrability. Flexibility is a key feature of the Sealion design, allowing survey sensors, hydraulic power tools and work skid to be added when required. Telemetry and video transmission is via copper or fibre optic link. The vehicle frame is constructed from easily repairable stainless steel hollow sections that form a robust 'box' and houses the following major equipment:-

- Eight units of Kaplan thrusters
- 100HP electro-hydraulic power unit
- Servo valve and manipulator valve pack
- Subsea transformer
- Gyro compass pod & main control pod
- Oil compensators with level monitoring
- 2 units of 7-function manipulator arms
- Pan and tilt unit
- 1 x echo sounder & 1 x obstacle avoidance sonar
- 3 to 4 cameras and 4 x 250W dimmable lights

The Sealion MK II (4-Vert) ROV is operated from a fully air conditioned A60 rated (upgradeable for zoned area operation) 20ft x 8ft control cabin certified by Lloyds Register of shipping. The system comes with a rugged A-frame based launch & recovery system (LARS) rated for sea state 6 operation. It also comes with a fully equipped 15ft x 8ft workshop container that satisfies all offshore maintenance requirements.

Sealion MK II (4-Vert) Heavy Work Class ROV

DEPTH AND POWER RATING

Depth	1000MSW or 2000MSW
Power	100 HP

PHYSICAL CHARACTERISTICS

Length	2700 mm
Width	1450 mm
Height	1850 mm
Weight	2000 kg
Through frame lift	5000 kg
Payload	100 kg (with standard buoyancy)

THRUST

Six thrusters provide the following at 175bar system pressure:-

Forward	425 kg
Vertical	434 kg dive / 288 kg surface
Lateral	425 kg

SPEED

Forward	1.42 m/s (2.76 knots)
Lateral	1.33 m/s (2.29 knots)

MANIPULATORS

Type	7-function rate controlled
Reach	1.6m
Lift capacity	50kg
Rotate torque	108Nm (79lbf.ft)
Jaw gripping force	80-85kg at 175bar

CAMERAS

The vehicle supports 4 simultaneous video channels and equipped with circuits to operate 3 cameras with focus/zoom control.

LIGHTS

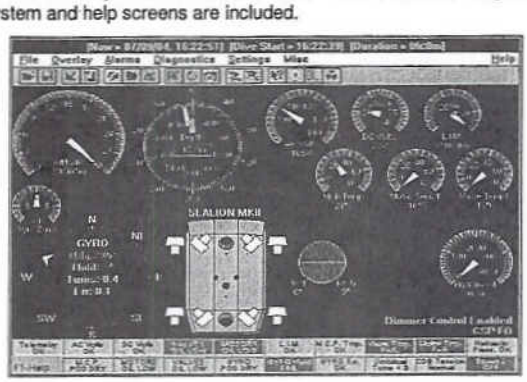
2x500W or 4x250W quartz halogen lights on two dimmer channels.

PAN & TILT UNIT

Type	Hydraulic rate control
Pan/Tilt travel	±135º
Torque	Adjustable up to 50 Nm
Speed	Adjustable up to 20º/sec

VEHICLE CONTROL SYSTEM

Vehicle control is performed by a Z180 processor based real time control system housed in the main control pod. The Z180 system communicates with the surface control system via full duplex copper or fibre optics links. The surface control system runs on MS Windows/Intel 486 or Pentium platform. The surface control system is user friendly with a Windows GUI. An advanced diagnostic system and help screens are included.



VEHICLE AUTO CONTROL ROUTINES

Auto Depth ±100mm Auto Altitude ±100mm Auto Heading ±1.5°

STANDARD GYRO COMPASS SYSTEM

Type	Bendix King KGS 305 with flux valve
Accuracy	± 1°

DEPTH SENSOR

Transducer type	DRUCK PCDR 810
Range/Accuracy	0 - 1000m / 0.1%

ECHO SOUNDER

Type	Mesotech 807
Frequency/Range	200kHz 0.6m-30m

SPARE INPUT AND OUTPUT CHANNELS

The vehicle comes with large number of spare input and output channels which can be configured for specific task requirements.

Down
- 10 x user relays, digital control 250V AC @ 2A
- 3 x 8 bit analog output channels –5 to +5V @ 0.5A

Up
- 7 x 16 bit analog input data channels
- 4 x 8 bit input flag channels
- 2 x auxiliary channels
- 2 x auxiliary/video water alarms
- 4 x surface indicated LED, multi purpose flag inputs

OPTIONAL TETHER MANAGEMENT SYSTEM

Fugro's side-entry or top-hat TMS with 200m tether excursion range.

SYSTEM POWER REQUIREMENTS

Incoming 3-phase electrical supply (380–500V 50-60Hz) is fed into a power distribution panel that performs the function of electrical power distribution management. Electrical supplies for the ROV are stepped up to 1200V by two transformers (6KVA single phase & 180KVA thee phase) before being transmitted via the umbilical cable. Incoming power is also reduced to 220V/110V for supplies to the control cabin lights, air conditioning, equipment racks and workbench sockets. Total system (ROV + Control cabin + Workshop container + LARS) power demand is 250KVA.

SAFETY

Insulation resistance of the umbilical on high voltage lines is monitored with multiple LIM units (Line Insulation Monitor). The LIM units shut down the high tension outputs in the event of insulation fault. Earth leakage circuit breakers are provided to monitor leakage to earth of the cabin 220V supply to ensure safety of personnel.

ROV CONTROL CABIN

This is an A60 rated 8ft by 20ft offshore container housing the electrical power system and three equipment rack units comprising:

- ROV pilot console
- Two to four 10-inch or 14- inch high resolution industrial colour video monitors
- Video recording systems
- Video switchers, video line correctors, video overlay unit and distribution amplifiers
- Personnel communication system c/w 3 headsets for deck use
- Obstacle avoidance sonar display
- Surface control unit for all other sensors if fitted

The cabin is fitted with emergency lighting, discussion table/workbench and filing cabinets. Electrical cable entry to cabin is via MCT cable transit system.

Fugro Subsea Services Pte Ltd

35 Loyang Crescent Singapore 509012

Tel: +65 6546 1163 Fax: +65 6546 1157

www.fugrosubsea.com.sg

TAB 2.A

EASTAR OFFSHORE PTE LTD

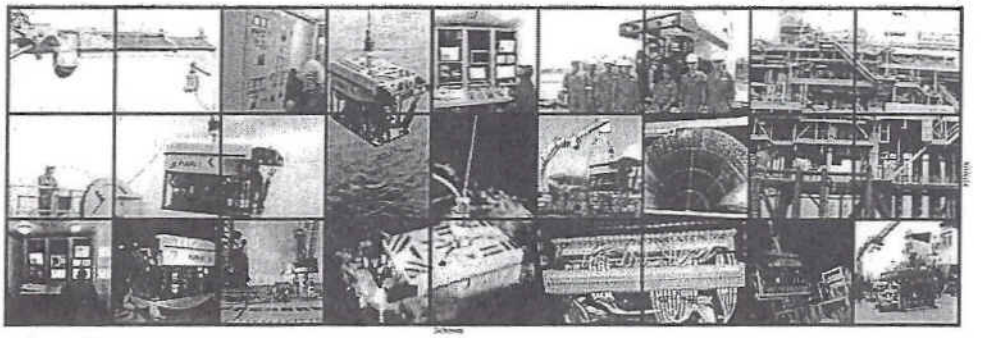
Singapore Registration No. 200602786C

ALAM SUBSEA PTE LTD

Singapore Registration No. 200800065W
(wholly owned by Eastar Offshore)

(MEMBERS OF ALAM MARITIM GROUP OF COMPANIES)

COMPANY PROFILE



We are members of

IMCA

Issue Feb 2010

1. COMPANY PROFILE

Introduction

Set up by former staff of MTQ Subsea Technology Pte Ltd in 2006, Eastar Offshore Pte Ltd acquired the entire ROV Intellectual property of MTQ Subsea Technology, as well as its available assets. Eastar and its wholly owned subsidiary Alam Subsea currently employ all the latter's key staff.

Based in Singapore, Eastar Offshore Pte Ltd offers Design, Manufacture and Operational support packages for its ROV range of products:

175hp Work-class Phoenix ROV System
125hp Work-class Swift ROV System
175hp Deep Swift Work Class ROV TMS System
Falcon Observation-class ROV / Kingfisher Observation-class ROV

18 of above ROV systems have been manufactured, and a further 1 is currently in production. They are owned and operated by various ROV companies. These ROVs have successfully performed work for major oil & gas companies, such as: Exxon Mobile, Shell, BP, CONOCO, Agip, Chevron, Petro Vietnam (PV), Korea National Oil Corporation (KNOC), ONGC India, China National Offshore Oil Corporation (CNOOC), Petronas (Malaysia) & etc.

Eastar/Alam Subsea have an experienced engineering and operations team and besides our operating capability we have the capability to design, manufacture & offer a range of work class & observation class ROVs with proven track records. In addition Eastar has manufactured specific tooling packages for a number of clients.

Alam Maritim Group of Malaysia (listed on the KL Exchange) holds a 75% stake in Eastar Offshore /Alam Subsea Group. The Alam Maritim Group offers vessel services as well as saturation and air diving services. Eastar brings to Alam its ROV design and manufacturing capability as well as ROV tooling expertise. Alam Subsea adds the ROV operational experience.

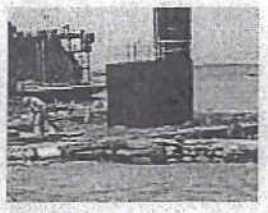
Also based in Singapore Alam Subsea is the ROV Operational arm of the Alam Group. It has quickly built up a reputation as an efficient and reputable ROV Operator.

In November 2009, Eastar and Alam Subsea moved to a newly acquired and directly owned 50,000 sq ft factory facility in Singapore. We proudly believe that this facility is second to none in the region.

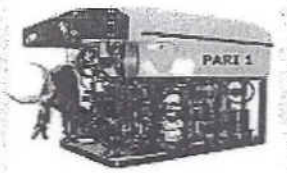
TAB 2.B

ALAM MARITIM RESOURCES BERHAD

OFFSHORE MARINE



OFFSHORE CONSTRUCTION, SUBSEA ENGINEERING & UNDERWATER SERVICES



ROVs

INTEGRATED LOGISTICS & ANCILLARY SERVICES

SHIP REPAIR & MAINTENANCE

FEATURES VIDEO

CORPORATE VIDEO PRESENTATION

View Corporate Video

VACANCY | WEBMAIL

20110202:
No event for today

February 2011

CORPORATE OVERVIEW

Alam Maritim Resources Berhad ("AMRB") is an investment holding company with subsidiaries mainly involved in the provision of **transportation support services and offshore facilities construction and installation, underwater services** to the upstream activities in the oil and gas industry.

AMRB was listed on the

ANNUAL REPORT

Invenstor Information

view details...

Stock Quotes

CONTACT US

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57000 Kuala Lumpur,MALAYSIA
Tel : +603 9058 2244
Fax : +603 9059 6845
info@alam-maritim.com.my

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	**2**	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

<< < > >>

Main Board of Bursa Malaysia Securities Berhad on 20 July 2006. To-date, AMRB and it subsidiaries ("Alam Maritim Group") is an established **owner and operator of 36 offshore support vessels (OSVs)** , making it among the largest owner of Malaysian-flagged OSVs in term of tonnage in Malaysia.

The business of the Group is being undertaken by its wholly owned and associated companies throughout the region.

Alam Maritim Resources Berhad ("AMRB") business commenced in 1998 when Alam Maritim (M) Sdn Bhd, a wholly owned subsidiary of AMRB first started its operation as a ship operator and manager for third party offshore support vessels in Asian countries.

Today, AMRB and its subsidiary companies ("Alam Maritim Group") have emerged into becoming a reputable **integrated marine offshore service provider** operating in the South East Asian region as well as the Middle East.

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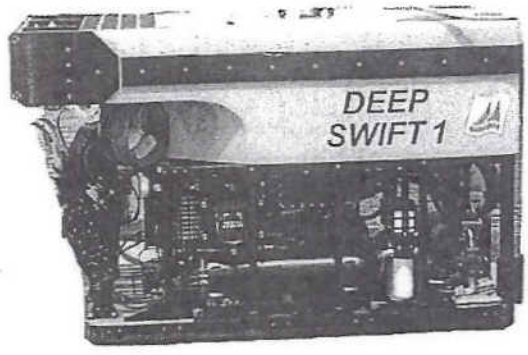
TAB 2.C

2.3 Deep Swift ROV System (TMS)



Model	:	**SWIFT 3000 MSW**
Manufacturer	:	Eastar Offshore Pte Ltd Singapore
CC Classification / Certification	:	DNV 2.7-1 A60 Zone II
Type	:	3,000 (TMS) Meters 150 HP Work and Survey Class
Work Capabilities	:	Drill Support Construction Support Cable and Pipeline Pre and Post Lay Survey Platform Inspection and Cleaning Salvage and Oceanographic Survey Jacket Inspection and Cleaning Special Tooling Pipe Lay Barge Support Suction Anchor Installation Anode Installation

SYSTEM OVERVIEW

VEHICLE

Depth Rating

Standard Depth Rating	3,000 meters

Total Power Rating	110 kw/150hp

Dimensions & Weight

Length	3,100 mm
Width	1,600 mm
Height	2,000 mm
Weight In-air	4,500 kgs

Performance

Forward	700 kgf	3.5 knots
Lateral	550 kgf	3.0 knots
Vertical	500 kgf	1.5 knots

Payload (including manipulators)

Payload of Standard Vehicle	250 kgs
Optional Additional Payload	50 kgs
Through Frame Lift	2,500 kgs

Propulsion System

7 Eastar 350mm diameter 10kw/13.5hp hydraulic thrusters individually servo valve controlled

Lateral	4 x 350 mm Ø thrusters
Vertical	3 x 350 mm Ø thrusters

Power Pack

110kw/150hp 60hz motor
Twin Axial Piston pump configuration
Main Pump 240lpm @ 200barTooling Pump 75lpm @ 200 bar

Video & Telemetry System Transmission via single mode fibre optics
8 video +16 RS 232 / 485 channels

Lighting

2Kw available from 4 x 500 watt dimmer channels

250 or 500 watt 3000m Rated Lights	4

Option 8 lights 2 pre channel @ 250 watts each
2 x HID Lights

Control & Navigation

Flux Gate Compass and Integrated Rate Gyro System	1
Tritech SeaKing DFS Sonar system	1
Tritech SeaKing PA200-20	1
Eastar Depth Transducer System	1

Auto functions, Heading, Depth, Altitude

Standard Components

Eastar 7-Function Rate Manipulator	1
Eastar 5-Function Rate Grabber Arm	1
Eastar10 Station Solenoid Valve Pack	2
Hydraulic Tooling Manifold	1
Hydraulic Tooling Servo Valve	1
Eastar Hydraulic Pan & Tilt	1

Power Packs & Tooling Interfaces (optional fit)

Schilling or equivalent T4 Manipulator
75mm diameter Wire Rope Cutter
Disc Cutter / Grinder
API Standard Hot Stabs
API Torque Tools
Standard AX / VX Ring Tools
Ragan Latch Override Tool
Special tooling to suit customer requirements supplied on request.

Sensor Interfaces

Standard Single Mode Video/Data Transmission System
8 Video + 16 Data Channels
Optional Fiber Optic Gyro Compass with Pitch and Roll Sensors
Optional TSS Pipe Tracker
Optional CP Inspection Sensors
Optional BATHY Hi-Resolution Depth and Altitude Sensor
Optional DHSS Dual Scanning Sonar System
Optional USBL
Optional FMD
Optional Side scanner sonar

Spare Bulkhead Connectors -	4 off

User Power Supplies - 1kw @115VAC
750VA @ 24vdc regulated

UMBILICAL

3300 meters:
23 x 4mm sq 3kv Rated Power and Earth Cores
6 Single + 6 Multi Mode Fibres in a common loose tube
1 x Screening quad

CONTROL CONTAINER, A60 ZONE II

Length	6,058 mm
Width	2,438 mm
Height	2,791 mm
Shipping Weight	10,000 kgs

DNV 2.7-1 certified

WORKSHOP CONTAINER, A60

Length	6,058 mm
Width	2,438 mm
Height	2,791 mm
Shipping Weight	10,000 kgs

DNV 2.7-1 certified

LAUNCH & RECOVERY SYSTEM
(Zone II OPTION)

Time to recover from 3000 msw	95 minutes
SWL	16 Te
A Frame Outreach	4,7 m
3 Axis Snubber	
Shipping weight (with Umbilical) Max	56Te

DNV 2.7-1 certified

SERVICES

Power (Total)	440V, 300 amps 50/60 Hz
Air (LP)	Optional for Zone II only

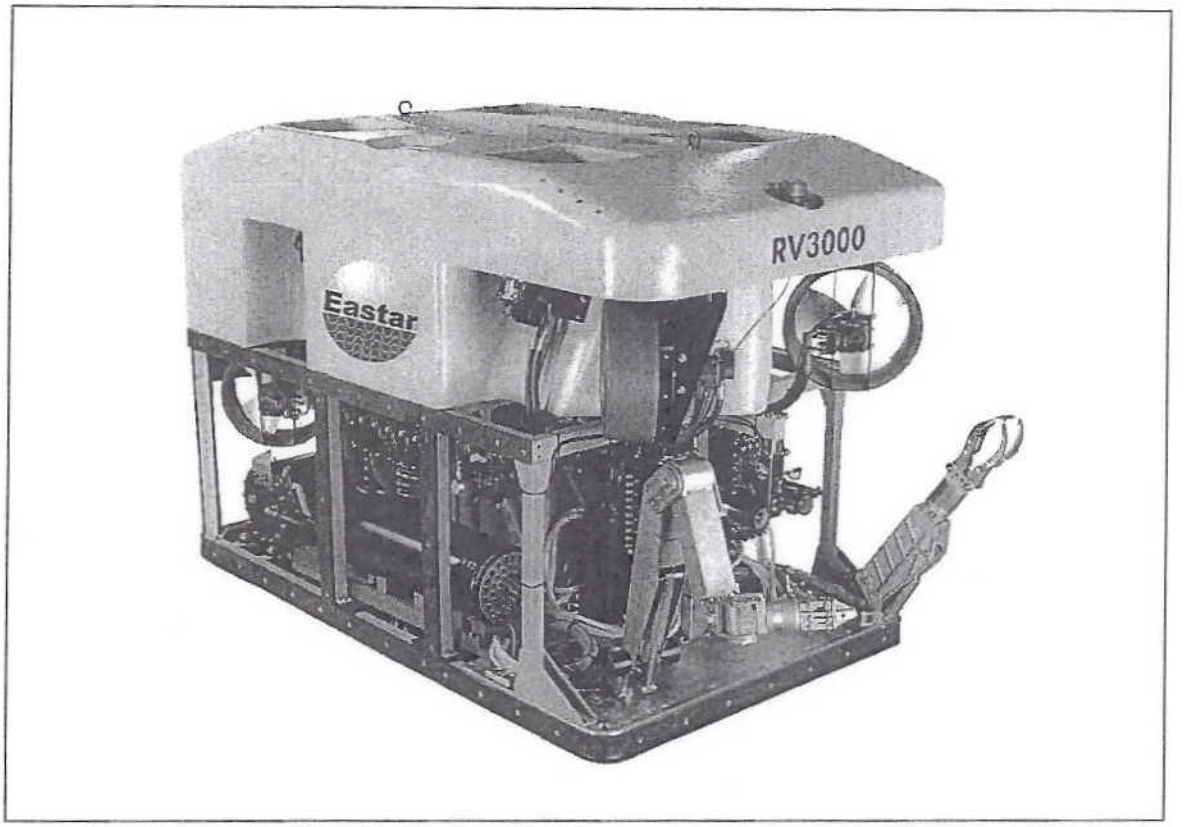
TMS

Major Diameter	1,800 mm
Height	2,000 mm
Weight in Air	3,000 kg
Weight in Water	1,800 kg
Tether Length	500 meters

All specifications are subject to change in line with EASTAR's policy of continual product development.

TAB 2.D

2.4 Phoenix ROV System



Model:	**PHOENIX**
Type:	175 HP Work Class
Work Capabilities:	

- Drill Support
- Construction Support
- Cable and Pipeline Pre and Post Lay Survey
- Platform Inspection and Cleaning
- Salvage and Oceanographic Survey
- Jacket Inspection and Cleaning
- Special Tooling
- Pipe Lay Barge Support
- Suction Anchor Installation
- Anode Installation

VEHICLE

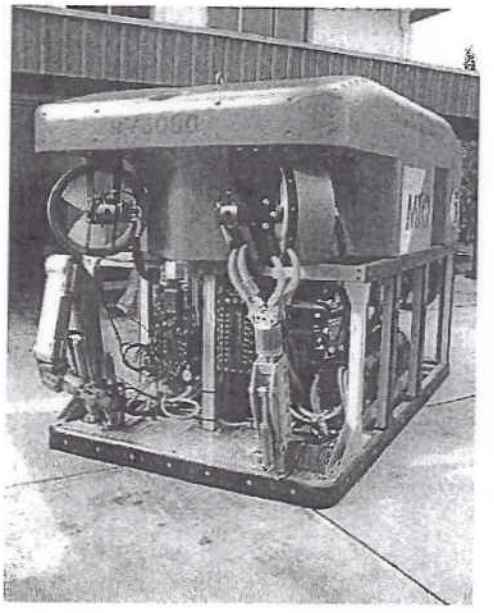
Depth Rating

Standard Depth Rating	3,000 metres

Total Power Rating	175hp

Dimensions & Weight

Length	3,200 mm
Width	1,850 mm
Height	2,100 mm
Weight In-air	4,500 kgs



Performance

Forward	800 kgf	3.5 knots
Lateral	700 kgf	3.0 knots
Vertical	800 kgf	1.5 knots

Payload (including manipulators)

Payload of Standard Vehicle	250 kgs
Through Frame Lift	3,500 kgs

Propulsion System

8 Eastar hydraulic thrusters individually servo valve controlled

Lateral	4 x 420 mm Ø thrusters
Vertical	4 x 350 mm Ø thrusters

Standard Power Pack 175hp

Eastar 175hp shaft output power, 3 phase, 4 pole, 3KV motor, oil filled and compensated.
Vickers piston pump, output 300lpm @ 200bar

Video & Telemetry System (Fiber Optic optional fit)

Transmission via fibre optics and copper
Fiber Optic: 8 video + 16 RS 232 / 485 channels
Copper: 4 Video + 8 Data Lines
Real-time Video Channels, 4 on Coax / 8 on Fibre

Lighting

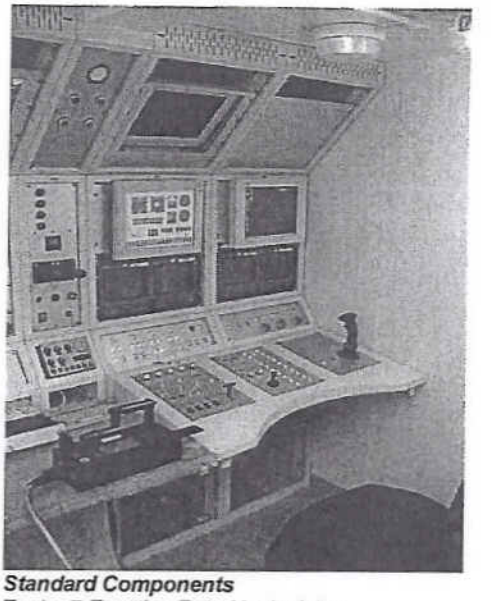
4Kw available from 4 x 500 watt dimmer channels
& 4 X 500 watt non-dimmer channels.

Eastar 250 or 500 watt 3000m Rated Lights	8

Control & Navigation

Fiber optic gyro	1
Tritech SeaKing DFS Sonar system	1
Tritech SeaKing PA200-20	1
Eastar Depth Transducer System	1

Auto functions, Heading, Depth, Altitude & Turn Rate



Standard Components

Eastar 7-Function Rate Manipulator	1
Eastar 5-Function Rate Grabber Arm	1
Eastar 10 Station Solenoid Valve Pack	2
Hydraulic Tooling Manifold	1
Hydraulic Tooling Servo Valve	1
Eastar Hydraulic Pan & Tilt	1
Eastar CCD Colour Camera	2
Eastar CCD Monochrome Camera	2

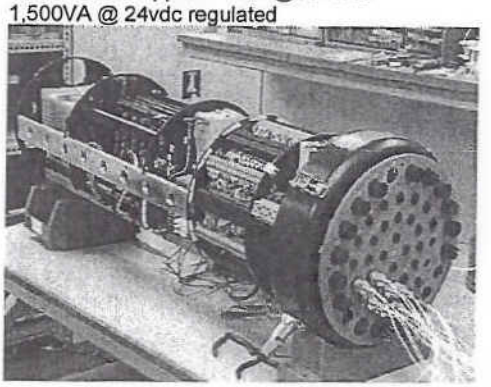
Power Packs & Tooling Interfaces (optional fit)

Eastar Hydraulic Power Pack 175hp
Eastar tooling Power Pack 100hp
Schilling 7-Function Titan T3
Schilling 5-Function RigMaster Grabber Arm
Guide Wire Cutter
75mm diameter Wire Rope Cutter
Disc Cutter / Grinder
API Standard Hot Stabs
API Torque Tools
Standard AX / VX Ring Tools
Special tooling to suit customer requirements supplied on request.

Sensor Interfaces (optional fit)

Prizm or Focal Single Mode Video/Data Transmission System
8 Video + 16 Data Channels
Multibeam Sonar
TSS Pipe Tracker
CP Inspection Sensors
BATHY Hi-Resolution Depth and Altitude Sensor
DHSS Dual Scanning Sonar System

FMD
USBL
Side scanner sonar
Spare Bulkhead Connectors - 20 off
User Power Supplies - 2kw @115VAC
1,500VA @ 24vdc regulated

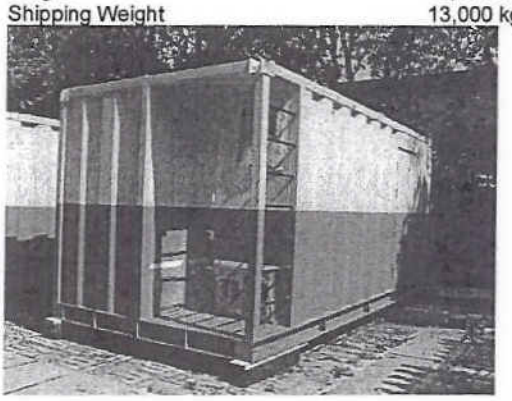


UMBILICAL

The standard Aramid umbilical is 40 mm in diameter and has the following cores:
17 x 4mm sq 3kv Rated Power and Earth Cores
4 x 75 ohm Coaxial
4 x Screened Twisted Quads
6 Single + 6 Multi Mode Fibres in a common loose tube

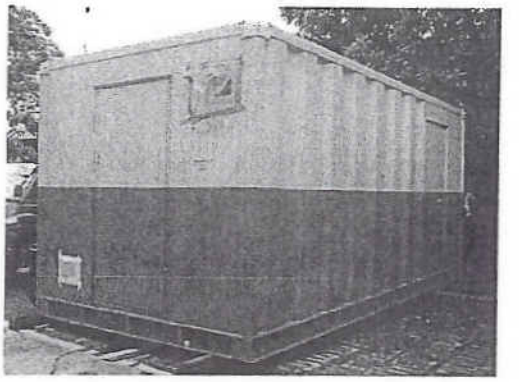
CONTROL CONTAINER (A60, ZONE2 OPTIONAL)

Length	6,000 mm
Width	2,926 mm
Height	2,774 mm
Shipping Weight	13,000 kgs



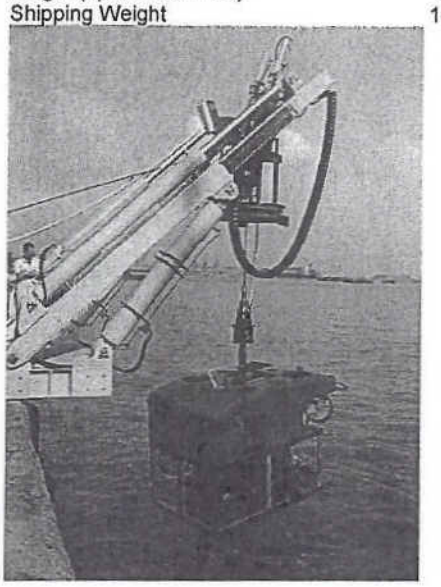
WORKSHOP CONTAINER (A60, ZONE2 OPTIONAL)

Length	6,000 mm
Width	2,926 mm
Height	2,774 mm
Shipping Weight	15,000 kgs



LAUNCH & RECOVERY SYSTEM / WINCH (ZONE2 OPTIONAL)

Length	6,000 mm
Width	3,400 mm
Height (shipping)	2,960 mm
Height (operational min)	5,859 mm
Height (operational max)	8,159 mm
Shipping Weight	18,000 kgs



SERVICES

Power (Total)	440V, 400 amps 50/60 Hz

TAB 2.E

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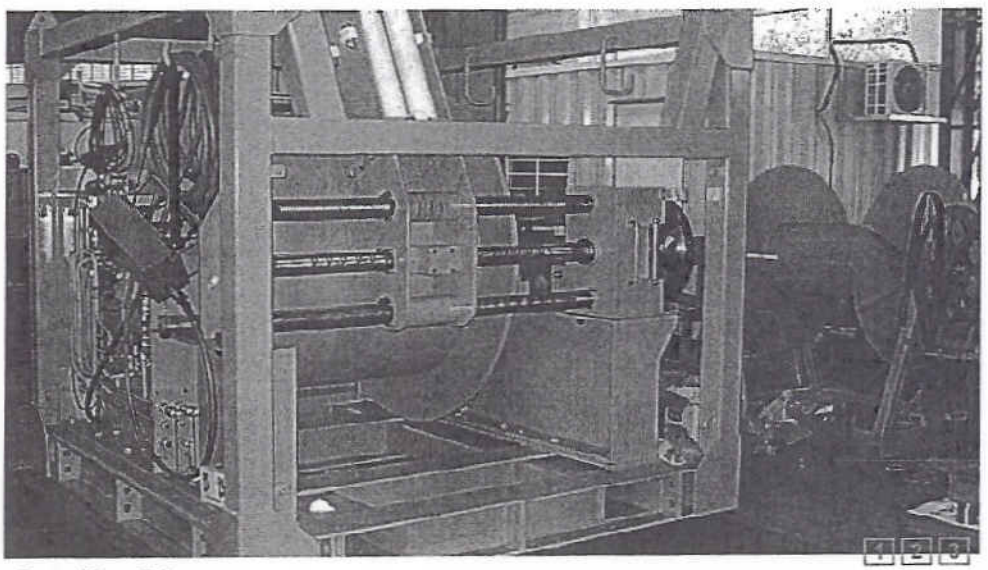
COMPANY REPORT: EASTAR/ALAM SUBSEA

Deep sea rovers

The subsea energy and exploration industry in SE Asia is growing year by year and vehicles and services provided by Eastar and Alam Subsea are very much part of it

Written By Ruari McCallion & Produced By Lorraine Heist | Wed Jan 6, 2010

TAGS: Alam, Alam Subsea, Company Reports, Eastar, Eastar Offshore, Energy, Sam Sassoon



The drivers behind rising oil and gas prices are twofold: demand and resource availability. Economies in the developed world are going through a lean time right now but the emerging economies of South Asia, the Far East and SE Asia are continuing to grow - and that means demand is healthy and oil prices remain around $70/barrel.

The oil and gas industry is looking further and further for its needs and higher prices mean that offshore oilfields will become economic to develop. The new generation of offshore energy fields is far too deep for human divers, so the need for machinery to do the job. That's where **Eastar** comes in.

STATISTICS

Name: Eastar/Alam Subsea

Country: Singapore

Est: 2006

Employees: 28

GETTING STARTED

"We have been established for three years," says **Sam Sassoon**, Executive Director of the company. "In one way or

her, we've been in the ROV (remote operated vehicle) business since the early 1990s."

Revenue: +MR320 million
Website: **www.eastaroffshore.com**

MANAGEMENT
Executive Director: Sam Sassoon

Eastar was founded in April 2006. Based in Singapore, Eastar decided to focus on the growing offshore energy business on its doorstep, primarily in the waters of Malaysia, SE Asia and the Pacific Rim, which includes Australia. Eastar currently owns its own facility, a 50,000 sq ft factory in Singapore's key Industrial Zone.

Alam Subsea was set up in 2007 to operate ROVs. With a growing fleet currently at five, it has quickly established itself in the region.

"Singapore has no oil fields, but Malaysia does. We feel we have the foundation for more successful partnerships," says Sassoon. ROVs come in three types: Type 1 vehicles are work-class, for fairly heavy-duty applications; Type 3 machines are smaller and mainly used for observation and monitoring. Type 2s are between the two. Eastar makes Types 1 and 2. With working depths now going down to 3,000 meters (10,000 feet), remote vehicles are essential to the offshore energy industry. A 175 Horse Power 3000 Meter Deep Swift System is currently undergoing Factory Acceptance Tests and another will be ready for delivery before March 2010. Altogether Eastar has delivered eight Work Clas ROVs in the last two years.

"Ongoing and contract pipelaying, jackets, structures and cable laying all require ROVs," says **Stuart Raines, Operations Manager**. "They're essential fo surveying, inspection and intervention. Remote wellheads, manifold systems and flow lines are all installed by ROVs." Technology has a tendency to pres ahead relentlessly and today's state-of-the-art equipment is often next year's junk - but that isn't entirely the case with ROVs, as Chief Design Engineer John Clark explains.

CUSTOMIZED CRAFT

"Three thousand meter systems have actually been around for the last 20 years, but there hasn't been much 3,000 meter work until recently," he says. "Tl basic technology hasn't changed much over the years. You have hydraulic systems, thrusters, controls, fiber optics and sensors. What has changed is the capacity and capabilities - they have increased greatly. Reliability has also improved - it's no longer an adventure to go on a 3,000-meter dive, wondering you'll get there. You will." **Eastar ROVs** are built and equipped around the core system of a 125 or 175hp mobile platform, which is attached by umbilical t the surface drill or exploration vessel - but a myriad of variations flow from that heart.

"We first meet with our clients and discuss their requirements," says Clark. "We design and engineer the ROV and peripherals they will need and send the designs to our suppliers in Singapore and internationally, who make the individual parts. Each ROV has hundreds of components - thrusters, computers, piping, hydraulics and handling systems. We undertake final assembly and testing here, in our new 50,000 square foot factory."

The vehicles are thus custom-made and built to order, usually over six months. A complete system includes the **ROV**, onboard spares cabin, control cabir the A-frame recovery rig. The new plant also has a simulator, which enables new recruits to learn how to handle the equipment before they go out on

"We employ around 28 people directly, with additional on-site personnel hired on a day-basis," Sassoon said. "We recruit graduate engineers or certified technical staff and train them in the specific requirements of the job."

There's another aspect to the company, also, which is to do with contracting. A majority stake was acquired by listed vessel operator Alam Maritim a year after its foundation and is now a subsidiary. Alam has a fleet of 28 plus vessels and is growing. It also offers vessel management and saturation diving services. The synergy of the acquisition was immediately felt, and a lot of **Eastar's** work is for its parent but it still operates as a separate business unit.

That distinction is important because the company offers its services to other organizations as well, and a degree of independence is important for commercial confidentiality - it's much the same relationship as England's Lotus Cars has with Malaysian auto manufacturer Proton; Lotus is a consultant f other manufacturers, as is Eastar for other exploration and drilling companies. As its progress, experience and growing reputation demonstrates, it's a strategy that delivers the goods.

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TAB 3.A

Hallin

25th August 2010

HALLIN'S NEW, PURPOSE BUILT, STATE OF THE ART SINGAPORE FACILITY OPENS

Hallin Marine Subsea International's new, state of the art, multi-purpose facility in Singapore has been officially opened by Dave Dunlap, the CEO of parent company Superior Energy Services.

The 11,000 square metre, purpose built premises are a 'clear indication of the commitment we have to South East Asia and our plans to continue to grow our presence in the region' Mr Dunlap explained during the opening ceremony for staff and guests.

He added: 'It gives Hallin Marine the best possible facilities: it's a great operational base next to where our vessels will tie up; a first class maintenance and storage centre; an outstanding manufacturing facility for our dive and ROV systems; and a wonderful environment in which to work for our design engineers and our executives and support staff.

'This facility will also give other Superior subsidiary companies a base to grow their own operations in the region while working together to produce and deliver technically advanced solutions for our clients.'

The facility has been built on the marine jetty in Loyang (the centre for Singapore's busy offshore oil and gas industry) and been some two years in the planning and gives Hallin the room to further expand.

Hallin's senior team worked closely with the developers and the Singapore authorities to ensure the showpiece development fitted its current and planned future needs.

It brings under one roof the company's East operating division; its manufacturing and marine divisions; the company's administration centre and the Singapore arm of Prospect, Hallin's engineering design business as well as acting as a base for other Superior subsidiaries in the region.

The development is in excess of 11,000 square metres and boasts 5,000 square metres of yard space, of which almost a quarter is covered.

With 3,000 square metres of workshop space, including designated 'clean areas' for electronic, hydraulic and electrical assembly and testing, and a further 3,000 square metres of office space, Hallin believes it has planned for the next step of its expansion programme.

For more information please contact:
John Quinn
+44 (0)2380 454160
+44 (0)7736 149410

john@johnquinnconsult.co.uk

About Hallin Marine

Hallin Marine is a provider of integrated subsea solutions to clients in the oil, gas, nuclear and renewable energy sectors across the world. The Group was founded in 1998 by CEO John Giddens, who has overseen growth from a turnover of $1m in its first year to $139m. Hallin Marine UK opened in Aberdeen in 2006 and is a wholly owned subsidiary of Hallin Marine Subsea International Ltd. The PLC was purchased by Superior Energy Services, Inc, in January 2010.

Hallin's broad range of offerings includes the latest saturation diving systems, remote operated vehicles (ROVs) and purpose-designed support vessels, as well as state of the art engineering and manufacturing capabilities. Work undertaken typically comprises the design, installation, construction, maintenance, repair or survey of equipment required to transport oil and gas from the seabed. The Group's focus is on the design and delivery of unique, cost effective and fit for purpose solutions that meet the demands of its blue-chip client base.

Please find further information on the Company's website: www.hallinmarine.com

TAB 3.B

Hallin Marine

Manufacturing

Hallin's wholly-owned subsidiary designs, engineers and builds subsea intervention assets for both Hallin Companies and for third parties. Based at its modern facilities in Loyang Singapore, Hallin Manufacturing Services has years of experience in the successful design and construction of Saturation Diving Systems for use by the oil and gas industry.

Hallin's systems are in operation throughout the world and its state of the art 12 man ABS classed, 200m rated, portable system is now an industry standard whose design the company pioneered.

Hallin's competitively priced Saturation Diving Systems are industry proven and can be produced as a standard portable system for deck mounting or permanently mounted system to be built into a vessel at its construction stage. As well as building for other companies Hallin has built all the 12 man Sat systems it operates.

Hallin Manufacturing Services can provide a complete design and build service in support of your subsea project.

For more information on our manufacturing capabilities and services, please email us at manufacturing@hallin.com.sg

Documents

- HMS Modular SAT web.pdf (0.17 MB)
- Containerised surface supplied air dive system web.pdf (0.21 MB)
- Surface Supplied Mixed Gas Diving System web.pdf (0.20 MB)
- Onboard fitted Saturation diving system specsheet v2 060910.pdf (0.70 MB)
- Hyperbaric rescue facility web.pdf (0.21 MB)
- HMS Workclass CROV web.pdf (0.25 MB)

TAB 3.C

Hallin Marine

Singapore Manufacturing Facility

Hallin is proud of its subsea manufacturing facility. It builds portable and fixed saturation diving systems and remote operated vehicles for its own use and for other subsea operators to the highest standards.

TAB 3.D

Hallin Marine

Hallin Shows Commitment to Singapore with Opening of New, Purpose Built Facility

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The 11,000 square metre, purpose built premises are a 'clear indication of the commitment we have to South East Asia and our plans to continue to grow our presence in the region' Mr Dunlap explained during the opening ceremony for staff and guests

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Documents

100825HallinOpensNewFacility.doc
(0.06 MB)

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to

News

TAB 3.E

Offshore Shipping Online

Hallin launches its own ROV

Vessel & ROV News - February 7, 2008

| More

Hallin Marine announces it has designed, built, tested and successfully demonstrated its own ROV.

The C-ROV (pronounced Sea Rov), was designed and built by Hallin staff at the company's Singapore manufacturing facility and fulfilled a brief to create a technically advanced, low cost 100HP, free-swimming, work class machine.

The C-ROV will operate in depths to 1,000m and can be fitted with a range of specialist sensors and tooling to carry out wellhead intervention, drill support and survey work.

It will complement Hallin's existing fleet of heavier duty, tethered, deeper operating construction and work class ROVs and the company's range of smaller, inspection class ROVs.

The company has an immediate in-house operational requirement for all initial production units, in line with existing demand for its ROV services.

In future, the company may consider building C-ROVs for other subsea operators.

The AIM quoted provider of subsea solutions to the oil and gas industry has expanded the size of its Singapore manufacturing facility by 50 per cent to cope with the sustained high level of demand for its in-house designed and built saturation diving systems and the C-ROVs.

To facilitate this expansion, the company has signed a lease on a factory unit adjacent to its existing building at the Loyang Offshore Supply Centre.

The Hallin board has decided it is appropriate, given the current and projected sales values and scale of the company's manufacturing, to form a standalone manufacturing division.

This is the company's third division (the others are the operations East Division and West Division) and, like the other divisions, it is to be headed by its own managing director, Andrew Threlfall.

Andrew, 42, has been recruited as the manufacturing division's first MD. He joins Hallin with 16 years' experience in the marine support industry, in leading offshore contracting, engineering and manufacturing companies around the world.

A fuller technical specification of the C-ROV follows at the end of the release.

Hallin CEO John Giddens said: "The production of the C-ROV is a major and exciting step for Hallin that will benefit the whole company and is a natural progression from our other, successful manufacturing activities."

"The demonstration to potential and existing clients was very well received and the C-ROVs should prove to be excellent, commercially competitive and strategic additions to our ROV fleet."

"We are delighted to welcome Andrew Threlfall who joins us as the MD of our new Manufacturing Division and, I'm sure, he will do an excellent job driving forward this important division of Hallin Marine."

More articles from this category

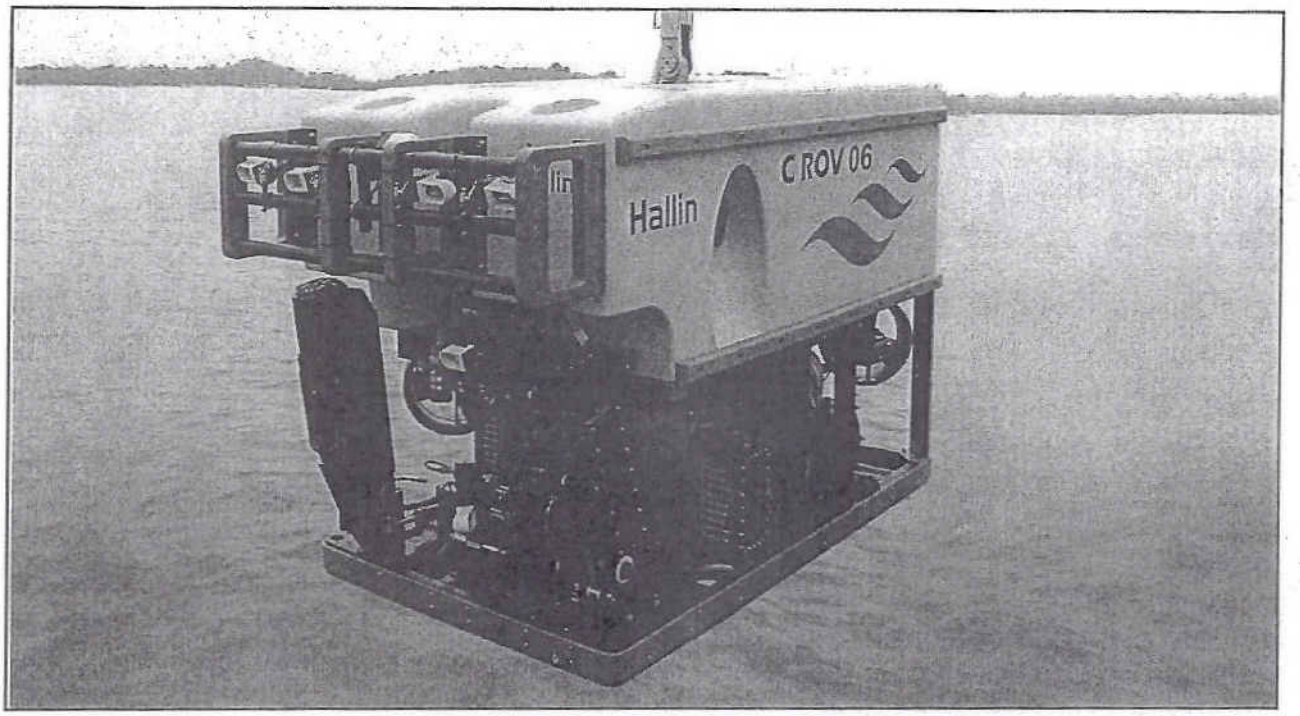
More news

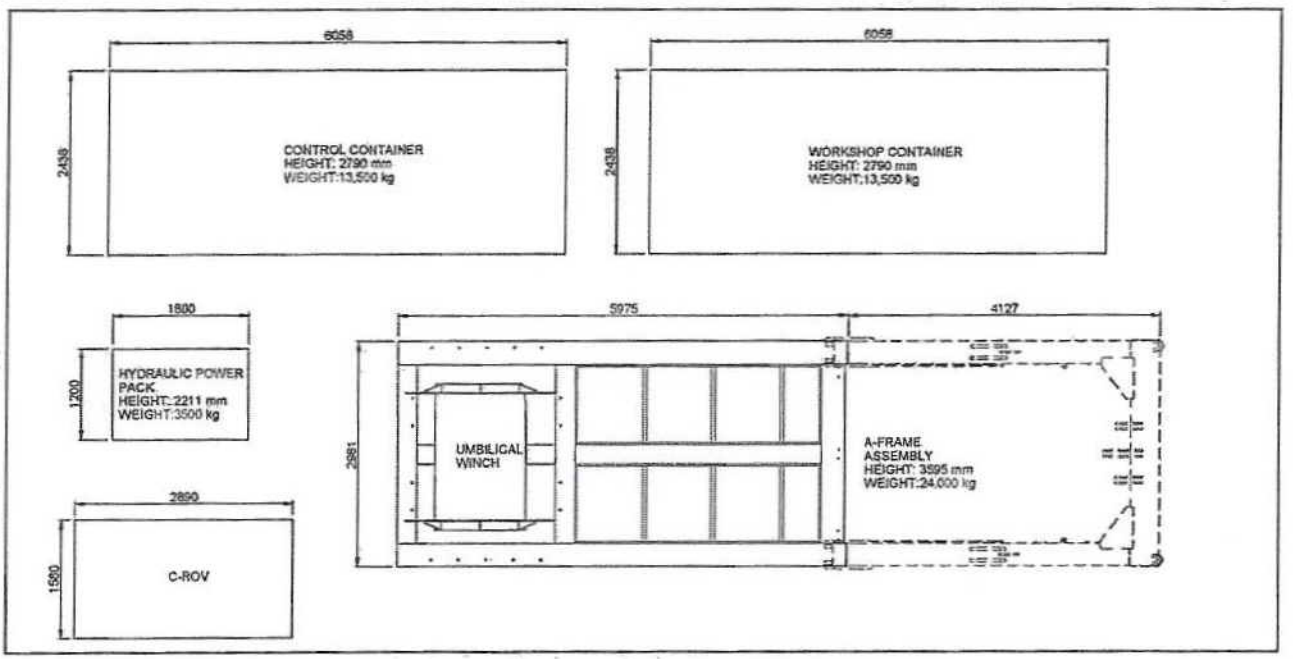
- Havila Clipper delivered
  Vessel & ROV News - February 2, 2011
- Singaporean firm takes stake in Aries Offshore Singapore Pte Ltd
  Company News - February 2, 2011
- Metocean contracts for Fugro GEOS
  Contracts, Tenders and Rates - February 2, 2011
  Oil and gas executives forecast investment opportunities after volatile year
  News - February 2, 2011
- Petition calls for Med oil moratorium
  News - February 2, 2011
- Otto Marine to acquire Go Marine Group Pty Ltd
  Company News - February 2, 2011
- Farstad incurs loss as a result problems at Subocean
  Company News - February 2, 2011
- Subsea 7 awarded contracts offshore Brazil
  Contracts, Tenders and Rates - February 1, 2011
- Edda Freya extended
  Contracts, Tenders and Rates - February 1, 2011
- Tor Viking called in for icebreaking work
  Contracts, Tenders and Rates - February 1, 2011
- Sea Trucks Group raises US$200 million
  Company News - February 1, 2011
- Siem Marlin extended by MPL
  Contracts, Tenders and Rates - February 1, 2011
- Technip confirms acquisition of Subocean
  Company News - February 1, 2011
- New President for IMCA
  Organisations and Associations - January 31, 2011
- Maritime Assurance & Consulting Ltd established In Aberdeen
  Company News - January 31, 2011

TAB 3.F

Hallin

Workclass ROV - 'C-ROV'





The C-ROV ROV is a Hydraulic / Electrical Work class vehicle. This ROV was built with Construction and Drill Support projects in mind. Fitted as standard 100HP hydraulic power unit, the vehicle delivers an outstanding 450kgf forward/aft thrust performance. The compact size of the C-ROV does not diminish its work capabilities, as it will easily perform all tasks normally associated with much larger vehicles. The C-ROV is particularly suited for heavy duty construction support, where remote intervention tasks are required such as positioning of subsea structures, pipelines/umbilical connections, pipeline repairs, component change-out, valve operation, fluid injection, debris removal plus many more.

To enhance the capability of the C-ROV, it may be fitted with purpose built tooling skids weighing up to 600kg in air. The vehicle may be fitted with a range of acoustic sensors to perform precision surveys and conduct salvage operations. The vehicle is designed to work long hours in water and to a working depth of 1000m. Built in accordance with the latest international industry standards and certified for Zone II (Class 1 Division 2) hazardous area operations, the C-ROV may be operated on relatively small vessels of opportunity, fixed or floating platforms. A great deal of thought and attention to detail has gone into minimising the required amount of deck space, while at the same time maximising the performance and capability of the entire system.

MAIN PARTICULARS

Builder	Hallin Manufacturing Services Pte Ltd
Design Standard	DNV
Operating Environment	Certified for Class 1 Division 2 (Zone II)
Operating Temperature	-20°C to +45°C

MAIN COMPONENTS

Remotely Operated Vehicle
Control Container
'A' Frame Assembly
Umbilical Winch (built in to the A-frame)
Hydraulic Power Pack
Workshop/Stores Container

REMOTELY OPERATED VEHICLE

Operating conditions	Up to and including Sea State 6 (3g)
Depth rating	1000 metres sea water
Hydraulic power	75kW (100 shaft horse power)
Length	2890mm
Width	1580mm
Height	1895mm (docking bullet not included)
In air weight	3200
In seawater weight	Neutral
Fwd/Aft bollard pull	450kgf
Lateral bollard pull	400kgf
Vertical bollard pull	400kgf
Fwd/Aft surface speed	3.0 knots
Lateral surface speed	2.5 knots
Vertical surface speed	2.0 knots
Payload	600kg with manipulators fitted
Through frame lift	3500kg @3g at work skid attachment points
Propulsion	4 x 350mm horizontal and 3 x 350 vertical hydraulic thrusters 20kw/26.8HP each
Thruster control manifold	1 x 8 station Servo control manifold valve 200 Bar/ 77 Ltr/ Min
Hydraulic control manifold	2 x 10 @ 15 Ltr/min station bi-directional control valve manifold assembly for manipulators
Auto functions	Heading, depth, altitude
Gyro	±1.0 degrees
Depth sensor	±0.15%
Altimeter	±20mm
Telemetry	Transmission via copper(RS485) or fiber optics (RS232)
Lighting	2 Kw available from 4x500 watt dimmer channels
User power supplies	1KW@115VAC 750VA @ 24vdc regulated
Equipment Interface	Capability to fit most 3rd party equipments and tooling in the current & future markets e.g. TSS 340/440, bathy, profiler, FMD, 3" cutter, torque tool, boom cameras, CP inspection, etc.

CONTROL CONTAINER AND EQUIPMENT

Control Container	1 x A60 (20ft.) DNV 2.7-1 & 2.7-2 (Zone II) operations
Pilot/Co-Pilot Control	Ergonomic control console with video wall, co-pilot console
Incoming Supplies	1 x 440Vac 300 Amps 50/60Hz 3 phase

VEHICLE EQUIPMENT FIT AS STANDARD

Manipulator	1 x Hallin 7 Functions
Grabber	1 x Hallin 5 functions
Camera Pan and Tilt	1 x Hydraulic P & T (Hydrolek)
Colour Camera	3 x ROVSCO 3000
Low Light Camera	Optional
B&W Camera	1 x ROVSCO 3000BW
Sonar	1 x Imagenex Sonar or equivalent

'A' FRAME ASSEMBLY

Type	Hydraulically powered 'A' frame c/w umbilical sheave
Safe Working Load	3500kg
Design Factor	3g
Deployed Reach	4127mm out board reach
Dimensions	6000mm (L) x 3000 (W) x 3595mm (H) stowed position
Max Gross SWL	24,000kg

UMBLIICAL WINCH

Type	Planetary driven reduction gear box (storage winch only)
Line Pull	4000kg
Design Factor	3g
Umbilical Storage Cap	1250m of 41mm diameter umbilical
Line Speed	Variable up to 35 metres per minute
Braking	Internal braking system
Max Gross SWL	7,800kg
Control	5 station proportion control bank

CONTROL AND WORKSHOP CONTAINER

Length (mm)	6058
Width (mm)	2438
Height (mm)	2790
Weight (kgs)	13500

LARS SKID W/ UMBILICAL WINCH

Length (mm)	6000
Width (mm)	3000
Height (mm)	3595
Weight (kgs)	24000

CROV

Length (mm)	2890
Width (mm)	1580
Height (mm)	1895
Weight (kgs)	3200

HYDRAULIC POWER PACK

Length (mm)	1800
Width (mm)	1200
Height (mm)	2211
Weight (kgs)	3500

Hallin Marine
Loyang Offshore Supply Base 25, Loyang Crescent Blk 106, TOPS Street. 12 Box 5083 508988
Tel:+65 6546 0341 Fax:+65 6546 0342 Email:manufacturing@hallin.com.sg

TAB 3.G

Offshore Shipping Online

Hallin Marine invests in ROV fleet

Vessel & ROV News - September 8, 2008

| More

Hallin Marine has announced it is continuing to grow its fleet of ROVs with a commitment to invest US$15.3 million in a total of seven new work class machines, manufacturing four of the vehicles itself and purchasing externally the remainder.

The expansion follows the success of the company's existing fleet of eight work class and seven inspection class ROVs – every vehicle the company has manufactured or purchased has immediately been deployed on profitable projects.

The company's first in-house designed and manufactured vehicle, the C-ROV1 (pronounced Sea Rov 1), has now successfully completed more than 100 operational dives while working off of Vietnam and C-ROV2 has been successfully deployed on a Hallin project immediately following the completion of its post-build testing in Singapore.

Hallin's manufacturing division will now complete the build of C-ROVs 3 and 4 for the company's operational divisions.

The board has agreed to the subsequent build of C-ROVs 5 and 6, also for Hallin's own operation.

In addition, the East Division has placed an order for a Saab Seaeye Panther XT ROV.

The West Division is currently placing an order that confirms its letter of intent for two Quasar 125 HSP 3,000m ROVs from SMD Hydrovision.

The funding for the ROVs will be met by a combination of Hallin's internal resources and bank borrowing that has already been fully secured.

More articles from this category

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TAB 4.A

SUB Dimension

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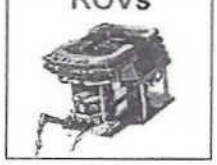
News

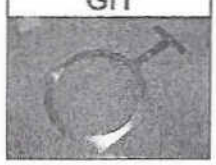
ROVs



ROV Tooling

Components

GIT



Rental

Welcome

Sub Dimension Engineering supplies & maintains ROV's & Submarines to the inshore and offshore oil and gas industries

SUB DIMENSION ENGINEERING CO LTD

Is a British owned, ROV, Submarine & Remote Intervention Tooling manufacturing company. We are a specialist design & manufacturing facility catering specifically to the subsea market.

An associate member of the Foundation Group, we have design & manufacturing facilities in Thailand & Singapore.

We maintain an extensive product line & also offer a bespoke design & manufacturing service, for subsea & remote intervention solutions. Our range of standard products include:-

ROV Manufacturing
ROV Launch & Recovery Systems
ROV Components including DC & AC Thrusters, replacement control systems, HPUs, compensators, lights, cameras, valve packs & Thruster Control Units.
Manned Submarines
Remote Intervention Tooling
Subsea Engineering Design
Inverter Controlled Thruster Systems
Subsea ROV Trenching Motors, Hydraulic & Water Pumps
Remote Intervention – Stand alone Control Systems
ROV Tooling Rental including Hydraulic Cutters & HID Lights Systems
Pipeline flange assembly tooling (GIT) design, & manufacturing.

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Company Info

Sub Dimension Engineering Co Ltd [Thailand]

City: Nong Kham, Sriracha

Province/State: Chonburi

Country/Region : Thailand

Business Type: Manufacturer, Distributor/Wholesaler

Online Postings: Products[30]

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About Us

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Sub Dimension Engineering Co Ltd are a British owned & operated, specialist subsea engineering design & manufacturing house, located in Chonburi, Thailand. Borne of more than 70 years cumulative experience with manned submarines, diving systems, ROVs & remote intervention tooling. We are the premier subsea manufacturing facility in Thailand.

Our core business is the design, manufacture & maintenance of: -

ROVs
ROV based Trenchers & Trenching Systems
Manned Submarines & associated systems
Submarine & ROV thrusters
Submersible motor / variable speed drive systems
Submersible HID Lighting & Flasher Units
Submersible LED Lighting Systems
ROV & Submarine deployed Hydraulic Cutters
Deep sea pressure compensation systems
Ballastable Skid Systems
Subsea Winches
Special application Subsea Camera Systems

Based on the Eastern Seaboard of Thailand, we are ideally situated to serve the industry worldwide. Located in a Thailand government Board Of Industry (BOI) registered industrial complex, we enjoy expedited import & export benefits, enabling us to operate globally without restrictions.

We have in house machining capabilities & a team of highly skilled designers, machinists, engineers & technicians.

Our facility contains 1200 sq mts of clean covered factory space + 240 mts of design office space + 750 mts of uncovered yard space. We offer rented yard & internal storage space, together with planned maintenance contracts for stored equipment, to suitable applicants.

We offer a worldwide commissioning service & comprehensive warranties with all goods & services supplied.

Bespoke design inquiries for subsea & general engineering are welcome.

Company Profile

Basic Information

Company Name:	Sub Dimension Engineering Co Ltd
Business Type:	Manufacturer, Distributor/Wholesaler
Product/Service (We Sell):	ROVs, Submarines, Subsea Tooling, Motors & Drives, Subsea Components
Address:	Pinthong Industrial Estate, 789 / 23 Moo 1
Brands:	AquaJack, Odyssea, Pulsar, Orion ROVs, Aurora HID Light
Number of Employees:	11 - 50 People
Company Website URL:	http://subdimension-engineering.com

Ownership & Capital

Year Established:	2006

Ownership Type:	Corporation/Limited Liability Company
Legal Representative/Business Owner:	Mike Garner

Trade & Market

Main Markets:	North America South America Eastern Europe Southeast Asia Africa Oceania Mid East Eastern Asia
Export Percentage:	81% - 90%

Factory Information

Factory Size:	1,000-3,000 square meters
Factory Location:	Chonburi, Thailand
Contract Manufacturing:	OEM Service Offered Design Service Offered

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Sub Dimension Engineering Co Ltd

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Submarine Lighting [3]
HID Underwater Lighting [1]
Swimmer Delivery Vehicle [2]
ROV Pressure Compensator [2]
ROV Underwater Hydraulic utters [2]
WORK CLASS ROV [1]
LIGHT WORK CLASS ROV [1]
HEAVY WORK CLASS ROV [1]
Timber Felling Remote Operated Underwater Vehicle [1]

Company Profile
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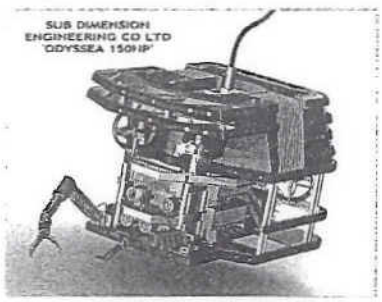
ODYSSEA 150 HP ROV...

ODYSSEA 150 HP ROV



ODYSSEA 150 HP ROV

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Product Details:

Place of Origin	Thailand
Brand Name	Sub Dimension Engineering Co Ltd
Electro-Hydraulic	PLC Control

Payment & Shipping Terms:

Price:	FOB USD 2,488,110 Get Latest Price
Minimum Order Quantity:	1 Set/Sets System
Port:	Bangkok
Packaging Details:	Can be transported on standard 40' trailers & by s tandard 20' shipping container.
Delivery Time:	26 Weeks
Payment Terms:	T/T
Supply Ability:	4 Set/Sets per Year

Offline View Contact Details

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Detailed Product Description

Comprehensive work class specification with 1000m, 2000m & 3000m ratings.

Comprehensive Heavy Work Class Specification; 1000m, 2000m & 3000m Ratings

ROV, Launch & System, Winch, Telescopic 'A' Frame, HPU & Snubber

Schilling Manipulators & extensive Tooling Inventory

Fibre Optic Telemetry & Video Transmission

State of the Art Control System in 20' Shipping Container

20' Workshop Container

Full Operational Spares Inventory

Available in 26 weeks from placement of order.

Company Info

Sub Dimension Engineering Co Ltd [Thailand]

City: Nong Kham, Sriracha

Province/State: Chonburi

Country/Region : Thailand

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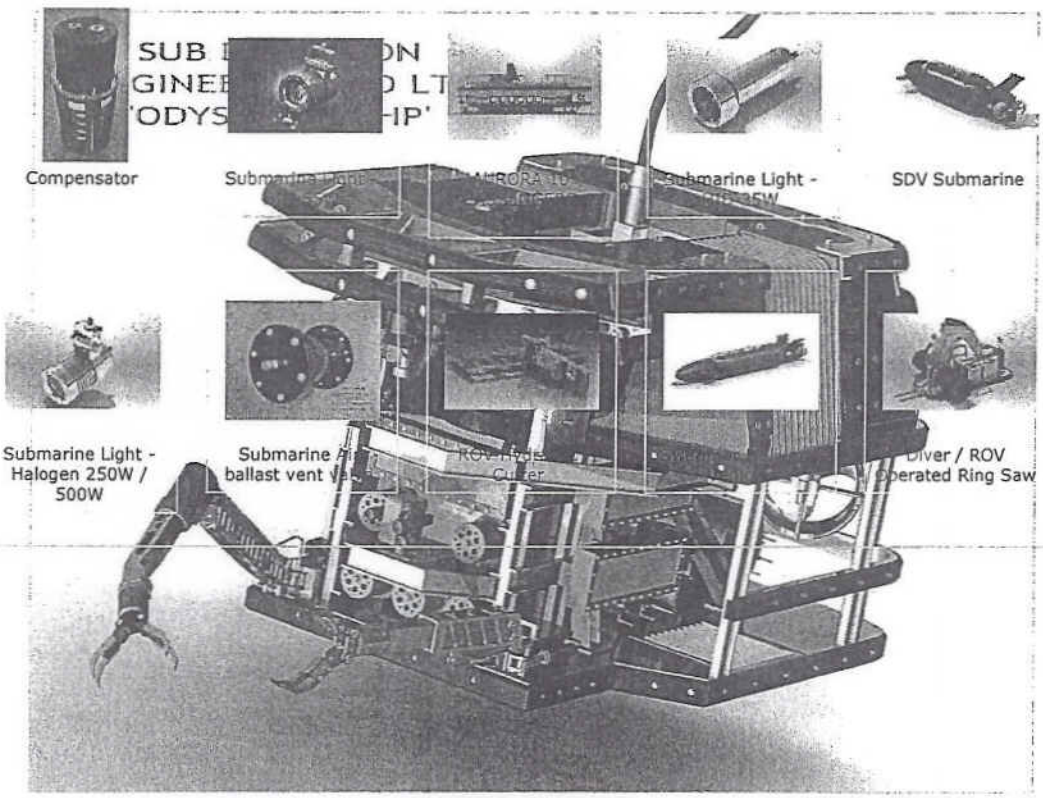

ODYSSEA 150 HP ROV

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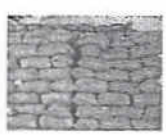

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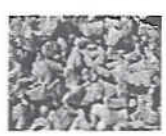
Gold Supplier



dried whole ginger

Gold Supplier

TAB 4.D

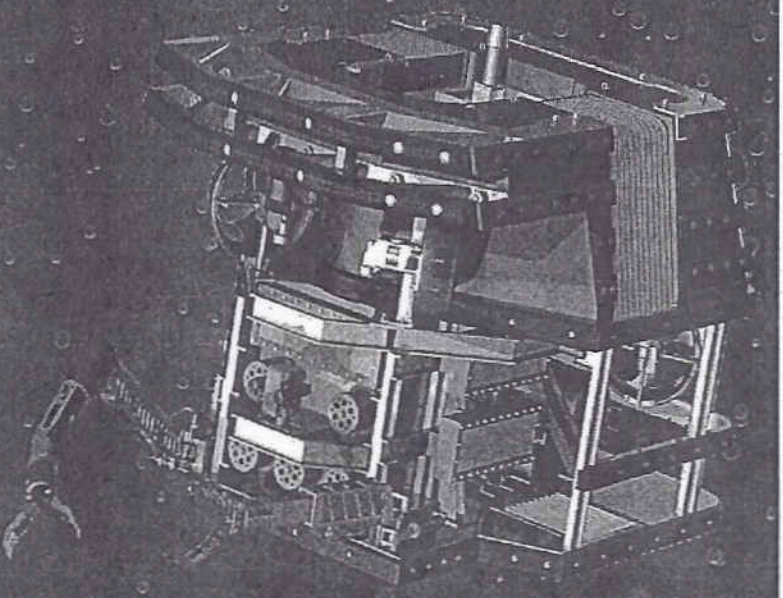
SUB Dimension

'Odyssea'

150 HP HEAVY DUTY WORK CLASS
DEPTH RATING 3000m (2000m & 1000m Options)

FEATURES

- 1000 & 3000m Depth Rating
- 300kg Standard payload and 750kg additional (Skid)
- 5000kg through frame lift.
- Multipoint variable Lift points to suit different tooling arrangements
- Buoyancy, Synthetic Foam Abrasive Resistant Shell.
- Manipulator/Camera boom mounting points
- 112kW SME power pack for Propulsion, Tooling and manipulators
- 7 x SA420 - 18 Hp/480mm Ø Hydraulic Thrusters (6 Vectored + 1 Tunnel)
- 1 x 12 way Hydraulic proportional valve packs (All Proportional or Mix)
- 1 x 8 station servo TCU (77Lpm@70 Bar pressure drop)
- Auto depth and Heading and Altitude (With Altimeter)
- 1 x Umbilical Termination Box
- 1 x Subsea Control POD, 3000m Rated
- SD-D2-RIO Control System
- 6 x Video channels over Fibre optics (Supports up to 6 Cameras)
- 1 x 32 way Auxiliary Junction Box
- 1 x Lighting Junction Box
- Bump bar and protection frame



DIMENSIONS

L 2,750 X W 2,114 X H 1,800
Mass in Air 6000kg

PERFORMANCE

Forward	1.75m-s
Lateral	1.5m-s
Vertical	1.0m-s
Turns rate	120 deg-s

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Submarine Components [6]

ROV Wire Cutter [1]

Submarine Lighting [3]

HID Underwater Lighting [1]

Swimmer Delivery Vehicle [2]

ROV Pressure Compensator [2]

ROV Underwater Hydraulic Cutters [2]

WORK CLASS ROV [1]

LIGHT WORK CLASS ROV [1]

HEAVY WORK CLASS ROV [1]

Timber Felling Remote Operated Underwater Vehicle [1]

Company Profile

Trade Show

PULSAR 125 HP ROV

PULSAR 125 HP ROV

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Product Details:

Place of Origin	Thailand
Brand Name	Sub Dimension Engineering Co Ltd
All Electric	Environmentally Friendly

Payment & Shipping Terms:

Price:	FOB USD 2,867,649 Get Latest Price
Minimum Order Quantity:	1 Set/Sets System
Port:	Bangkok
Packaging Details:	Can be shipped using standard 20' & 40' shipping containers & trailers
Delivery Time:	26 Weeks
Payment Terms:	T/T
Supply Ability:	4 Set/Sets per Year

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Detailed Product Description

'PULSAR' 125 HP ALL ELECTRIC WORK CLASS ROV

Pulsar 125 HP. All Electric Work Class ROV

Using an all electric propulsion system as used on our manned submarine installations, Pulsar is the most environmentally full work class ROV on the market.

Using SDE 11.5kW electric thrusters, Schilling 5 & 7 function manipulators, 8 channel video & 3 pass fibre optic telemetry transmission, it is one of the most advance work class vehicles of its kind.

Control is effected using Siemens PLC based multi-channel telemetry system, an industrial standard, allowing for modularization & ongoing future upgrades.

Its dedicated Launch & Recovery System comprises of Winch, Telescopic "A" Frame, HPU & Snubber.

It comes with a dedicated containerized 20' control room & 20' workshop shipping container.

Company Info

Sub Dimension Engineering Co Ltd [Thailand]

City: Nong Kham, Sriracha

Province/State: Chonburi

Country/Region : Thailand

Business Type: Manufacturer, Distributor/Wholesaler

Online Postings: Products[30]

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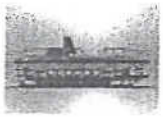
A full Operational Spares INventory is also included.

Available 26 weeks from placement of order.

Compensator

Submarine Light - HID 55W



AURORA 10 PASSENGERS Submarines

Submarine Light - HID 35W

SDV Submarine

PULSAR 125 HP ROV

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PULSAR 125 HP ROV

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TAB 4.F

SUB Dimension

'Pulsar'

125 HP HEAVY DUTY WORK CLASS
DEPTH RATING 3000m (2000m & 1000m Options)

FEATURES

14kW SDE Auxiliary power pack for tooling and manipulators
7 x SDE ROV54-6 11kW 420mm Ø AC Thrusters
2 x Sub Atlantic 12 way Hydraulic proportional valve packs
Auto depth and Heading and Altitude (with Altimeter)
1 x Umbilical Termination Box
1 x Subsea Control POD, 3000m Rated
SDE PLC control system (Siemens PLC's), 16 x RS232/ 12 x RS485/ 1 x Arcnet
8 x Video channels over Dual Fibre optics (Supports up to 8 Cameras)
2 x 18 way Auxiliary Junction Boxes (26 telemetry channels + 8 video)
1 x Lighting Junction Box

PAYLOAD & CONSTRUCTION

300kg Standard payload and 750kg additional (Skid)
6000kg through frame lift. SS316L & Al T6061 Construction
Multi-position lift point to suit different tooling arrangements
Manipulator/Camera boom mounting points

DIMENSIONS

L2750 X W2114 X H1800
Mass in Air 4250kg

PERFORMANCE

Forward 1.75m-s
Lateral 1.5m-s
Vertical 1.0m-s
Turns rate 120 deg-s

TELEMETRY

Siemens PLC based
Focal 907E Dual F.O. Transmission
RS232 16 Ch
RS485 12 Ch
Arcnet 1 Ch
Video 8 Ch

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TAB 5.A

Deep-ocean exploration using remotely operated vehicle at gas hydrate site in Krishna–Godavari basin, Bay of Bengal

G. A. Ramadass*, S. Ramesh, J. Manecius Selvakumar, R. Ramesh, AN. Subramanian, D. Sathianarayanan, G. Harikrishnan, D. Muthukumaran, V. K. Jayakumar, E. Chandrasekaran, M. Murugesh, S. Elangovan, V. Doss Prakash, M. Radhakrishnan and A. Vadivelan

National Institute of Ocean Technology, Velachery-Tambaram Main Road, Narayanapuram, Pallikaranai, Chennai 600 100, India

Work class remotely operated vehicle (ROV) rated for 6000 m depth of operation (ROSUB 6000) has been developed at the National Institute of Ocean Technology, Chennai, for deep-ocean resource studies. This system is being developed for the exploration of deep-sea mineral deposits such as poly-metallic nodules, gas hydrates, cobalt crust and other deep-ocean scientific observations in the Indian waters. The first ROV-based deep-water scientific expedition was performed to decipher the surface expression of gas hydrate at a depth of 1017 m in the Krishna–Godavari basin, Bay of Bengal, during September 2009. High-resolution bathymetry with multibeam sonar, vertical profiles of dissolved oxygen and water temperature were also collected in real time using ROV. Live images of sea-floor habitats and deep-sea organisms such as fishes, shrimp, corals, holothurians and polychaetes were recorded and identified. Probable deep-water coral reef province is being established from deep waters of the Bay of Bengal and the exploration results have brought out chemosynthetic habitat at the expedition site in Bay of Bengal.

Keywords: Chemosynthetic habitat, coral reef, deep-ocean study, gas hydrates, remotely operated vehicle.

THE ocean basins of the world are a vast alien landscape. It is the last frontier of the earth with exciting underwater environment of abundant unexplored secrets. Deep-water studies for diverse scientific missions are in progress for the past six decades in India using indirect and direct measurement devices[1–3]. However, physically observing the activity in the deep-sea bed in our ocean basins is a dream of Indian scientists. So far observations of deep-sea bed have been carried out by towed camera devices[4,5].

Plunging to the depths of ocean basins can be fulfilled only by the development and deployment of underwater vehicles. Deep-sea technological device development is a challenging mission and it is imperative to have novel devices to carry out scientific studies in ocean basins. To cater to such a need, remotely operated vehicle (ROV) (Remotely Operable Submersibles – ROSUB 6000) (Table 1) has been developed at the National Institute of Ocean Technology (NIOT), Chennai, in collaboration with the Experimental Design Bureau of Oceanological Engineering (EDBOE), Moscow. ROSUB 6000-ROV is rated for 6000 m water depth of operation and shall cover 97% of the water depth in the world ocean basins. This system has been developed for deep-sea mineral exploration such as polymetallic nodules, gas hydrate, cobalt crust and other deep-ocean scientific observations in the Indian waters.

The ROV developed at NIOT weighs 3.7 tonnes in air and is positively buoyant in salt water with a payload of 150 kg. The Tether Management System (TMS) acts like a depressor to position ROV in deep waters. TMS weighs 2.7 tonnes in air and has a 400 m long tether cable to release ROV at any required depth to perform spot-selective exploration activity. ROV and TMS docked together are (Figure 1) lowered to the designated water depth using dedicated Knuckle boom-type Launching and Recovery System (LARS), storage winch mechanism and 7000 m long electro-optic aramid umbilical cable. The umbilical cable has electrical conductors to provide the required power for ROV operation and optical fibre for real-time communication and control. Traction winch of LARS in conjunction with the storage winch handles the umbilical cable load during lowering/heaving of ROV

Figure 1. View of ROSUB 6000 during deployment from the ship.

*For correspondence. (e-mail: ramadass@niot.res.in)

Table 1.

Details	Specification
Remotely Operated Vehicle	
Diving depth	6000 m
Size	2.53 m × 1.8 m × 1.7 m
Weight	3700 kg in air; – 20 kg in sea water
Mechanical structure	Open frame architecture made of aluminum alloy (AA 5056)
Floatation	Syntactic foam (density 600 kg/m^3)
Payload	150 kg
Propulsion	Electrical thrusters (7 nos); 10 kW each
Cameras	1 colour CCD; 2 B & W; 2 mini cameras
Lights	7 (LED, HID and halogen); total 1000 W
Manipulator	1 no. 5 function; 1 no. 7 function
Forward velocity	2 knots
Electrical power	6.6 kVA AC/460 Hz transmission; 75 kW
Control system	Real-time hardware and software
Communication	Single-mode fibre optic data and video telemetry
Navigational equipment	Doppler velocity log
	Underwater photonic inertial navigation system
	Sound velocity profiler
	Depth sensor
	Acoustic transponder
Auto control	Heading, depth, roll, pitch and altitude
Scientific payload	Multibeam (7125 and 7128) – 400 kHz
	Oxygen optode
	Conductivity sensor
	Kinematic methane sensor (4000 m depth rated)
	Niskin water sampler (5 l)
	Short push corer of 40 cm length
Tether Management System	
Diving depth	6000 m
Weight	2700 kg in air; 2000 kg in water
Tether length	400 m
Pumps	Two hydraulic pumps
Latching mechanism	Hydraulic
Umbilical Cable	Electro-optic Kevlar; 7000 m

and TMS. Two slip rings are in place, one in the storage winch and another in TMS. The slip rings provide continuous power supply and fibre optic communication during ROV deployment and operation.

Real-time positioning and operation of ROV is possible with the Doppler Velocity Log (DVL), Depth Sensor, Underwater Photonic Inertial Navigation System (UPHINS) and Multibeam Sonar in ROV. In addition, ROV has oxygen optode, conductivity sensor, Niskin water sampler and two 40 cm acrylic core liners for sediment sampling[6].

Gas hydrates are the crystalline form of low molecular weight hydrocarbons (mainly methane) and water molecules. Gas hydrates which contain approximately 98% methane are perceived to be the future alternate energy resource. Hence, scientific and technological developments are in progress to understand the behaviour, occurrence, spatial extent and resource assessment of gas hydrate deposits. Gas hydrate exploration is a nascent science. In India, the Krishna–Godavari (KG) basin in Bay of Bengal shows good potential for gas hydrate exploration. Geophysical studies on the basis of occurrence of bottom stimulating reflectors (BSR) in KG basin had reported the probable presence of gas hydrates[7–9]. Drilling executed under the National Gas Hydrate Programme (NGHP) established the occurrence of 120 m thick gas hydrates within 40–160 mbsf (metres below sea bed) at ~ 1020 m water depth in KG basin[9]. Occurrences of carbonate worm tubes indicating gas seepages and chemosynthetic community were also reported from KG basin sediments[9]. Subbottom profiler datasets and long core samples collected from KG basin had shown palaeo-methane venting activity[10].

Based on the geophysical observations, ROV-based expedition was conducted off Kakinada in Bay of Bengal at a depth of 1019 m (lat. 15°51.95540′N and long. 81°49.84920′E; Figure 2). Exploration and investigation of these regions is a challenging task and the results will allow us to understand diversity of the habitats to establish further scientific facts on surface expression of methane vents from Indian waters. The expedition was carried out to identify the surface features of the venting site and to throw light on the available habitat ecology

with finer details of information. There is no record available regarding the seafloor characteristics and ROV-based study at the gas hydrate site in the Indian waters.

ROV-based studies have been performed extensively at gas hydrates sites elsewhere using deep-water ROVs like Ventanna, Victor 6000, etc. and submersibles. Some of the notable results are Nyegga pockmark site[11,12]; Guaymas Basin, Gulf of California[13]; Hydrate Ridge, Oregon[14]; chemosynthetic ecology from black ridge[15], and pingo-like features on Beaufort Sea[16]. Results from such ROV-based direct observations at the gas hydrate regions and chemosynthetic habitats have proved exciting for those in the field.

Similar type of deep-sea scientific exploration was carried in the Indian waters with ROSUB 6000 ROV using Ocean Research Vessel *Sagar Nidhi*. During the expedition, the vessel was dynamically positioned at the pinnacle of the selected diaper structure. Within the accuracy limit of GPS, UPHINS interfaced with DVL and acoustic transponders, the position derived from ROV at 1000 m water depth could be within 20 m range. High resolution mapping and exploration was carried out using the ROV-mounted multibeam sonar, video imaging system, scientific sensor and samplers. ROV was released from TMS at 965 m water depth to hover close to the sea bed, using the seven thrusters of ROV at the selected site (~ 1019 m). By controlled tether payout and thruster operation, ROV manoeuvering was performed in real time. Water sample was collected at the required position using the robotic arm of ROV. Sediment core samples were also collected using core liners when ROV bottom surface touched the seafloor. The outcome of ROV expedition at the gas hydrate site after its qualification trial conducted at 3057 m water depth in the Bay of Bengal during this expedition is given below.

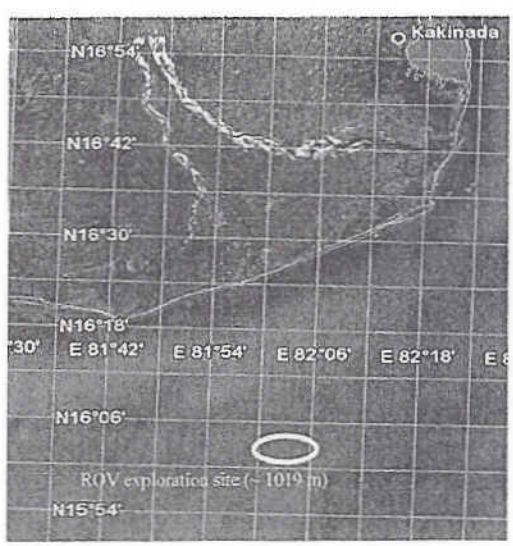

Figure 2. Study region (source – Google map).

ROV-based multibeam bathymetry survey conducted within 80 m^2 of the survey region at the gas hydrate site has indicated a rugged topography similar to pingoe-like feature observed in the Norwegian Sea[12]. The northeastern part of the survey region is the topographically high region at 1011 m. The southern and western sides of the survey region reached a maximum depth of 1019 m. A deeper depression of 1–2 m near the mound feature on the NE side of the dive site has been clearly established from the multibeam datasets (Figure 3). The observed mound-like features are similar to the chaotic submarine seafloor[12], disruption craters[17] and pingo-like structure[18] observed elsewhere at gas-seepage margins in the deep-oceans.

A basic fact regarding ocean basins is that pressure increases at a rate of 1 atm with every 10 m depth. Accordingly, deep-sea organisms change its morphology. Due to selective filtering of solar radiation with ocean depth, light is not available below 100–150 m (ref. 19). In such deep-sea hostile environment with high pressure and low temperature without light, different habitats generate meso-pelagic, bathypelagic, bentho-pelagic and abyssal ecology[20]. In the study area, dissolved oxygen and water

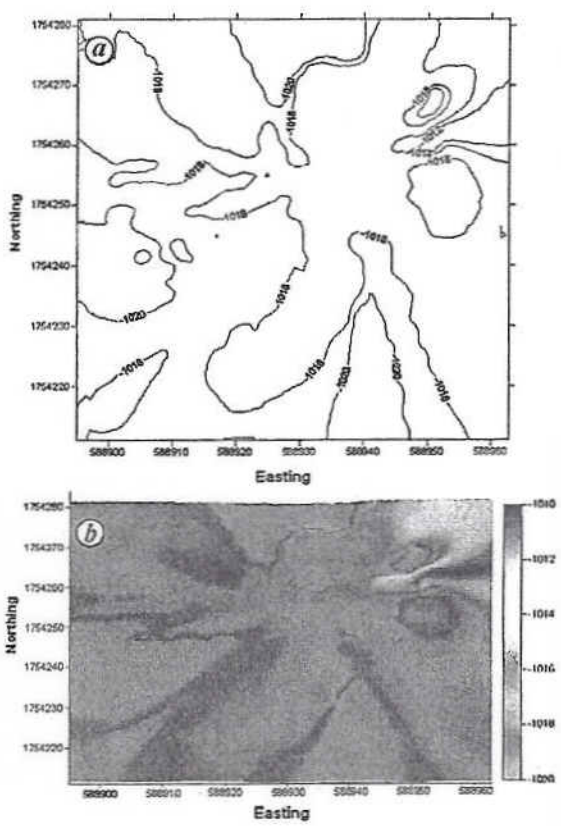

Figure 3. Sea-bed morphology deciphered from ROV-mounted multibeam sonar (400 kHz). *a*, Contour map; *b*, Colour-coded bathymetry.

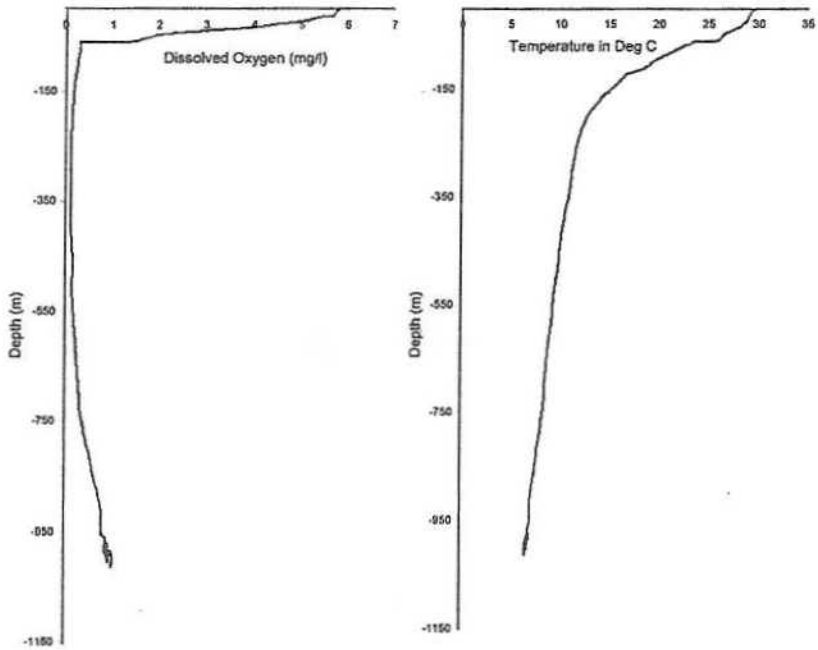

Figure 4. Vertical profile of dissolved oxygen (mg/l) concentration and water temperature.

Figure 5. Sea-bed with burrows and devoid of organisms.

temperature values were continuously observed from the surface to the sea bed. Oxygen availability reduced from 6 mg/l (surface water) to less than 0.5 mg/l at 1017 m depth and water temperature reduced from 27°C (surface water) to 5°C (Figure 4).

ROV-based expeditions conducted at seepage regions elsewhere had shown the occurrence of bacterial mats, small tube worms, carbonate blocks, etc., indicating as gas venting submarine seafloor[12]. On similar lines continuous underwater videography was performed within the altitude height of 1–2.5 m above the seafloor and within 50 m radius of the selected region. Videography was performed using bottom-looking fixed focus colour CCD camera and black and white zoom navigator camera mounted with pan and tilt arrangement. The seafloor was illuminated with halogen and LED lights in the front and bottom. Vehicle speed was kept slow, less than 0.2 knots. At required positions ROV was kept stationary by changing the heading alone. Navigation of ROV was performed using remote joysticks from a control console container mounted on the ship. Feedback from UPHINS and DVL in ROV was used in combination for navigation. Depth of ROV was controlled using DVL altitude feedback in combination with Digiquartz Depth sensor feedback. The collected video data were used for megafaunal mapping, since they contain positional and depth information with time details.

The studied site is an unexplored region for seafloor marine habitats by ROV. On the basis of video footing of the sea bed, the study region can be divided into (i) soft sediment and (ii) ecologically fertile regions. The soft sediment habitat was composed of silty and heavily bio-turbated mud. Several burrows and small mound-like features are clearly seen in the seafloor. Occurrence of burrow holes in the sea bed indicates the presence of living assemblage in the dive region. The video images were similar to those published from the Victor 6000 ROV in the soft-bottom habitat in the Angola margin[21]. No organisms were observed at this region in the present expedition (Figure 5).

Ecologically fertile sea-bed images with dense living assemblages of deep-sea organisms were observed in the adjacent region. The images resembled antipatharians, holothurians, polychaetes, shrimp and fishes. These types

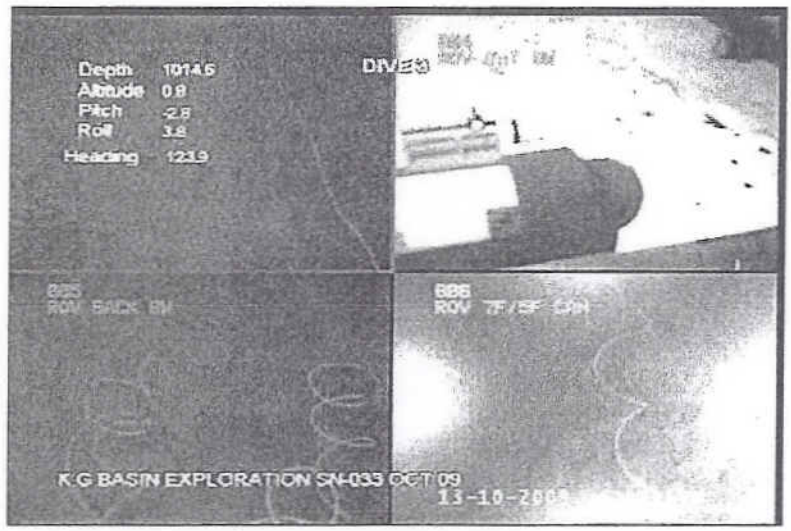

Figure 6. Spiral whip-type coral observed in all cameras of ROV (bottom, front, back, bottom in clockwise direction from top left).

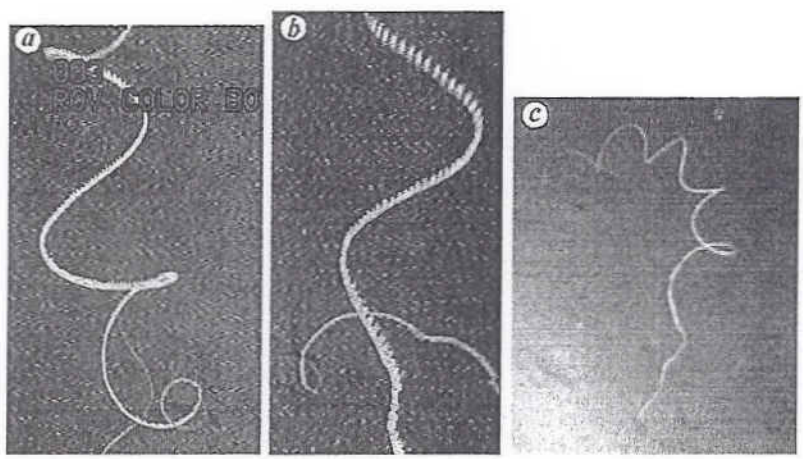

Figure 7. Spiral-type coral with serrated external morphology.

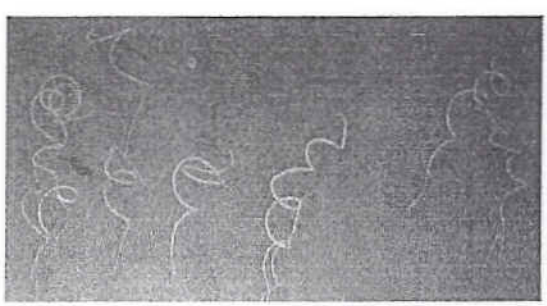

Figure 8. Spiral coral colony observed in front using black and white camera.

of non-migratory deep-water marine organisms have been reported at a depth range of 900–1300 m in the Norwegean Sea and Angola marigin[11,15,21].

Details of the 1012–1017 m faunal assemblages recorded by ROV are as follows: Close-up images of the spiral assemblage resembled antipatherian coral communities, observed by cameras mounted in the front, back and bottom of the vehicle (Figure 6). The spiral assemblage was attached firmly in the bottom mud; the tails had a thin tapering shape. These coral communities support deep-water fertility for other habitats. Analysis of video images revealed dense colony of more than 1–2 m^2 area. The observed organisms were spiral-shaped individual members, around 2–3 m in height with serrated external morphology. Based on the distance to the object and camera focus angle, it was observed that the width of the organisms was around 1–2 cm. From the video footings the spiral whip coral of the deep sea is clearly established (Figures 7 and 8). Another type of straight coral resem-

bling seapen was also observed. These corals are single-membered, attached to the sea bed without spiral or serrated external morphology. They are around 1 m in height (Figure 9). Based on the close-up images, the observed spiral whip coral colony was similar to *Cirrhipathes spiralis* sp. The straight short coral was similar to the *Stylopathes* sp. from Angola margins[21]. The observed coral colony from the ROV-based video devices needs further sampling and investigation in the study region. These coral communities belong to the antipatharians genera, which are suspension feeding fauna reported from deep waters of NE Atlantic[22]. Similar type of coral communities was also observed in chemosynthetic habitats[23]. As indicated by Hoveland and Judd[24], deep-sea reef communities in seep environment (which may be expected at the exploration site in KG basin) are a matter of preferential settlement.

A fish observed during the survey was similar to the Macrouridae genera and it might be *Coryphaenoides* sp. It has a long body tapering down to the pointed tip of the tail. The tail fin is absent and it has a blunt head. Fish movement recorded in the forward-looking black and white camera shows that these are weak swimmers and move slowly. This was observed at a water depth of 1019 m and it swims with its long tail and close to the sea bed within 0.5–1 m altitude. It is 0.8–1 m long and the head is approximately 17 cm with tapering long tail (Figure 10). Shrimps were recorded near the spiral whip coral at a depth of 1017 m. It is approximately 20 cm in length with 2 cm wide and has two clear eyes (Figure 11 *a*). A flexible, worm-like, tough-skinned, cylindrical-shaped, bottom attached and one side curved organism was observed. It was recorded using the black and white camera and was similar to the sea cucumber or Holothurians (Figure 11 *b*). Polychaete tube-like feature about 1 ft in height with 2 cm width and top hollow was also observed (Figure 11 *c*). All these organisms are probable indicators of the chemosynthetic community which had been reported from the Norwegian Sea and Angola margins from ROV-based expeditions[12,21]. At ROV dive site bivalves were completely absent. Spatial distributions of the deep-water organisms at the study site are given in Figure 12.

ROV exploration at the study site has revealed a faunal assemblage resembling methane seep region, established

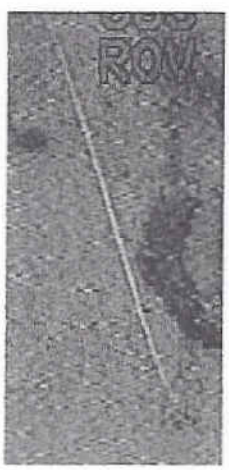

Figure 9. Straight coral (sea pen).

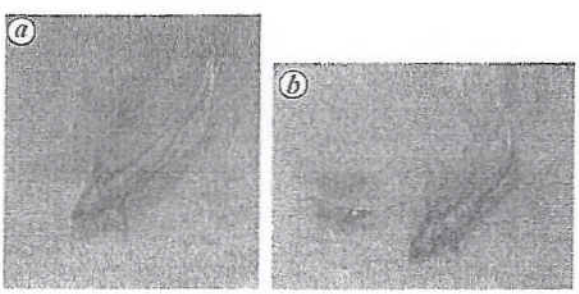

Figure 10. Deep-water fish (*a*) and shrimp with fish (*b*).

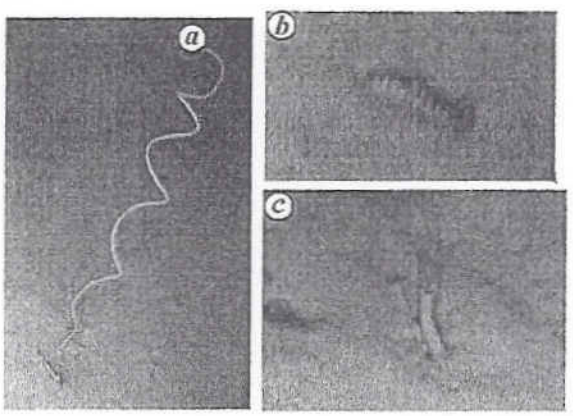

Figure 11. *a*, Shrimp with spiral coral; *b*, Holothurians and *c*, Polychaete.

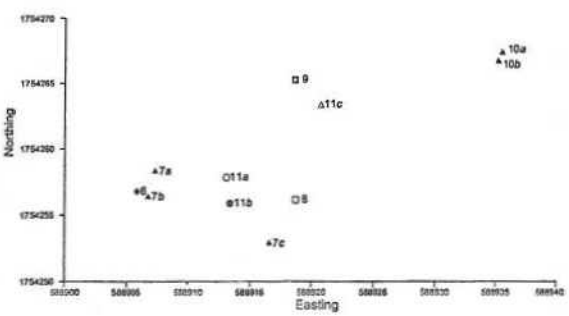

Figure 12. Spatial distribution of deep-water organisms at the study site (numbers refer to the figure numbers in the text).

with ROV elsewhere such as the Norwegian Sea, Beaufort Sea, Guyana basin, etc. However, further sampling and studies are needed to prove these assemblages as chemosynthetic community. Observations indicate that the seep regions are not far from the dive site. Since the study regions are reported with hydrocarbon reserves and gas hydrates occurrences (from 40 mbsf), surface expulsions by the way of methane venting are expected by tectonic fracturing. This can be established in detail based on benthic ecological studies, water chemistry and future observations.

This communication provides results from the deep-water ROV developed in India at depth ~1020 m. The abundant spiral whip corals observed along with other deep-sea organisms are rare in KG basin. As indicated by Rouse[25], water depths between 1000 and 4000 m form the biggest habitat on earth and also the least explored. Results from the deep-water exploration at 1000 m water depth have revealed the chemosynthetic habitats in the Bay of Bengal. Moreover, these results also indicate that the deep-water work class ROV (ROSUB 6000) developed by NIOT is an effective tool to unravel many unknown mysteries of ocean basins in India in future.

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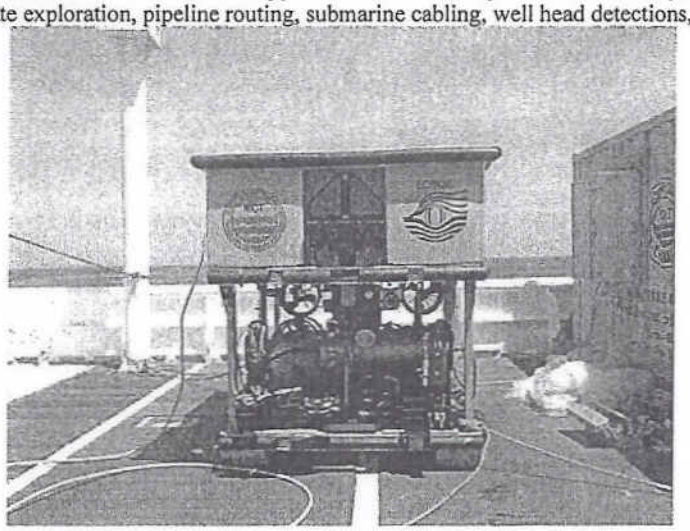
NATIONAL INSTITUTE OF OCEAN TECHNOLOGY

(An Autonomous Body under Ministry of Earth Sciences, Govt. of India)

The Technology for harnessing the wealth of Ocean begins here...

Technology Projects > Submersibles > Introduction

Development of deep-water work class ROV by NIOT in collaboration with Experimental Design Bureau of Oceanological Engineering (EDBOE), Moscow was initiated by Polymetallic Nodule Management (PMN) Board of the Ministry of Earth Sciences (MoES), Govt. of India. The Submersible is equipped with multifunctional tools and sensors for offshore applications such as deep ocean mineral exploration, seabed imaging, gas hydrate exploration, pipeline routing, submarine cabling, well head detections, sampling etc.



The ROSUB system is rated for 6000m depth operation. It consists of Work Class Remotely Operable Vehicle (ROV), Tether Management System (TMS), Ship based Launching and Recovery system (LARS), Power transmission and Data telemetry system, Integrated Navigation System (INS), Control and operational system (soft). The submerged weight is compensated by buoyancy packs made of syntactic foam fitted to the upper part of the frame. It is fitted with a five-function grabber arm, used to position the ROV steadily in one position by holding on to a support, and a seven-function manipulator is then used to perform assigned robotic tasks. The manipulator is similar to those found in various industrial applications on-shore, having a number of joints, a rotating wrist, and a hand-like claw.

TAB 5.B

TAB 5.C

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Russian Academy of Sciences
Experimental Design Bureau of
Oceanological Engineering

Equipment

Underwater vehicles
- ROV ROSUB 6000
- RIFT
- GNOM
- Manned Underwater Vehicle "ARGUS"
- Manned Underwater Vehicle "OSMOTR"
- "Rift-1" & "Rift-2"
- "Mir-1" & "Mir-2"

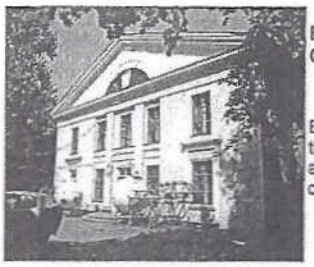
all vehicles >>

Multifunction geophisical systems
- Ocean bottom geophysical observatory (OBO)
- Underwater geophysical complex

Seismic stations
- ABSS-1 autonomous bottom seismic station (ocean)
- MARSS - marine autonomous recorder of seismic signals
- ARSS-1 - autonomous recorder of seismic signals
- Broadband autonomous bottom seismograph
- IGLA - Infrasonic Geophysical Locator of Anomalies

Seismometers
- SM-3KV
- SM-5
- SM-6

Hydroacustic
- Transponders AHAR-MP, AHAR-EC
- Hydroacoustic navigation system (HANS)



Experimental Design Bureau of Oceanological Engineering

EDBOE RAS was established in 1970 by the Decree № 33-306 of the Presidium of the USSR Academy of Sciences (now Russian Academy of Sciences, RAS) in accordance with the Regulation of the State Committee on Science & Technology of Council of Ministers USSR.

Main directions of activity:

- Providing research and experimental design of scientific instrumentation for fundamental research in physics, chemistry, biology, geology, geomorphology, ecology and acoustics of World Ocean
- Development, design and manufacture of special instruments and scientific equipment for onshore and ocean research, environmental monitoring, investigation and exploration of underground and seabed natural resources
- Development, design and manufacture of a wide range of geophysical, hydrochemical, hydrological, hydroacoustic and other scientific measurement devices, sensors, ocean bottom stations and observatories, multi-purpose manned and unmanned research submersibles
- Supply facilities and maintenance of equipment for measurement, processing, analysis and interpretation of geophysical and oceanographic data
- Scientific research and engineering survey

The main office of EDBOE RAS is in Moscow, the Southern branch is in Gelendzhik, Black Sea.

More info >>>

EDBOE news&events

October 13-15, 2010

International Naval & Maritime Innovations Exhibition SEA FUTURE 2010 took place in the exhibition center SREZIAEXPO (La Spezia, Italy) on 13-15 of October. The exhibition was held by the authorities of Liguria region, by the government and the Trade council of the province La Spezia under the auspices of the Ministry of economic development and the Institute of foreign trade of Italy.

EDBOE RAS took park in the exhibition as part of Russian delegation from trade exchange development department of Italian embassy.

SEAFUTURE is one of the main events for those who are interested in naval and maritime innovations; it is a meeting point for scientific research centers, universities, manufactures, distributors and concerned national and international institutions. It is a place of experience exchange and state-of-art technologies transfer.

September 27-30, 2010

The 4th International Specialized Exhibition of research apparatus and equipment "SIMEXPO – scientific instrumentation - 2010" took place in September, 27-30.

The exhibition was held under the auspices of the Russian Academy of Science, Russian foundation for fundamental research, Federal Agency on technical regulation and metrology, Federal Agency on science and innovations.

120 leading enterprises, organizations and companies from Russia and CIS were present at the exhibition. They were mainly manufacturers of apparatus and equipment designed for scientific research in all spheres of contemporary science, also manufactures of components and materials used for apparatus production and operation. There were as well representatives and official dealers of leading foreign companies.

EDB OE RAS participated in the exhibition at the joint stand with the Russian Academy of Science.

September 8, 2010

On September 8,2010 the Experimental Design Bureau of Oceanological Engineering of the Russian Academy of Sciences (EDBOE RAS) and the P.P.Shirshov Institute of Oceanology of the Russian Academy of Sciences (IO RAS) met with the Taiwan delegation from National Cheng Kung University. During the conference EDBOE acquainted the

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TAB 5.D

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Equipment

Underwater vehicles
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- Manned Underwater Vehicle "OSMOTR"
- "Rift-1" & "Rift-2"
- "Mir-1" & "Mir-2"

all vehicles >>

Multifunction geophisical systems
- Ocean bottom geophysical observatory (OBO)
- Underwater geophysical complex

Seismic stations
- ABSS-1 autonomous bottom seismic station (ocean)
- MARSS - marine autonomous recorder of seismic signals
- ARSS-1 - autonomous recorder of seismic signals
- Broadband autonomous bottom seismograph
- IGLA - Infrasonic Geophysical Locator of Anomalies

Seismometers
- SM-3KV
- SM-5
- SM-6

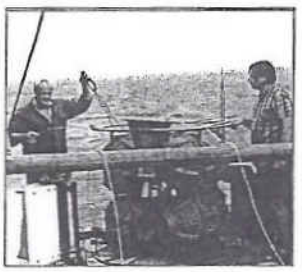
Hydroacustic
- Transponders AHAR-MP, AHAR-EC
- Hydroacoustic navigation system (HANS)

About Experimental Design Bureau of Oceanological Engineering

Director of EDBOE RAS - Sergey Ya. Sukonkin

Structure of EDBOE RAS:
- Electronic R&D department
- Mechanical R&D department
- Submersibles R&D department
- Geophysical systems R&D department
- Department of designing and production of printed circuit boards
- Processing department
- Metrological department
- Experimental manufacturing department
- Marketing department
- Administrative and financial group
- Maintenance group

Customers and partners of EDBOE RAS in Russia are:
Shirshov Institute of Oceanology RAS, Institute of Physics of the Earth RAS, Oil and Gas Research Institute RAS, Institute of Water Problems RAS, Institute of Water & Ecological Problems RAS, Institute of Nuclear Research RAS, Institute of Radio-Electronics RAS, Acoustic Institute, Oceanography & Navigation Department, State Research Institute of Hydrography & Navigation of Ministry of Defence, Research Institute "Morphyspribor", Scientific & Industrial Enterprise "Sevmorgeologiya", State Scientific Center "Yuzhmorgeologiya", Scientific & Industrial Enterprise "Volna", Ltd "Navdyne", Ltd "Geospectr", Ltd "Poisk", Ltd "Seatechrim", Bauman Moscow State Technical University, OAO "Gazprom" and other institutes and companies.



EDBOE RAS collaborates with foreign research and design institutes and companies from the USA, India, Japan, Greece, Germany, France, England, Spain, Taiwan, Norway, Poland, Denmark and others.

Main directions of EDBOE RAS activities during last years are geophysical onshore and offshore investigation and exploration using in-house designed state-of-the-art scientific instruments like ocean bottom stations, autonomous recorders of seismic signals, underwater observatories.

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TAB 5.E

Russian Academy of Sciences
Experimental Design Bureau of
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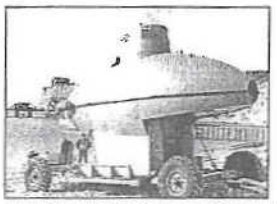
EDBOE RAS manned systems experience

EDB OE RAS designed, construction, trial and operating or took part in this works of the next manned systems:

Manned Underwater Vehicle "ARGUS" (1975).



MUV "Argus" is a 9,5-ton, three-men submersible, capable of operating at depths approaching 600 m is intended primarily for performing scientific research, inspection, engineering works, filming, photography, search and recovery of underwater objects. It has 7- degrees manipulator.

MUV "Argus" have the following operational capabilities:
- carrying out scientific oceanological, geological, biological, chemical and other researches;
- undertaking engineering works and emergency-salvage operations.

MUV "Argus" can be equipped also for the measurements of hydrophysical and hydrochemical parameters of marine environment, measurements of electrical field potential beside the seabed and estimation of magnetic field anomalies, measurements of density, temperatures and pressure, analysis of heavy metals contents in sea water.

"Argus" also has the capability of working for following operations at all range of depth:
- Telephoto shooting and visual inspection of underwater objects;
- Search of sinks objects and mapping of seabed;
- Marking objects at the seabed by any kind of beacon (responders, transponders, flashlighters, etc.);
- Engineering-work, at underwater oil-gas pipelines, structural work of industrial installation.

General features of MUV "Argus":

Operating depth, max	600 m;
Weight	9.5 t;
Crew (2 pilots + 1 observer or 1 pilot + 2 observer)	3
Dimensions: Length-Width-Height	6,7-2,5-3,2m
Payload (from surface)	Approx. 400 kg;
Inside diameter of pressure hull	2,2 m;
Maximum Speed	2.5 knots (horizontal)
Endurance for normal underwater operation	6 hours
Emergency life support endurance	72 h (3 persons)
Viewports	1x200 + 3x120 mm
Storage of electric energy	60kWh

Reference
Manned Underwater Vehicle "Argus" was designed and constructed in Experimental Design Bureau of Oceanological Engineering (EDBOE) and trial operated in South Brunch of EDBOE at the Black Sea (nearby Gelendjik). "Argus" was operated in different regions of the World Ocean. Now MUV "Argus" is in South Brunch of EDBOE.

Manned Underwater Vehicle "OSMOTR" (1986).

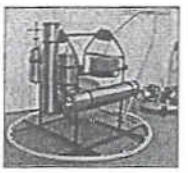
Manned Underwater Vehicle "OSMOTR" on transport vehicle.

Manned Underwater Vehicle (MUV) "Osmotr" is a 14,6-ton, two hulls, five-men submersible capable of operating at depths approaching 300 m with two saturated divers. First command hull with normal pressure has pilot, co-pilot (or observer) and diver's specialist. Second contained two divers. Both hulls can be connected with help of hatch between them. It has 7- degrees manipulator too. MUV "Osmotr" was intended primarily for performing scientific research, underwater inspection, engineering works, filming, photography, search and recovery of objects 'in situ' with diver's including aid.

The MUV "Osmotr" have the standard operational capabilities including:
- delivery two saturated divers under high pressure from deck diver's complex to work position at the depth up to 200 m and back;
- delivery two divers from a support vessel or from a coastal base to work position at the depth up to 100 m and back. - - In this case decompression carry out in diver's hull of MUV on the deck of support vessel or at the coastal base.
- Due to good storage electrical energy lockout "Osmotr" can be equipped by different kinds of special instruments with the hydraulic drive for example for sampling from the seabed.
- "Osmotr" also can be used as tourist vehicle.

General features of "Osmotr":

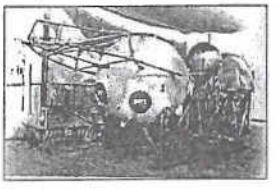
Operating depth, max	300 m;
Diver's operating depth	200m;
Weight	14.6 t;
Crew (2 pilots + chief-diver in control hull & 2 divers in diver's hull)	5 (3+2);
Dimensions:	
Length	6,6 m;
Width	2,75 m;
Height	3.3 m;
Payload (from surface)	approx. 500 kg;
Inside diameter of pressure hull	1.4 m;



Maximum Speed	2.5 - 3.0 knots (horizontal)
Endurance for normal underwater operation	12 hours
Emergency life support endurance	72 h (5 persons)
Viewports	1x460mm+6x200mm+12x120 mm
Storage of electric energy	90kWh

Reference.
Manned Underwater Vehicle "Osmotr" was designed and constructed in Experimental Design Bureau of Oceanological Engineering (EDBOE) and trial operated in South Brunch of EDBOE at the Black Sea.

Deep Submergence Vehicles "Rit-1" and "Rift-2"



Submersibles "Rift" are 15-ton, three-man submersibles capable to operate at depth approaching 4 km (all devices and units are designed for 6 km although crew sphere was certificated for 4 km). Submersibles "Rift" are intended primarily to carry out scientific research, works with research drilling ship (she was not completed too), underwater inspection, search and recovery etc.

All structures of "Rift" were produced from Ti alloys.
Two submersibles "Rift-1" and "Rift-2" are being built simultaneously.

"Rift" also can be used as tourist vehicles for extremal tourism for example on black smokers or other deepwater objects.

Rift-1 and Rift-2.
Manned hulls on frames.
Rift-1 at a stage of assembly.

Main Technical Data:

Operational depth, m	4000
Weight in air, ton	15
Length, m	7
Width, m	3.7
Height, m	3.7
Cruising speed, knots, approx.	3
Life support endurance, man-hours	246
Battery capacity, kWh	57
Payload capacity (4000 m), kg	50

Manned Underwater Vehicles "Mir" (Mir-1 & Mir-2)

Manned Underwater Vehicles "Mir" (Mir-1 & Mir-2), three-man submersibles, with operating depth up to 6000 m. (participation in design, construction, trial, sea operation, modernization and upgrading and development scientific equipment).

Shore research and training hyperbaric diving complex GKK-DP-450

Shore research and training hyperbaric diving complex GKK-DP-450 for short or saturated simulating dives (more than two months) up to 450 m depth (design, construction, trial and operation).

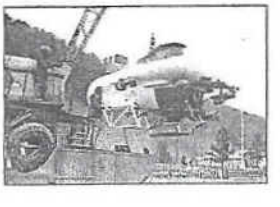
Underwater Laboratory Chernomor-1, Chernomor-2, Chernomor-300

Underwater Laboratory Chernomor-1 and Chernomor-2 for real saturated dives (design, construction, trial and sea operation).
Underwater Laboratory Chernomor-300 for real saturated dives (design and particular construction; project was interrupted).

Underwater Complex for ORV Vityaz

Underwater Complex for ORV Vityaz, which including Deck Diving Complex for short or saturated dives up to 250 m, manned submersibles with supporting equipment and different types of towing bodies (preliminary design, supervision on construction, trial and sea operation).

Manned Underwater Vehicles "Pisces"

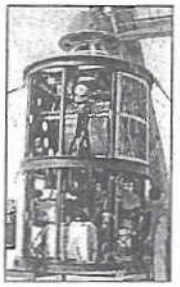


Manned Underwater Vehicles "Pisces" (Pisces-VII & Pisces - XI), three-man submersibles, with operating depth up to 2000 m. (participation in trial, sea operation, modernization and upgrading and development scientific equipment).

Tourist submersible Angara

Tourist submersible Angara, eight-man submersibles, with operating depth up to 600 m. (design and particular construction; project was interrupted).

Remotely Operated Vehicle ROSUB-6000



Remotely Operated Vehicle. Complex of multi-purpose deep-water long-distance underwater device of working class ROSUB-6000.

Specifications:
Operration depth - 6000 m
Dimensions - 2,53 x 1,8 x 1,5 m
Weight - 3080 kg in air (- 20 kg in water)
Payload - 150 kg
Propulsion system - 7 electrical thrusters (2 mid-flight, 2 lag, 3 vertical)
Power supply - 6,6 kV (three-phase), 460 Hz
Cameras - 5 pcs.: 2 color, 1 B&W, 2 mini-cams. on manipulators
Manipulators - 2 pcs.: 7 degrees of freedom and maximum payload 150 kg 5 degrees of freedom and maximum payload 450 kg
Lights - 6 lamps (led and halogen)
Speed, up to - 2,5 knots (forth), 2,0 knots (back), 2,0 knots (lag) 1,5 knots (vertical up & down)
Number of channels for data and video transmission - 12 (through 2 single-mode optical fibers)

More info

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TAB 5.F

RON'S ROV LINKS

Category : ROV news

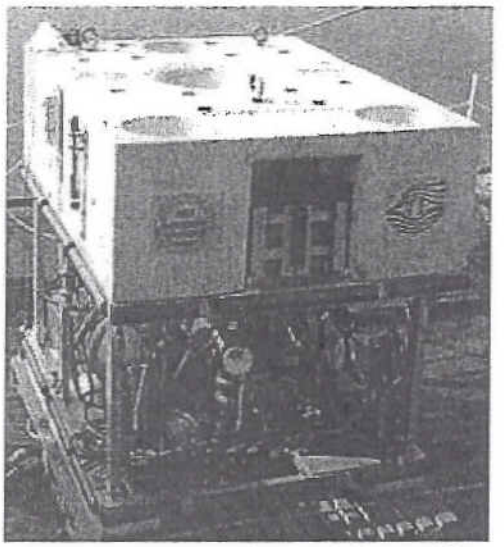
Published on 04 May 2010

Indigenous ROSUB 6000 expedition puts India in elite league

India has joined an elite league of nations like US, Japan and China in deep sea mining with the successful completion of the Remotely Operable Submersible with 6000-m depth capacity vehicle (ROSUB 6000) expedition at the Central Indian Ocean Basin from onboard ocean research vessel *Sagar Nidhi* on April 17.
The Remotely Operable Vehicle (ROV) also returned with rock nodules of manganese, much to the delight of the scientists working on the project. An Indian flag was also dropped down into the seabed at a depth of 5,289 m, using Sagar Nidhi.

"India has deep sea mining rights in 75,000 sq km of area in the Central Indian, Ocean about 2,500 km from the tip of Kanyakumari.

The ROV reached a depth of 5,289 m below sea at a pressure of 600 times more than the normal atmospheric pressure and successfully completed its expedition," Union Minister of State for Earth Sciences Prithviraj Chavan told reporters at the National Institute of Ocean Technology (NIOT) at suburban Pallikarani.



After preliminary preparations, the expedition left Mangalore on April 1 and reached the polymetallic nodule site in the Central Indian Ocean Basin on April 12.

"The ROV was retrieved after some electrical problems were detected during the first trial on April 14. It was redeployed on April 17 at the same location and reached a depth of 5,289 m," Mr Chavan said.

"India now joins US, Japan and China as some of the few nations in the world to have achieved such a deep sea mapping objective," he added.

Mr Chavan said: "We have to analyse the data collected from this expedition. This is a very futuristic programme and can go a long way in mitigating shortage of natural resources like manganese, cobalt, nickel and natural gases." He said the main objective of the expedition was to map the sea bed through a remote process. "We can now carry out more such expeditions with the help of the reusable ROV."

With deep sea mining being a relatively new area of scientific exploration of resources in the seabed, other countries do not share data or information.

In this context, the Indian expedition was planned and executed indigenously.

"Only the ROV was developed by NIOT in association with Russia's Experimental Design Bureau and Oceanological Engineering (EDBOE).

The research and development based on the success of the ROV expedition can assist in a vast spectrum of activities, including studying climate change and discovering new drugs," the Minister

informed.

The NIOT-EDBOE team took four years to evolve the reusable ROV that could penetrate the depths of deep sea and was capable of reaching down to 6,000 m.

The ROV used multi-beam sonar to study the depths of the sea.

"Plants survive under adverse conditions with the help of certain bio-compounds. If we can separate the bio-compounds from deep sea plant life, we can perhaps look out for medicines to cure cancer and diabetes, akin to preparing medicines from snake poison," Secretary in the ministry of Earth Sciences Shailesh Nayak, who was also present, said.

The scientists also conducted an experiment of dropping a paper cup at that depth. Due to the intense pressure of the deep sea, the paper cup was compressed to nearly one-fifth of its original size.

The ongoing deep sea project has been taken up at a cost of Rs 25 to Rs 30 crore.

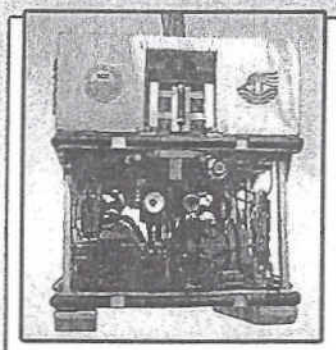
"However, once we harvest the fruits of our hard work in deep sea mining, the costs will be reduced," Mr Nayak added.

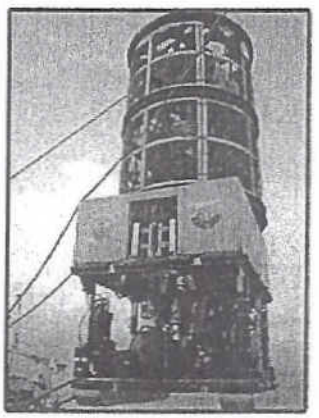
http://www.ronsrovlinks.nl

TAB 5.G

Russian Academy of Sciences

Experimental Design Bureau of Oceanological Engineering





Multipurpose deep water remotely operated vehicle ROSUB-6000

Oriented for research and engineering survey at depth up to 6000 m remotely operated from shipboard. Structure: remotely operated vehicle, Top-hat, Tether Management System (TMS) with 400 m rope, onboard system.

Specifications:

Operating depth	-	6000 m
Dimensions	-	2,53 x 1,8 x 1,5 m
Weight	-	3080 kg in air (- 20 kg in water)
Payload	-	150 kg
Propulsion system	-	7 electrical thrusters (2 mid-flight, 2 lag, 3 vertical)
Power supply	-	6,6 kV (three-phase), 460 Hz
Cameras	-	5 pcs.: 2 color, 1 B&W, 2 mini-cams. on manipulators
Manipulators	-	2 pcs.: 7 degrees of freedom and maximum payload 150 kg 5 degrees of freedom and maximum payload 450 kg
Lights	-	6 lamps (led and halogen)
Speed, up to	-	2,5 knots (forth), 2,0 knots (back), 2,0 knots (lag) 1,5 knots (vertical up & down)
Number of optical fibers for data and video transmission	-	12 (now used only 2)

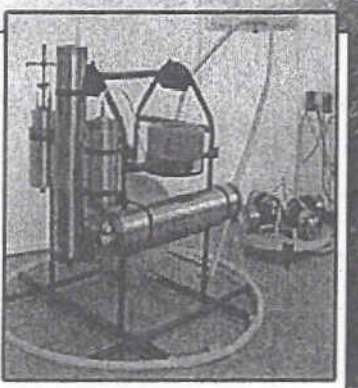
High-precision navigation system:

- Inertial navigation system
- Hydroacoustic navigation system
- Doppler velocity log
- Depth sensor
- Sound velocity probe
- Multibeam echosounder with forward looking and bottom-looking sonar regimes

Developed in collaboration with National Institute of Ocean Technology, Chennai, India

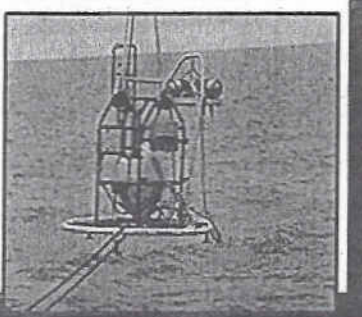
Ocean bottom geophysical observatory (OBO)

Oriented for investigations of geophysical and geochemical processes in bottom layer of World Ocean, continental shelf and internal water basins. It can be applied for integrated investigations of natural and man-made ecological disaster in open sea and offshore zones as well as for long-time monitoring. Data can be stored inside of the observatory during operating in autonomous regime (up to several months period) or can be transmitted through deep water cable to the costal Center of data storage and summarizing in real-time.



Composition:

- 3D seismometer
- Seismo-acoustic hydrophone
- Current meter & CTD
- Magnetometer
- Radioactivity spectrometer
- Acoustic-optical spectrometer
- Support mooring station
- Hydroacoustic & cable communication subsystems
- Vessel and shore base data collecting and processing subsystems
- Shipboard hydroacoustic communication subsystem



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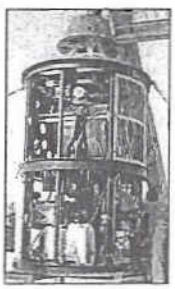
Russian Academy of Sciences
Experimental Design Bureau of
Oceanological Engineering

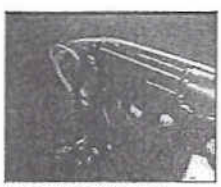
Remotely Operated Vehicle. Complex of multi-purpose deep-water long-distance underwater device of working class ROSUB-6000.



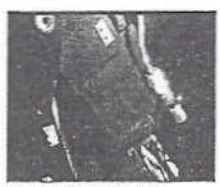
Specifications:
Operration depth - 6000 m
Dimensions - 2,53 x 1,8 x 1,5 m
Weight - 3080 kg in air (- 20 kg in water)
Payload - 150 kg
Propulsion system - 7 electrical thrusters (2 mid-flight, 2 lag, 3 vertical)
Power supply - 6,6 kV (three-phase), 460 Hz
Cameras - 5 pcs.: 2 color, 1 B&W, 2 mini-cams. on manipulators
Manipulators - 2 pcs.: 7 degrees of freedom and maximum payload 150 kg 5 degrees of freedom and maximum payload 450 kg
Lights - 6 lamps (led and halogen)
Speed, up to - 2,5 knots (forth), 2,0 knots (back), 2,0 knots (lag) 1,5 knots (vertical up & down)
Number of channels for data and video transmission - 12 (through 2 single-mode optical fibers)
High-precision navigation system:
* Inertial navigation system
* Hydroacoustic navigation system
* Doppler velocity log
* Depth sensor
* Sound velocity probe
* Multibeam echosounder with forward looking and bottom-looking sonar regimes

Data acquisition and control system
Data acquisition and control system has been built using the Virtual Instrumentation of National Instruments LabVIEW. LabVIEW PXI-8186 RT Controller and Compact Field Point real-time system enable us to build the application in most effective manner. Compact Field Point system is compact, rugged and reliable.

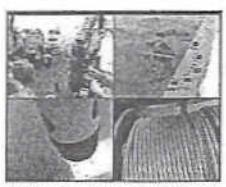
Software
- System consists of 3 industrial computers, PXI controller, TMS controller and ROV controller. They are networked through TCP/IP.
- Entire test results – data, events and errors that will give a detailed description of the current status in the user interface screens and as log files.
- These files are stored at real-time controllers if link is failed, hence there is no data loss.
- Redundant RS-485 serial link establishment if failure in ROV or TMS.
- Selectable video channels from ROV and TMS to view in three plasma screens.
- Redundant control of ROV by Pilot/Co-pilot.
- Interlocks and alarm sound for critical operation.



Manipulators 7 function



Manipulators 5 function



Multiscreen mode on the board of the pilot.
Above the image from deck videocameras, below - from chambers of garage: preparation for joining.

Control panel

Archive

Articles, documents

Awards

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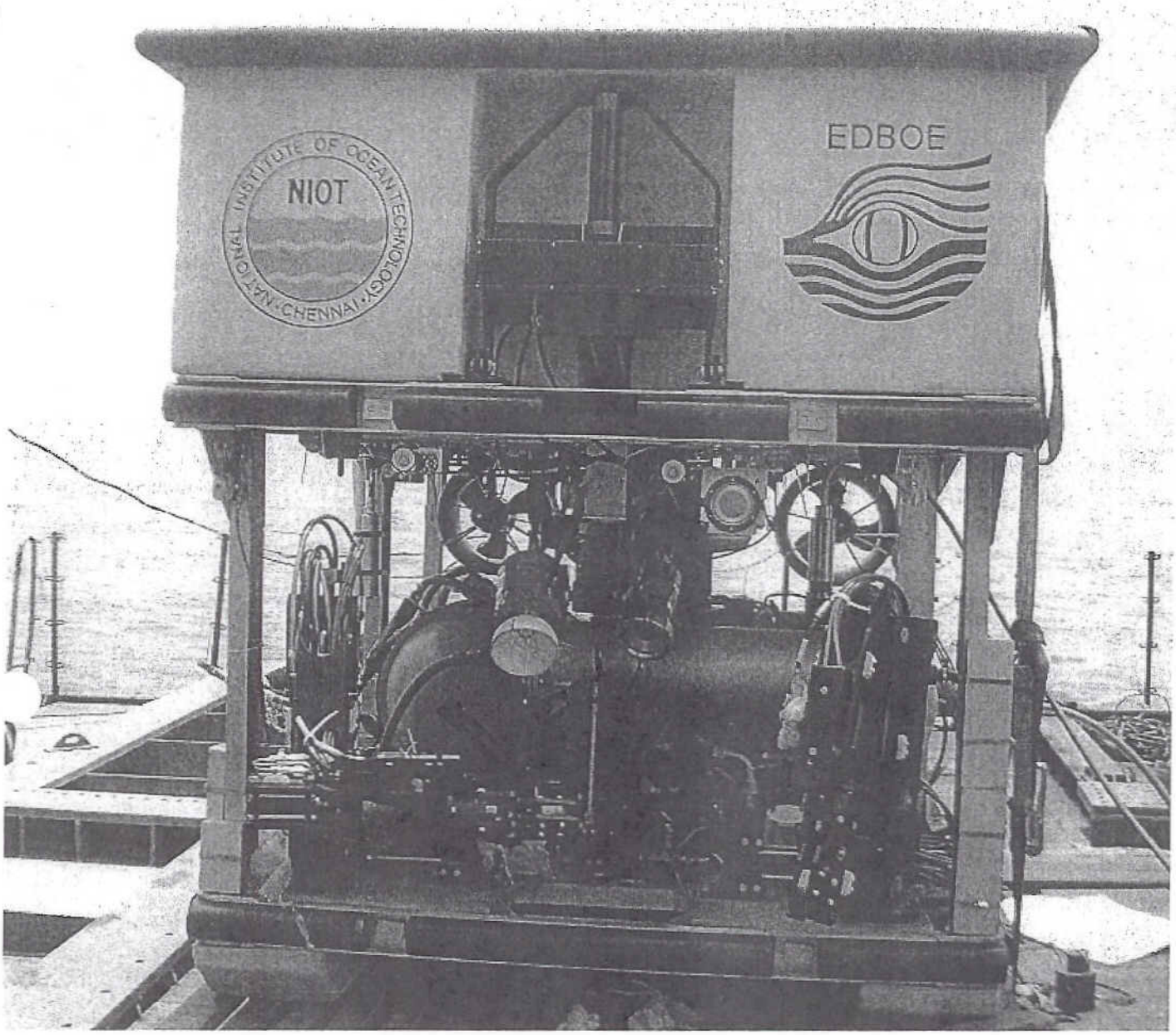
TAB 5.H


NIOT
NATIONAL INSTITUTE OF OCEAN TECHNOLOGY · CHENNAI ·
EDBOE

TAB 5.I

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY

(An Autonomous Body under Ministry of Earth Sciences, Govt. of India)

The Technology for harnessing the wealth of Ocean begins here...

Photo Gallery of the group Submersibles

Deck View	**LARS**	**LARS at Ship Sagar Nidhi**	**Powerhouse Container**
ROV Trail-2007	**TMS wet Test**	**TMS_ROV Launching**	**Trail at Nagarjuna Sagar**
Transponder			
1			

[Photo Gallery] [Back]

TAB 5.J

Technology Projects > Submersibles > Performance

Achievements

- Infrastructure and capacity building
- Design and development for ROSUB 6000
- Qualification of Integrated Navigation System (USBL, LBL, INS)
- Integrated test of Tether Management System and ROV at in-house facility in ATF
- ROSUB sea trial
  - ROV Phase I and II testing at Ennore Port, Chennai during June - Aug 2006
  - First, system functionality sea trial at depth of 205m off Mangalore during Oct 2006
  - Second, system functionality sea trial with Integrated Navigation System off Chennai during June-July 2007(~3000m)
  - Shallow water lake trial at Nagarjuna Sagar Dam during September 2007 (60m)
- Land based trials of Launching And Recovery System (LARS) for ROSUB □ Jan 2008
- Commissioning and testing of LARS onboard SAGAR NIDHI □ June 2008
- First deep water sea trial of ROSUB system
  - ROV and TMS functionality tested at depth of 1144m off Chennai during September 2008.
  - Functionality of sub sea power converter, data telemetry system, Thruster Controllers, Control software for ROV and TMS. All under water components are tested its envisaged functionality including ROV Navigation using thrusters and control joysticks, manipulators, underwater luminaries, cameras, scientific sensors, etc,.
  - ROV is detached from TMS at 1100m and then ROV maneuvered in six degree of freedom up to 1144m depth and docked back to TMS.
- Second deep water sea trial of ROSUB system □ Off Chennai on April 2009
  - Two dives carried out at off Chennai (2200m) and acquired sea bed videos with scientific pay loads (Oxygen, conductivity, temperature, water samples, short core samples, etc.)
  - Two dives carried out (~3045m depth)
- KG basin Exploration Sea trial □ Off Kakinada on October 2009
  - Two dives carried out at KG basin site (1017m and 1037m) and acquired sea bed videos with scientific pay loads (Multibeam, oxygen, conductivity, temperature, water samples, short core samples, etc.).
  - One dive carried at 3057m depth.

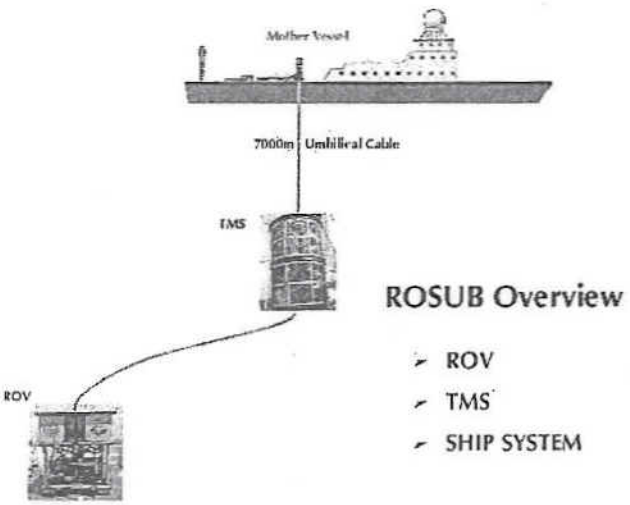
TAB 5.K

Technology Projects > Submersibles > Activities

Mandate :

- Design and Development of 6000 m depth rated deep water Work class Remotely Operated Vehicle (ROSUB 6000)
- Exploratory survey and support for the deep sea manganese nodule mining from Indian Ocean (~ 5200m)
- Exploration survey at Gas Hydrates site (< 2500m)
- Design and Development of shallow water work class Remotely Operated Vehicle

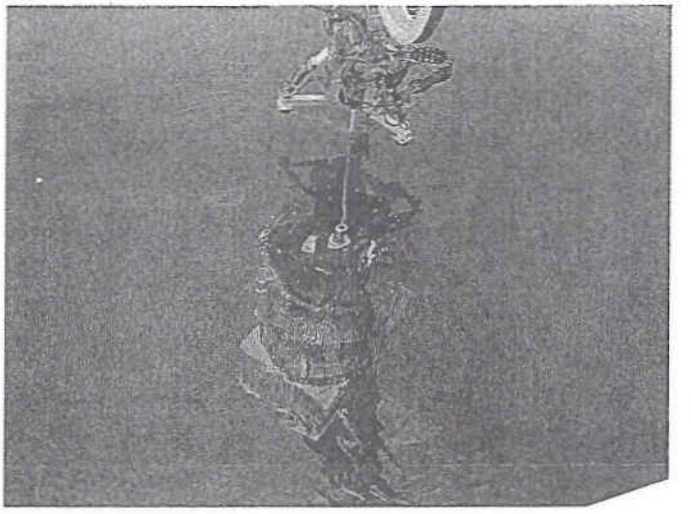
ROV Specification



Diving depth	6000 m
Length	2.5 m
Width, height	1.8 m and 2.0 m
Weight	3700 kg
Mechanical structure	Aluminum alloy
Flotation	Syntactic foams
Payload	up to 150 kg
Propulsion	Seven Electrical thrusters
Power	6.6 kV, 460 Hz, 3 Phase

Control	• National Instruments Real-Time Technology (Hardware & Software)
	• Single mode Fibre optic data and Video transmission system
	• ROV Mode of operation
	  • Manual Mode
	  • Semi Auto Mode

Cameras	3 Nos. and 2 Nos (Manipulator mounted with colour cameras)
Lights	7 Lamps (LED, HID & Halogen Lamps)
Manipulators	7 function and 5 function - each one
Speed of movement	2 knots
Navigational equipment	• Doppler Velocity Log • PHINS • Depth sensor • Hydro-acoustic navigation system (LBL and USBL) • Sound velocity probe
Multi beam Sonar	• Forward looking imaging sonar • Bottom looking sonar



Collaboration

- ROSUB 6000 has been developed in collaboration with Experimental Design Bureau of Oceanological Engineering (EDBOE) of Russian Academy of Sciences (RAS), Moscow, Russia.

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TAB 5.L

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY

(An Autonomous Body under Ministry of Earth Sciences, Govt. of India)

The Technology for harnessing the wealth of Ocean begins here...

Technology Projects > Submersibles > Future Vision

1. 1.Development of 4000m depth rated Manned Submersible
2. 2.Remotely Operable Vehicle for Shallow water application.
3. 3.Polar ROV

TAB 6.A

PRODUCTS FOR COMMERCIALISATION

1 Bio Aqua Plus Bio St

CIF- Songket

Development of Cyst From Marine Harpacticoid Copepods

Pre-Commercialization of SATRIA 102 Malaysia Work Class Remotely Operated Vehicle (ROV)

Metadata

Related

OceanMIX

R & D PRODUCTS / OUTCOMES

Institution	SUBSEA Explore Services (M) Sdn. Bhd
Project Title	Pre-Commercialization of SATRIA 102 Malaysia Work Class Remotely Operated Vehicle (ROV)
Project Leader	Zainal Abidin Bin Mohd Noor
Name of Products / Outcomes (please provide image)	Remotely Operated Vehicle (ROV)
Brief Description (products/outcomes application)	It is an underwater Robot that allows the vehicle Pilot (Operator) to remain in a safe atmosphere while the ROV with the capability to perform works in sub-sea/underwater hazardous environment beyond diver depth.
Awards/Certificates	AA certified company under 1-innoCERT (Innovation Certification for Enterprise Rating and Transformation) rating 2010. Best Innovation Award in Manufacturing Sector 2010, Organized by SME Corporation Berhad
Patent Status (country filed)	Pending application
Industry Link (if any)	Closely link with Oil and Gas industry
Gross Sale (if any)	
	- We are now at the stage Pre-Commercialization of "SATRIA 102" Malaysia Work Class Remotely Operated Vehicle (ROV) - Our ROV is still on development progress and we get the funding from MOSTI Techno fund. - We are doing research to developer this ROV to make sure this project will be successful for commercialization.

Commercialization Status	- ROV market is very niche, specialize, unique and exclusive in nature. - Due to its niche and specialization, Subsea has been regularly request to participate in Invitation to Bid (ITB) and Request for Quotation (RFQ) - Subsea has local and International market projection and is also actively involve on sales promotion by taking part in local and international exhibition. - ROV technology is considered as matured technology with low volume product but high added value. - Oil and Gas industry, the major economic resources of the world is the pillar clientele.
Contact Address Phone number E-mail Fax number	Address: Lot 20 Jalan PJU 3/39, SME Bank Factory Complex, Sunway Damansara, 47810 Petaling Jaya, Selangor Phone number: 03-78858700 Fax number: 03-78859700 E-mail: ses@subsearov.com

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TAB 6.B

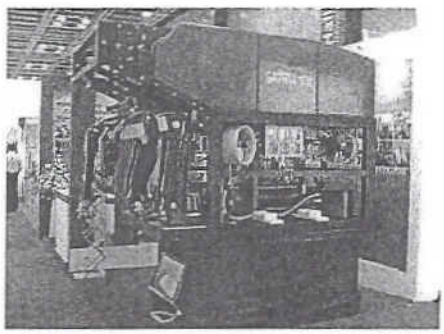
SUBSEA EXPLORE SERVICES

Welcome :: Selamat Datang

Subsea Explore Services (M) Sdn Bhd

pleased to offer a full pledge ROV solutions :

- Oil and Gas Industry
- Pipeline Inspection and Installation
- Oil Rig Surveillance and Inspection
- Drilling Support
- Construction Support
- Search and Rescue Operation
- Underwater Cable Industries
- Military Application
- Other related underwater operation



With a highly motivated, experienced and well qualified professionals via optimal combination of our own ROV Units as well as technical, entreprenuerial and managerial skills embodied in our management team and personnel - delivering the best services is attainable.

IMCA *International Marine Contractors Association Member*

MAIN MENU

- Home
- Company Profile
- Service & Equipment
- Projects
- Contact Us

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SME Bank Factory Complex,
Sunway Damansara,
47810 Petaling Jaya,
Selangor
Tel +603 7885 8700
Fax +603 7885 9700
Email: ses(at)subsearov.com

Our Location (Malaysia)

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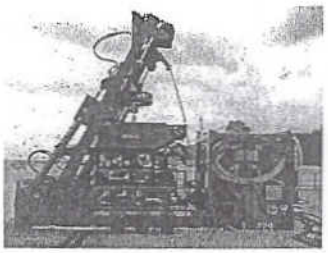
TAB 6.C

SUBSEA EXPLORE SERVICES

Our Equipments

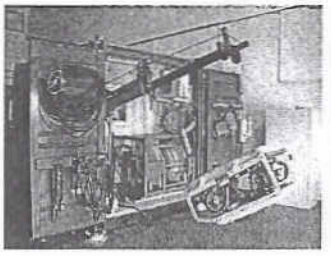
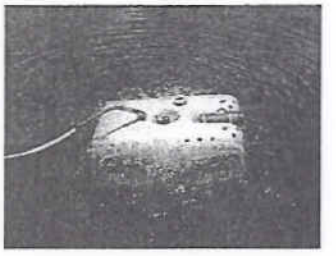
SATRIA 101 WORK CLASS ROV



Type	-	125 HP Survey / Work Class
Depth Ratings	-	1500 Metres, 140Kg Payload
Dimension	-	2500mm (L) x 1300mm(W) x 1600mm(H)
Propulsion System	-	6 Curvetech 300mm diameter 10kw/13.5Hp
		Vectored Thrusters individually servo valve controlled
Standard Power Pack	-	75KW / 125HP 3 Phase 4 Pole, 2.5KV motor
		Oil filled and compensated. Bosch Rexroth PD
		Pump, output 140 lpm @ 200bar
Video & Telemetry	-	Fiber Optic and Copper Coax
Lighting	-	1.25Kw from 5 x 250watt dimmer channel
		250 or 500 watt 2500m rated lights
Control & Navigation	-	Intelligence Gyro Compass, Tritech Seaking Sonar,
		Depth Transducer System, Head & Depth Auto Functions
Standard Components	-	2 x 7 Function Rate Manipulator, 10 Station Solenoid
		Valve Pack Toolings Manifold, Servo Valve, SES
		Hydraulic Pan and Tilt, Colour and Monochrome Camera
Umbilical	-	Standard Aramid Armoured 38mm
Vehicle Instruments	-	Control Panel System
		Fiber optic video and telemetry transmission system
		Focal Single Mode Video/Data Transmission System
		8 Video + 16 Data Channels
		DVD Recorder System
Vehicle status sensors	-	Hydraulic pressure and temperatures
		Hydraulic reservoir oil level
		Motor temperature, Motor oil compensation level,

		Voltage and current
Alarm sensors	-	Water ingress alarm, Compensation alarm, Telemetry status, Fiber optic link status, Gyro failure alarm, Vehicle turns alarm, LIM alarms, ROV voltage and current alarms
Control Container	-	Length 6058mm, Width 2438mm, Height 2591mm, Shipping Weight 10000kgs
Workshop	-	Length 6058mm, Width 2438mm, Height 2591mm Shipping Weight 8000kgs
Launch and Recovery System	-	Telescopic A-Frame System Length 5580mm, Width 3120mm, Height 2550mm, Height Operational 6550mm, Shipping Weight 10000kgs
Work Capabilities	-	Drill Support Construction Support Cable and Pipeline Pre and Post Lay Survey Platform Inspection Jacket Inspection Special Toolings Pipe Lay Barge Support Salvage and Oceanographic Survey Search and Rescue Operation

OBSERVATION CLASS ROV

Depth Ratings	-	300 Metres Maximum 450 Metres Low Drag Umbilical
Thrusters	-	Brushless DC, 4 Vectored and 1 Vertical
Camera	-	High Resolution Colour Camera on 180° Tilt Platform
Light	-	Variable Intensity 150 Watts of Lighting
Control and Navigation	-	Auto Heading, Depth and Rate Gyro Sonar Tracking with Distributed Intelligence System Integral Diagnostic Control System Portable Surface Control System
Power	-	Single Phase A/C Power Input - 100-270 VAC at 2.8 Kw
Manipulator	-	5 Function and Hand Control Unit
Control Van / Workshop	-	Integrated 10 Footer Air Condition Container Portable Junction Box Video Suite and Console Panel
LARS	-	Compact Launching Crane carry with Docking Device Umbilical Sheave Wheel including Hydraulic Latch

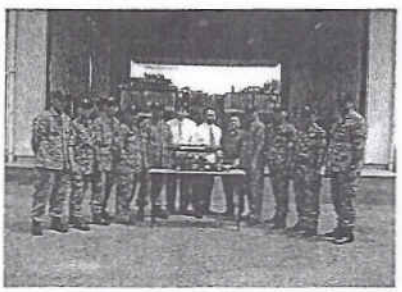
TAB 6.D

SUBSEA EXPLORE SERVICES

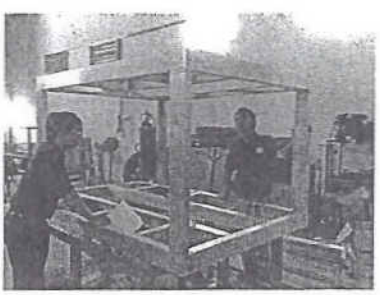
Our Services

- ***ROV Technical Sales and Services***
- ***ROV Manufacturing and Rental Provision***
- ***ROV Consultancy & Advisory Services***
- ***Provision of High Caliber ROV Operating Personnel***
- ***ROV Maintenance, Repair and Calibration Set-up***
- ***ROV Constructions and Inspections Work***
- ***ROV Technical and Piloting Training***

ROV Technical and Piloting Training



ROV Manufacturing



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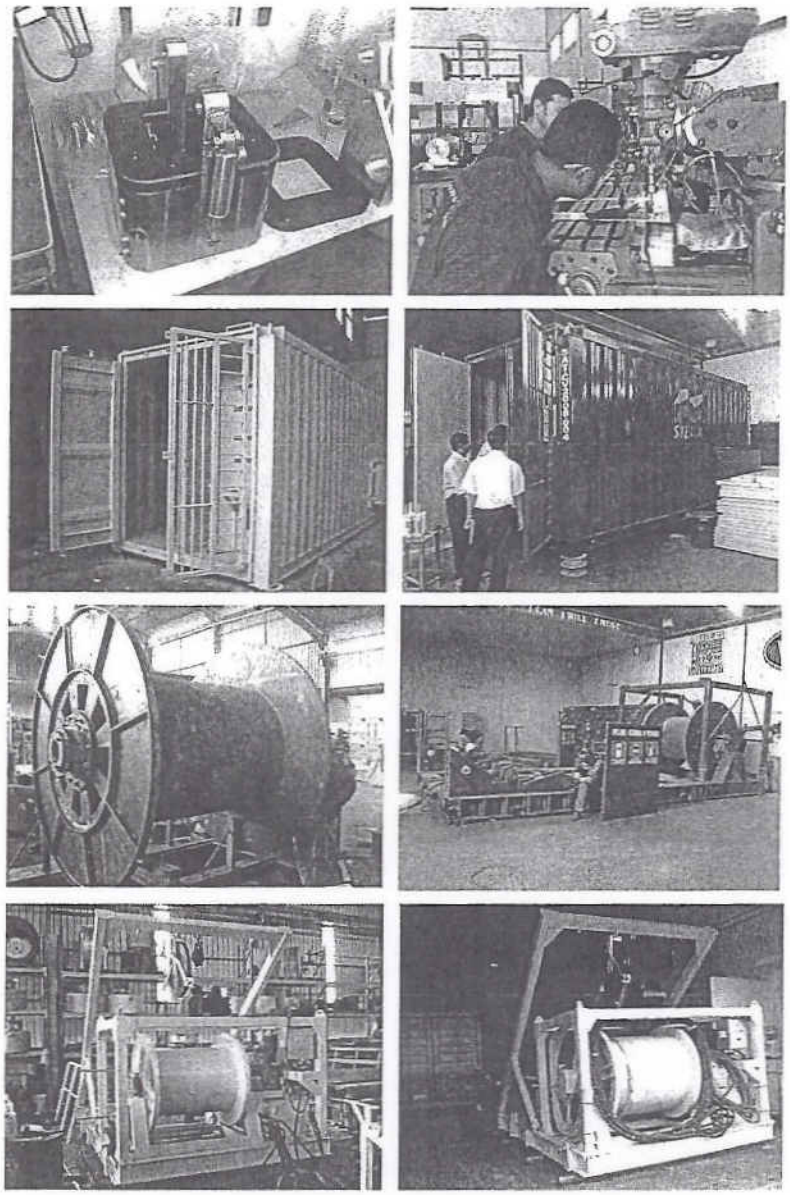
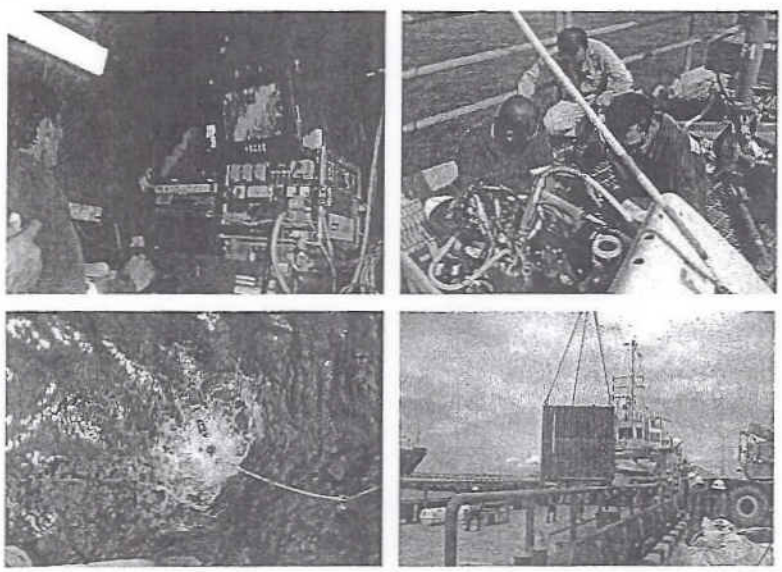
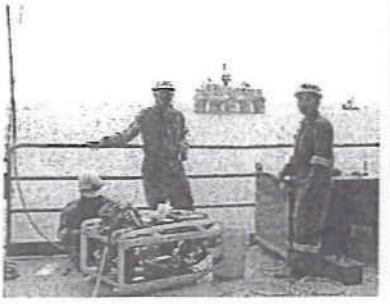
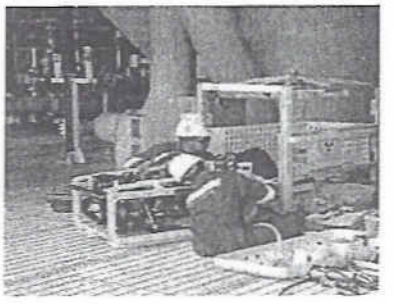


Subsea Construction and Inspection Works







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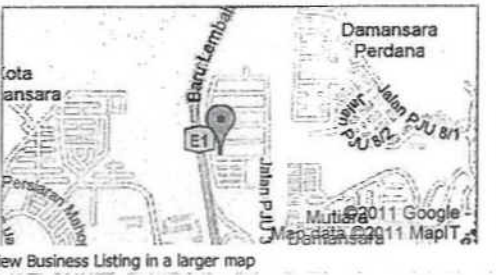
Our Location (Malaysia)



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TAB 6.E

1-InnoCERT

1-INNOVATION CERTIFICATION FOR ENTRPRISE RATING & TRANSFORMATION (1-INNOCERT)

The National Innovation Council (NIC) under MOSTI chaired by YB Prime Minister has formulated the National Innovation Agenda (NIA), aimed to establish the National Innovation Led Economy to achieve Market-Driven and Technology Driven Innovation for Wealth Creation and Societal Well Being.

The council also established the Jawatankuasa Tindakan Penyelarasan Inovasi Negara (JTPIN) where SME Corp. Malaysia has been entrusted to lead a sub-committee under the JTPIN namely, Innovation for SMEs Committee.

In view of the demands for a new breed of SMEs that can help drive market-driven and technology-driven innovation a study visit has been carried out by Malaysian Industry-Government Group for High Technology (MIGHT), MITI and SME Corp Malaysia to Korea, to learn their best practices in developing innovative SMEs.

In Korea, the criteria and mechanism for 1-InnoCERT is based on 2 levels of assessment; on-line assessment and site visit evaluation by experts. The scheme implemented in Korea has since been adopted, and fine tuned to suit with the Malaysian companies. Four main parameters evaluated in the 1-InnoCERT are:

- Technology Innovation Ability;
- Technology Commercialization Ability;
- Technology Innovation Management Ability; and
- Technology Innovation Result.

It was hoped that through the 1-InnoCERT Certification; companies could be;

- Provided fiscal incentives and encourage greater participation in high risk venture;
- Launch Fast Track Programme (FTP) for 1-InnoCERT companies;
- Establish angel network; and
- Programme as benefits for the 1-InnoCERT companies.

In recognition of these Innovative Companies, SME Corp. Malaysia organized the SME Innovation Award 2010 in conjunction with SMIDEX 2010. Through the process 65 SMEs were deemed to be 1-InnoCERT-fied SMEs and there were 6 award winners based on their sectors. They are:

- The Top Winner Of The SME Innovation Award And SME Innovation Award In Design 2010 - IC Microsystems Sdn Bhd
- SME Innovation Award In Green Technology and Energy Efficiency 201 - Device Semiconductor Sdn Bhd
- SME Innovation Award In Halal 2010 - Nutrivention Sdn Bhd
- SME Innovation Award In The Services Sector 2010- Romstar Sdn Bhd
- SME Innovation Award In Agriculture and Biotechnology 2010 - TT Biotechnologies Sdn Bhd
- SME Innovation Award In The Manufacturing Sector 2010 - Subsea Explore Services (M) Sdn Bhd

In response to YAB Prime Minister's visit to SMIDEX 2010; YAB Prime Minister announced during a cabinet meeting that a special council be set up and will be chaired by YB MITI Minister and YB MOF II Minister to prepare the "Green Lane Policy" to assist 1-InnoCERT companies and added that all GLCs should assist these 1-InnoCERT companies.

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TAB 7.A

UK edition Switch to US edition

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Manufacturer

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Autodesk

Soil Machine Dynamics, Delivering through dynamism

Manufacturing in Action, Source : The Manufacturer
Published : September 2008

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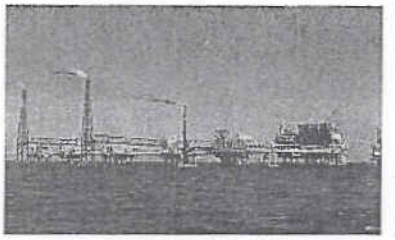
Soil Machine Dynamics has established itself as a world class manufacturer in the subsea engineering field. Continuous product development and a solid skills base are contributing towards a centre of excellence on the banks of the River Tyne



Founded in 1971, Soil Machine Dynamics (SMD) is a leading manufacturer of remotely operated submersible vehicles and marine surface equipment. Based in Tyne and Wear, the company fronts the River Tyne and, along with its own quay, boasts excellent sea, rail and road links, making its products and facilities easily accessible for a global and growing customer base ·ch spans a wide range of industries.

·e company currently has a total of 300 subsea machines and 200 pieces of deck equipment employed globally. Specific products include remotely operated underwater vehicles (ROVs), which are widely used by market leaders in the offshore oil and gas industry; other SMD products designed for this field include ploughs, tractors and towed jetters. Also a supplier to the telecoms industry, the company manufactures cable ploughs used by cable installers worldwide to protect underwater fibre optic cables, with over 100,000 kilometres having been buried this way to date. SMD work class ROVs are used by navies for rescue and salvage operations and, specifically within the scientific exploration industry, the company's Q-series work class ROV systems are used for deep water survey and observation work.

The company also supplies machines for the mining of minerals and diamonds and for use during wreck salvage operations. Cable protection products are manufactured for offshore wind farms, and a free stream tidal generator – TIDEL – is also under development. The company itself puts a strong emphasis on its own environmental policies; an area consistently under review and development.

A major contributing factor to the company's success thus far has been its engineers' proficiency and depth of skill across multiple disciplines, enabling it to maintain high standards in areas of design, production and customer service. Around half of the company's employees are qualified engineering graduates – a level of expertise supported by SMD's modern design software and extensive office facilities. Having the ability to attract strong talent to its operations is clearly a priority, and as such, a comprehensive benefits system is in place which includes bonuses, health insurance and flexible working options, in addition to competitive salaries. The company also prides itself in having low levels of bureaucracy and an informal but industrious working environment, which it views as crucial to retention and to maintaining high levels of productivity and efficiency.

A considered approach to both its employees and its products has clearly paid dividends – SMD can count among its clients such prestigious names as Subsea 7, AT&T, QinetiQ, the Ministry of Defence and the US Navy. Client care is a major component of the company's approach to maintaining its position in the market, and to facilitate this, it has built up a large team of highly skilled and highly trained technicians who make up the SMD Offshore Services (SOS) arm of its personnel. SOS is able to work across the breadth of SMD's product range and, in addition, a team of contractors is readily available to meet any ·requirements that the company and its client base may have. Services offered by these teams de emergency call-outs, site installation and on-site maintenance, as well as a 24-hour hotline to service engineers and spares staff, which customers can rely on if they need to resolve technical questions or submit spares requests.

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The company's drive to continuous improvement is also enhanced by its on-site training facilities. It has developed a Dri-ROV simulator specifically designed to simulate its entire range of ROVs, alongside a for audience viewing and full maintenance training resources. The facility is managed and run by a ROV training manager, and underscores SMD's commitment to providing a comprehensive service that extends beyond manufacturing.

Constantly looking to enhance its facilities, SMD opened new offices on its current site in April this year – the result of an investment totalling £1.75 million. Intended to assist the company in maintaining its reputation as a world class facility, the offices have been constructed at the same time as other improvements taking place along the banks of the River Tyne. Managing director of SMD John Reece said of the new development: "It has been a long-standing ambition of mine to house all of our 135 employees on a single site. We have a wonderful, well-equipped campus with room for further expansion. In total we have invested £2.75 million re-developing the Turbinia site. As well as the new main office we have improved the main assembly hall and added a new stores building, a new client and production office, a new canteen and support services office, a modern training facility with simulator and new wet test facility. This forms an important part of the general redevelopment of the banks of the Tyne to become a centre of excellence for subsea and marine technology."

Looking further afield, SMD was awarded its third supply contract to China in May, to supply a work class ROV for China Shipbuilding and Offshore International Company (CSOC) – clearly demonstrating that it is well equipped to operate in emerging markets. Sales director Mike Jones said of the deal: "We are delighted with this contract award. This will be the third ROV system we have supplied to China and it maintains our leadership in this marketplace. We will be working closely with our Chinese representative, Bluewhale, to build key parts of the system in China." Bluewhale Offshore Engineering Technology Company provides sales and equipment support for SMD deals in China, enabling it to deliver consistency in customer service throughout its global operations. CSOC is part of China's largest shipbuilding company, and the contract represents a strong move forward into the market for SMD.

A little closer to home, the company was also awarded a contract in March this year by the Marine Institute of Ireland. The deal, worth £2 million, is to supply equipment primarily for scientific purposes, but which can also be used by the navy, coastguard and for commercial purposes. SMD sales manager Mark Collins said of the agreement: "We are very pleased to be awarded this contract. This multifunctional, flexible system will be a key tool in the Marine Institute's armoury to achieve their goals of a thriving maritime economy in harmony with the ecosystem."

ompany was able to further cement its position in the global marketplace in February 2008, when it played host to the UK Trade and Investment international delegation, who were visiting the UK for the Subsea 2008 exhibition and conference in Aberdeen. Major industry leaders within the oil and gas sector from countries such as Brazil, the United States and India visited SMD and were thus afforded valuable insight into the company's breadth of skills and expertise. Graeme Slaven, who was the UKTI host for the delegation, said of the visit: "This is a fantastic opportunity to showcase the best of the UK oil and gas industry. We are very fortunate to visit SMD during their production of the world's largest ROV. The sheer scale of the equipment has impressed all of our visitors." The visit enabled SMD to showcase its skills and facilities to the world, as well as underlining the UK's position as a major player in this arena.

SMD is also due to supply its latest multi-depth three metre plough to NTT WEM in Japan later this year, to be installed on their cable lay vessel. The deal is taking place 10 years after SMD supplied its original model to the same company – illustrating its long-term capabilities and strong customer service delivery through its ability to retain key customers over many years. The plough's innovative design allows fibre optic cables to be laid to a depth of three metres, protecting them from activities such as deep sea fishing.

With a turnover currently in the region of £40 million, the company has clearly found a firm foothold in the subsea engineering market and looks set to expand in the coming years due to a rapid rise in demand for its products and expertise. One major project currently underway is the supply of two seafloor mining tools to Nautilus Minerals, a contract worth £30 million. Design will take place at the company's Tyne and Wear site before mining operations commence in south east Asia in 2010.

Further substantial growth plans are in place for SMD until 2012 and beyond, which will doubtless see the company further solidify its position as a world class supplier to leading subsea companies across the globe.

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Soil Machine Dynamics, Digging your scene

Manufacturing in Action, Source : The Manufacturer
Published : November 2010

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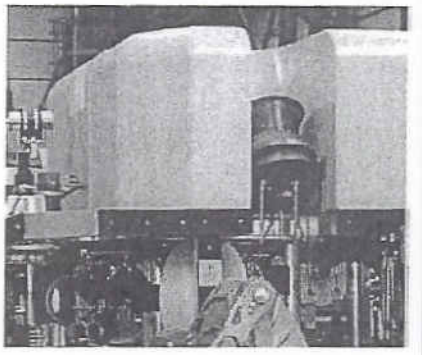
Felled by the dotcom bust, where its telecoms customers evaporated, subsea engineering company Soil Machine Dynamics has steadily gained market share in the oil and gas and renewables sectors. Peter Imlah tells Will Stirling how a company founded by three university lecturers hired an extra 100 people this year and is now devising complex flow production systems to cope with the swell in demand for its hi-tech subsea roving machines.



ıine the scenario: you go to university, you study ıeering. You leave university, apply what you've ıeamt and build some machines. You set up a company and sell those machines.

The product develops into new applications, the company grows into a multimillion pound business. For some engineers it's the dream outcome of their hard study. And it's precisely the kind of applied engineering, high value-add, export driven company the UK needs more of. This is the interface of science, engineering and good business. Welcome to Soil Machine Dynamics.

Company history

Soil Machine Dynamics (SMD) is a very good example of commercialised British ingenuity. A 40-year history with deep experience in telecoms and offshore subsea engineering helps. But it is the company's flexibility and will to make one-off special projects like trenching machines, more standardised remotely operated vehicles (ROVs) in quick series, and entire cable and pipe handling systems that is the reason behind its success. Newcastle-based SMD has grown year-on-year since 1997 to a turnover of £65m today.

The now part private equity-owned company was founded in 1971 by three engineering lecturers from the Agricultural Engineering department at the University of Newcastle upon Tyne who developed a pipeline protection system that had some similarities with existing agricultural technology. Subsea pipes and cables are prone to snagging by anchors and fishing gear. Their two main inventions were trenchless cable burial and plough steering.

'Trenchless' burial of cables involves minimum seabed disturbance that reduced towing forces and replaced the spoil from the cut trench directly back over the buried cable, leaving no open trench. Plough steering, a patented technique, allows the subsea plough to follow a cable laid on the seabed in front of it in a simultaneous lay and bury operation. The operation enables cables to be laid at lower tension.

The techniques and the prototype machines built to execute them proved successful and SMD was born.

g the mid-1980s the company built and sold several machines, mainly to telecoms companies. ..ıy of the employees in the early days of the company were graduates from the same university department. Alan Reece, the founder, MD and majority shareholder, went on to bequeath money to the University of Cambridge Engineering Department and in 2009, the Institute for Manufacturing at

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ffs to turnkey systems

SMD continued to build the main electro-hydraulicmechanical equipment used on the seabed, but it realised that full vessel systems were viable for manufacture. As each contract progressed, another piece of the suite of equipment was added. "The control system for the first machine built was outsourced, for the next machine we designed and built the control system ourselves," says joint managing director Peter Imlah, who has been with SMD since 1986. "Subsequently we designed and built the handling equipment, the launching system to deploy it from the ship, the towing winches, umbilical winches, then that built up into supplying telephone cable laying equipment which are linear cable engines – tension devices to hold on to the cable as it was laid in the water." Over time the company developed a turnkey solution to convert the whole aft deck of a ship into a cable laying system.

During this time, SMD expanded its subsea vehicle fleet into cable maintenance ROVs. These are big, post-installation, free swimming and neutrally buoyant machines, which carry out repairs and reburial inspections, propelled in some cases by 10 thrusters.

The power size starts from 180kW, but in the boom telecoms era the biggest one made was 900kW, for Global Marine Services. "We have since made a 2.1MW pipeline trenching machine, but this is exceptional," says Imlah.

"These are water-jetting devices with multiple thrusters and cameras, quite sophisticated devices." The basic technology of these is comparable to workclass ROVs used in the oil and gas industry, although they generally deal in lower power, smaller machines.

In 1999 SMD acquired Hydrovision, a small ROV company, in Aberdeen, primarily as a way of getting into the oil and gas market.

During the 1980s and 1990s the expansion of the telecoms industry fuelled SMD's growth. "For 10 years we were making just one unit a year, then suddenly we made 10 in a year,"says Imlah. "About 95% of our business was in telecoms then and turnover had peaked at about £50m in around 1998.

A ve had won a Queen's Award for technology and export." By 1999, SMD had developed a broad f equipment for a range of subsea maintenance and engineering applications.

Then the dotcom bubble burst and the good times came to an abrupt halt. As SMD's growth was linked directly to the growth of the telecoms industry, sales dived. The product is hard-wearing and the requirement for new equipment had been driven by the expanding number of installations.

"Although the bulk of the work was in telecoms, we had maintained a presence in oil and gas, mainly in trenching machines, but it was for less predictable requirements." Imlah adds: "But this one-off work often fuelled technical developments, like mechanical trenchers, chain cutters, wheel cutters, jetting technology – so it was important to keep that." The emergence of this oil and gas business coincided with the decline of the telecoms market, and SMD shifted its focus more exclusively into oil and gas ROVs. "We had a very quiet year or two [2001-2002], and reduced our headcount from about 150 down to 40," says Peter Imlah. "Turnover dropped from £50m to £10m until business started to pick up in oil and gas, supplemented by some renewable energy work." In 2002, SMD built a lay and bury tractor – or LBT1 – for installing inter-turbine array cables for offshore wind farms. These cables link turbines in an offshore farm in a gridpattern and the machine was designed to carry, pay out and bury the cable. "Many of our customers in the telecoms sector have shifted focus into the renewables sector."

Brave new world – Workclass ROVs The company broke into the workclass ROV market for oil and gas, a much more competitive area with several global providers. SMD were the new kids on a very big block. "In the early days we had a very niche product, the telecoms cable plough, and by the time anyone else had figured out it was a lucrative market we had become the preferred supplier," Imlah says. "Moving into ROV was a big challenge, there were well-established players. We sold our first workclass ROV to Qinetiq for military range maintenance work. Subsequently we won a contract to build vehicles for Subsea 7, a large oil and gas construction contractor which has the second or third biggest ROV fleet in the oil and gas industry." The Subsea 7 contract proved a turning point – by deciding it should focus on operating not manufacturing, Subsea 7 effectively removed itself as a competitor and became a customer. The first contract was to build four Subsea Hercules vehicles, which led to a real coup for SMD. A subsidiary of Subsea 7, drill support division i-Tech signed a frame agreement with SMD to build up to 20 new generation 'Centurion QX' ROVs to i-Tech's specification.

vas a big step for us in the market – in four years we built 18 of those vehicles," says Imlah. At the me SMD developed its own range of drill support and construction ROVs.

A more standardised production system From a standard telecom plough, SMD's product range has

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grown into a diverse subsea machine portfolio.

allenge now is to finetune a production system that reduces build time using cells for a rdised specification, while keeping flexible enough to produce one-off machines to any specification. "We'd like to standardise the range as much as we can, to bring costs down. At the same time we believe we have a competitive advantage by providing all the supporting equipment for the machines – the deployment systems and control units," says Imlah. "Some competitors are less able to do this We regularly provide turnkey solutions to match the deployment systems to the available space and layout of the vessel or rig." Today the company has repositioned itself as a major ROV player in the global oil and gas industry, while still sustaining some telecommunications and renewable energy business. Its oil and gas credentials were endorsed in July when SMD signed a new contract with Subsea 7 for 20 ROVs – with an option of a further 10 – to a new SMD design, to be delivered over the next 18 months.

A few years ago this delivery schedule would have been impossible, but the firm is developing a standard production process which can deliver two machines a month, which it intends to expand to three a month. It has also hired 100 people this year, bringing headcount to 260. Can SMD hit 20 machines in 18 months? "We're contractually committed to do it, so we will," says Imlah. "It is a challenge and has required a large change in approach from bespoke, one-off engineering activiy to a more standardised production system of identical product – but we've also had to maintain flexibility." The frequency and variance in the order book has forced SMD to adjust the way it builds its product.

Bespoke and new products

Trenching machines and tidal

The Special Purpose Vehicles business stream covers trenching machines for pipeline telecoms cables, power cable and renewables' cable burial.

These are more variable, customised.

SMD designed a tidal turbine for which it received a BERR (now Department for Business, Innovation and Skills) grant which it had not been able to do leverage a prototype. "We recently entered into an agreement with a company called Atlantis Resources Corporation to build their design tidal turbine, a op system. It was agreed with BIS to transfer the grant to Atlantis in a working partnership to build device, which has just been installed at the EMEC [test centre] in Orkney. We have the right skills to take that type of equipment and put it in a subsea environment." "The one-offs are still very important, interesting, and they maintain the design engineering focus in the company, which was founded on sound engineering principles."

Diversification – Subsea mining SMD nearly got its fingers badly burnt by the telecoms sector in the late 1990s. It realised that over-dependence on one market sector was too risky and that, as with many engineering companies today, diversification is essential.

A recent new area for SMD is subsea mining, a brand new application of ROV technology. Northwest Mining in Australia has pioneered the technique for mining offshore deposits in Papua New Guinea and SMD has a contract with them to supply three machines, deployed off the same vessel, where each performs different parts of the mining operation.

"It's based on mining copper but there are a lot of other minerals in deposits which can add upside to the process," Imlah says. "It's a huge technical challenge – the first site is in 1,700m of water, and the economics depend on getting a certain amount of output. The deposit is created by smokers, small volcanoes, so its a hostile environment, with high temperatures, and corrosive chemicals ." Water pressure, however, is not an issue for the machines.

Workclass ROVs are routinely rated to a depth of 3,000m.

"We're building two at the moment rated at 4,000m." The recent Deepwater Horizon oil spill in the Gulf of Mexico broadcast footage showing most of the main ROV operators, including SMD's machines. The company has never had such mainstream publicity, while sadly in a such an unfortunate context.

Testing, testing

The scale of some of the one-off machines makes onsite testing impractical.. Over the years SMD has made a number of prototype vehicles to prove trenching equipment concepts and developments. The machinery has few options for operational tests. "We will do some sub-assembly testing and have cted analysis and cutting trials on the mineral material that will be encountered at the mine site," says Imlah. "Our approach is to look at the established land-based technology out there and adapt it for

our purposes." So SMD has gone to the mining industry and looked to make technology work in a different environment.

says there will be a bigger, worldwide move into subsea mining. The company has talked to Joy Mining, a US mining machinery group with UK operations, and Sandvik.

Caterpillar too has been very helpful. "They're interested in this application and they may see us as a potential partner.

It's a fascinating project to be involved with. The advantage could go either way but we're obviously going to learn a huge amount on this development." Delivery of the three mining machines for NorthWest Mining is to Singapore in February 2012.

Headcount and growth

John Reece, the son of co-founder Alan Reece, was the majority shareholder but in 2008 sold a 60% stake to Inflexion Private Equity in a management buy-out involving new chief executive Andrew Hodgson. Mr Reece retains 25% and management own the remaining 15%. While its chairman is interested in the engineering activity, Inflexion's primary interest is financial. New ownership, says Peter Imlah, has galvanised a more professional focus on productivity.

With 100 new staff joining in 2010, is SMD's story unique for a company of this size and type in the North East? "It's partly come about because of private ownership, " he says.

"We've always been a successful, profitable company but we only needed to meet the needs of the owner. Clearly under private equity ownership growth and diversification is of huge importance. That has been a catalyst for some very good changes in the company."

The manufacturing process – sea change needed

Through the 1980s and early 1990s, the company employed mainly graduate engineers who did everything; sales, design, build, test and in some cases operation of the equipment. Fabrication was outsourced to local company, Pearson Engineering.

field testing would be done in-house. Peter Imlah says: "We grew beyond the ability to do it that way for all units but we retained the function – it became a very good training ground for graduate engineers to operate the machinery in the field and solve problems.

The management of the company were in favour of this approach – to use bright engineers to do everything, meaning at any point you could make key decisions – you could modify it, adapt and fix it. It could be very flexible but at the same time less controlled than a routine production environment." Today, to deliver the high throughput demanded, the manufacturing process has needed to become more standardised. Manufacturing staff are now skilled fitters and electricians, and while the engineers come into the factory to consult on assembly, they are based mainly in the design offices.

Making more standard ROVs plays to a more 'process- flow' manufacturing operation. When all the products were bespoke, the focus was primarily on the function of the machine – achieving critical trenching criteria. "Moving into the ROV market, the function of the machine is taken as a given. The focus is different – they're used by people throughout the world often operating multiple systems, so they need to have consistency across the fleet," Imlah says. The basic operational movements of ROVs, while not accredited, are established industry norms. These are hard machines to differentiate technically. All this makes for a more standardised, cell based manufacturing operation.

Now SMD's factory is organised, a little crudely while in transition, into cells. Factory manager Tom Turnbull shows how the factory will eventually look, with designated zones for ROV build and flexible areas for trenching machines and the one-off heavy projects. "This is gearing up for true production line type assembly," says Turnbull. "We plan to have specific teams doing specific tasks – a chassis build team, a hydraulics team, piping and cable team. Each ROV will be manufactured in exactly the same way." Logistical gains Factory and supplier delivery organisation is key to the next phase of growth, and the 20 vehicle order from Subsea 7 is a big driver of this. "It's the biggest batch of identical machines that we've ever built. This is a real opportunity to explore some of our supply chain options, to reorganise the logistics to make that as efficient as possible," says Imlah.

SMD has started line side delivery on its electrical systems. It is now using one supplier for 90% of its control systems' electrical components. "Rather than placing purchase orders for all components ually, we buy a number of kits from one supplier and they're delivered directly to our assembly nlah says. "These are not handled in our stores, we're not booking them in and out, these are delivered in four different kits through the build process. The system has been developed both internally

and with Routeco, the supplier. They looked at our bills of materials and told us the proportion of it they could deliver.

nly an advantage in logistics, but it's significant." There is a modest price advantage because Routeco will buy in slightly bigger bulk than SMD. "We've tried to deploy this new system to parts where its most appropriate. If it works well, we may apply it to our hydraulics components. We've had to restructure our bills of materials to facilitate that kind of production, which has required an education process to focus on attention to detail."

In the past, the engineers and technicians building the equipment and would just resolve assembly problems at point of discovery, placing ad hoc parts orders. "We could not apply this methodology to multiple unit assembly and we now use a range of production technicians, electricians and wiring specialists – so we must try and present the information accurately so they can build efficiently, without having to refer back to engineering all the time." The old way – making several one-offs – meant that correcting mistakes was done per unit, because they were probably never going to have to build that same unit again.

Volume orders for serial build means that this approach is redundant – the process now requires the manufacture of 20 or 30 systems identical across all machines.

"We've had to develop a system of capturing build standard faults and rectifying them, and if necessary making sure this is delivered across fleets of already delivered equipment," says Imlah.

"That type of diligence and version control is essential. Before it wasn't so critical for the type of equipment we were building."

Procurement alignment Procurement used to be done on a project by project basis, controlled by individual project managers. SMD saw that it didn't make sense to purchase for each project individually. And scheduling has also improved. Tom Turnbull adds: "We now have a formal schedule rather than ordering all components in one go and delivering to the shop floor in one hit, which has the potential to damage or lose components. Forward planning, we have longer lead times but we also kit certain assemblies, where we pre-order that for Week 3 of Build A we need kit X for a specific bay and we're at that point now." Availability of key parts is key to efficient production, so cross-project, joined up procurement was essential to the new production system. "It's worked well on the control cabins, where me in from a single third party supplier who provides a whole kit. We used to stock them all on our s, then restock them all again for production. Now they arrive in three to four kits direct to the production area." Better scheduling is essential for the new way, not least because the lead time on some parts are several weeks. Typically the delivery time on an umbilical cable, which connects the ROV to the ship, is 16-18 weeks.

"Our delivery schedule on the first of the new Subsea 7 units is 19 weeks from contract; that puts scheduling in perspective.

You can't do anything without the umbilical." These parts come from Nexans, a Norwegian company, but the vast majority of components are sourced locally, says Turnbull. "We try to keep the supply chain very local, partly to support local industry, and also to control supply chain risk and keep delivery costs down."

Engineering principles, not software

Well established designs form the basis of SMD's intellectual property. The company has no simulation software. Instead, Mr Imlah and the team prefer to rely on fundamental engineering principles. "Although we have Inventor and Ansys CAD packages we want to engineer something fundamentally correctly to begin with," he says. "I don't believe that the packages can do that for you; you have to put the right information in. If you don't design a structure correctly and then use a analysis package to make it strong enough, rather than taking good design and optimising it you're taking a poor design and making it heavier. If the fundamental structure of what you're designing is not correct, the analysis package will tell you where to strengthen it, but it will really just cover up the flaw."

North East subsea cluster

The North East region has developed a specialisation for subsea engineering and offshore oil and gas companies. Wellstream, Duco, oil and gas construction group CTC and SMD are all local and all occupy different parts of the subsea engineering chain. SMD has one direct competitor in the region, Engineering Business, a business formed by two ex-SMD founder directors. "They were taken over by IHC, a Dutch shipping and engineering company, and their focus has changed though they do still compete with us in market sectors " says Imlah.

Another potential business link is taking shape a few miles up the Tyne. The North East's links with offshore wind are well known, with the NaREC national renewable test centre at Blyth and the proximity

to the Greater Gabbard wind farm. US firm ClipperWind has built a factory at the old Neptune yard and will be installing plant soon. Wind turbines need cables to connect them. The SMD team may have to find r for more orders soon, this time from customers in their own back yard.

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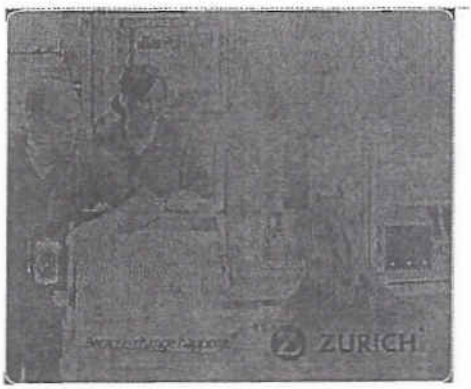

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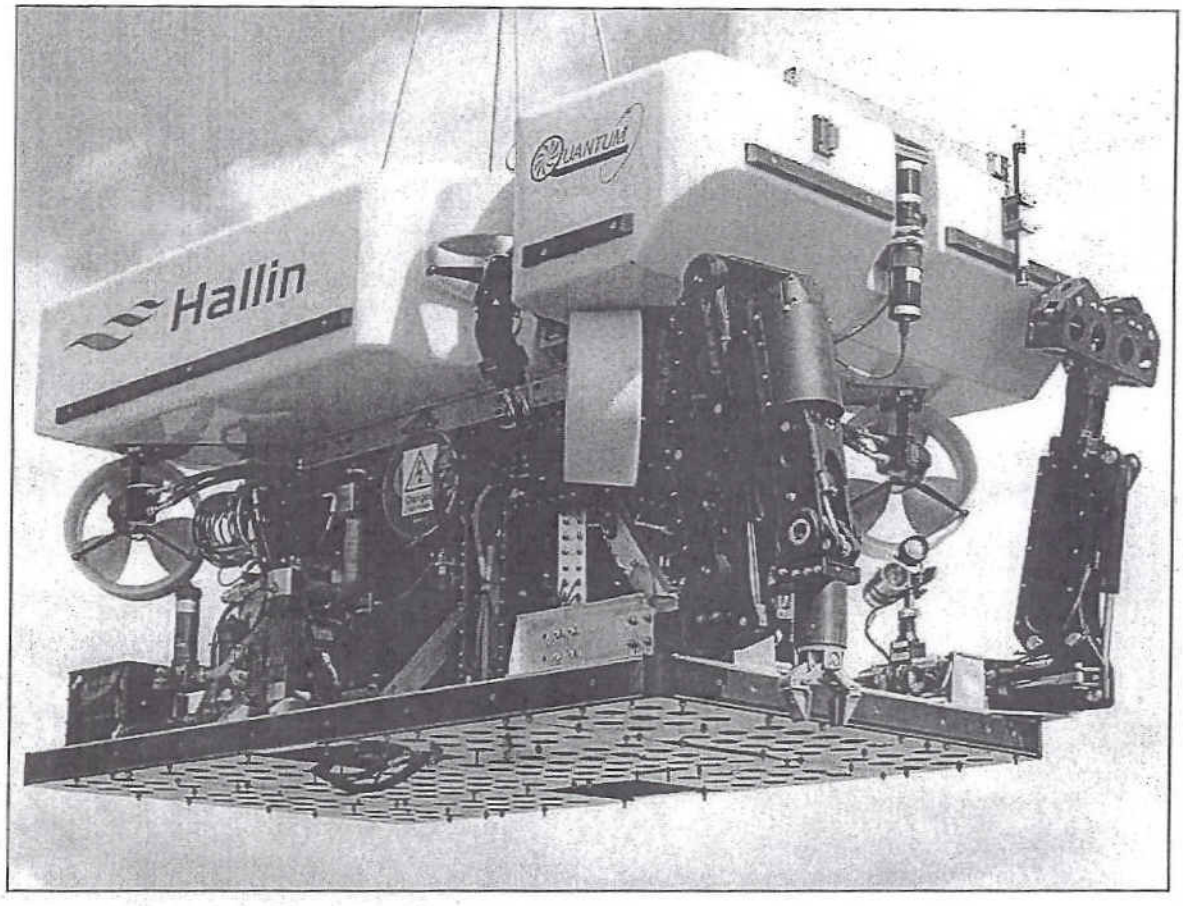
TAB 7.C

Hallin

Work Class ROV
Quantum



The Quantum is the ultimate in hydraulically heavy duty construction class remotely operated vehicle (ROV's). This all new design benefits from over thirty years of underwater vehicle build programmes and incorporates a number of enhanced components from one of the world's most respected underwater vehicle builders.

Designed and built to perform the most exacting operations in the harshest of environments for long periods, the Quantum provides the necessary attributes to get the job done. With an impressive 800 kgf thrust performance, the Quantum is in a class of its own.

The Quantum is particularly suited for heavy-duty construction support, where remote intervention tasks are required such as positioning of subsea structures, pipeline / umbilical connection, pipeline repair, component change out, valve operation, fluid injection, debris removal, plus many more. To enhance the capability of the Quantum, it may be fitted with purpose built tooling skids weighing up to 3000 kg (3 Te) in air. The vehicle may be fitted with a range of acoustic sensors to perform precision surveys and conduct salvage operations.

Deep water operations are aided by the use of a complimentary top hat tether management system (TMS), designed to maximise the performance of the vehicle by eliminating the effects of umbilical drag and vessel motion.

Built in accordance with the latest international industry standards are certified for Zone II (Class I Division 2) hazardous area operations, the Quantum may be operated from vessels of opportunity, fixed or floating platforms.

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Rev 10-12

Work Class ROV

MAIN PARTICULARS

Owner	Hallin Marine
Year Built	2006
Builder	SMD Hydrovision
Class Society	Lloyds Register of Shipping, Design Standard Designed in accordance with Lloyds Lifting, Appliances in a Marine Environment (Chapter 3)
Operating Environment	Certified for Class 1 Division 2 (Zone II)
Operating Temperature	-10°C to +45°C

MAIN COMPONENTS

Tether Management System
Control Container
'A' Frame Assembly
Umbilical Winch
Hydraulic Power Unit
Workshop/Spares Container
ROV Maintenance Hydraulic Deck Cart

TETHER MANAGEMENT SYSTEM

Operating Conditions	Up to and including Sea State 6 (3g)
Depth Rating	2000 metres / 3000 metres sea water
Tether Capacity	500m of Neutral or 900m of heavy tether, 500m off 35mm, 900m off 27mm
Hydraulic Power	8.5kW (11.4 Shaft Horse Power) as standard
Diameter	2194mm
Height	2265mm
In Air Weight	3000kg
In Seawater Weight	2500kg
Telemetry	6 x data channels plus 3 x video channels via single mode fibre
Depth Measurement	1 x Paroscientific Digiquartz sensor
Lighting	2 x 250W lamps
Video	2 x Monochrome cameras

'A' FRAME ASSEMBLY

Type	Hydraulically powered telescopic 'A' frame c/w umbilical sheave, damped snubber and rotating frame
Safe Working Load	12000kg
Design Factor	3g
Deployed Reach	4148mm
Dimensions	7000mm (L) x 4000 (W) x 10700mm (H - erected) Weight 20,000kg nominal

CONTROL CONTAINER AND EQUIPMENT

Control Container	1 x A60. 6093mm (20ft.) ISO rated for Class 1 Division 2 (Zone II) operations
Pilot/Co-Pilot Control	Ergonomic control desk panel with video wall, Power Room Integrated power room to house high voltage transformer units, control switch gear and external interfaces
Incoming Supplies	1 x 440Vac, 60Hz, 3 Phase main supply and 1 x 240Vac, 50/60Hz, 1 Phase auxiliary supply

REMOTELY OPERATED VEHICLE

Operating Conditions	Up to and including Sea State 6 (3g)
Depth Rating	3000 metres sea water (Quantum 4) / 2000 metres at sea water (Quantum 3)
Hydraulic Power	92kW (125 Shaft Horse Power) as standard
Length	3413mm
Width	1850mm
Height	1790mm
In Air Weight	3560kg
In Seawater	Weight Neutral
Fwd/Aft Bollard Pull	800kgf
Lateral Bollard Pull	800kgf
Vertical Bollard Pull	650kgf
Fwd/Aft Surface Speed	3.5 knots
Lateral Surface Speed	3.0 knots
Vertical Surface Speed	2.0 knots
Payload	250kg with manipulators fitted
Through Frame Lift	3000kg @3g at work skid attachment points
Propulsion	4 x 380mm horizontal and 3 x 380 vertical hydraulic thrusters
Thruster Control Manifold	One intelligent, 8 station servo control with thrusters isolation
Hydraulic Control Manifold	One intelligent, 12 station bi-directional, proportional control manifold
Hi-Flow Hydraulic Control Manifold	One intelligent, 4 station bi-directional Proportional control manifold
Auto Functions	Heading, Depth, Altitude, Pitch & Roll
Heading Control	±1.0 Degrees
Depth Control	±0.01%
Altitude Control	±100mm
Telemetry	16 x data channels plus 8 x video channels via single mode fibre
Lighting	Up to 12 x 250W lamps
Equipment Interface	One intelligent, Auxiliary Equipment pressure compensated junction box for interfacing acoustic and third party equipment

VEHICLE EQUIPMENT FIT AS STANDARD

Manipulator	Schilling Titan 4 (Quantum 4) / Schilling Long-Reach Orion (Quantum 3)
Grabber	1 x Schilling Robotics Rigmaster
Camera Pan and Tilt	1 x Electric c/w Position feedback
Camera Tilt	1 x Electric c/w Position feedback
Colour Camera	1 fitted as standard
Low Light Camera	1 fitted as standard
Observation Camera	1 x Monochrome
Sonar	1 x Tritech Super Seaking DFS
Bathymetric System	1 x Tritech Seaking 701
Emergency Flasher	1 x Novatech ST400 Strobe

UMBILICAL WINCH

Type	Hydraulically powered from external power unit Safe Working Load 12000kg
Design Factor	3g
Umbilical	3300m of 35mm diameter umbilical
Line Speed	Variable up to 50 metres per minute
Braking	Independent Emergency braking system
Dimensions	3600mm (L) x 2900 (W) x 3200mm (H)
Weight	23,900kg nominal with 3300m of umbilical installed
Control	Local and remote from Pilot control station

Hallin Marine
Unit 12 Wellheads Place Wellheads Industrial Estate Dyce Aberdeen AB21 7GB
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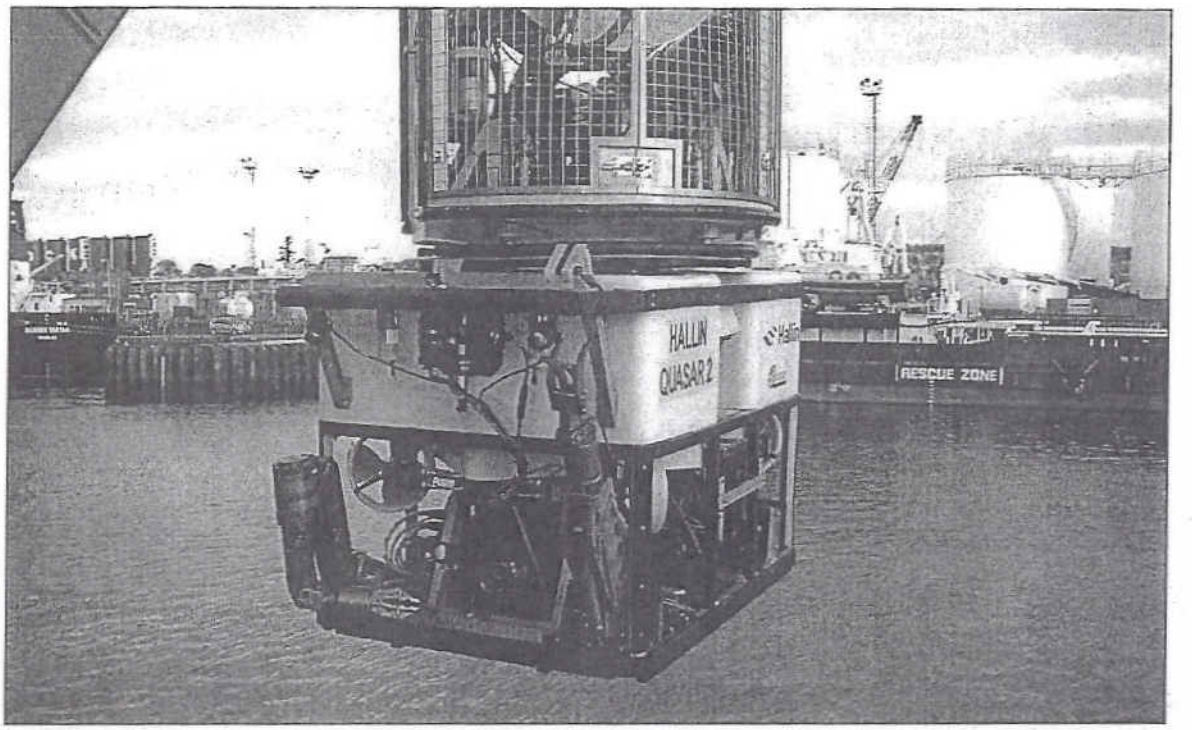
TAB 7.D

Work Class ROV
Quasar Compact



The Quasar is the world's most compact hydraulic Work Class remotely operated vehicle (ROV). Measuring just 1490mm by 1500mm by 2400mm, the Quasar Compact is in a class of its own, particularly when comparing physical size to power ration. Fitted as standard with a 92kW (125SHP) Curvetech hydraulic unit, the vehicle delivers and outstanding 670 kgf forward / aft thrust performance.

The compact size of the Quasar does not diminish its work capabilities, as it will easily perform all tasks normally associated with much larger vehicles. Indeed the Quasar provides all the benefits of a hydraulic vehicle in a package size normally associated with today's heavy-duty electric inspection vehicles. To enhance the capability of the Quasar, it may be fitted with purpose built tooling skids weighing up to 1000 kg (1Te)in air). The vehicle may be fitted with a range of acoustic sensors to perform precisions surveys and conduct salvage operations.

Deepwater operations are aided by the use of a complimentary top hat tether management system (TMS), designed to maximise the performance of the vehicle by eliminating the effects of umbilical drag and vessel motion. If necessary, the vehicle may be operated without the TMS.

Built in accordance wit the latest international industry standards and certified for Zone II (Class 1 Division 2) hazardous area operations, the Quasar may be operated on relatively small vessels of opportunity, fixed or floating platforms. A great deal of thought and attention to detail has gone into minimising the required amount of deck space, while at the same time maximising the performance and capability of the entire system.

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HMG-D-ROV-SPC-006-01
12 October 2010

Work Class ROV

MAIN PARTICULARS

Owner	Hallin Marine
Year Built	2006/2007
Builder	SMD Hydrovision Limited
Class Society	Lloyds Register of Shipping
Design Standard	Designed in accordance with Lloyds Lifting Appliances in a Marine Environment (Chapter 3)
Operating Environment	Certified for Class
Operating Temperature	-10°C to +45°C

MAIN COMPONENTS

Remotely Operated Vehicle
Tether Management System
Control Container
'A' Frame Assembly
Umbilical Winch c/w Integrated Hydraulic Power Unit
Workshop/Spares Container
ROV Maintenance Hydraulic Deck Cart

REMOTELY OPERATED VEHICLE

Operating Conditions	Up to and including Sea State 6 (3g)
Depth Rating	2000 metres sea water
Hydraulic Power	92kW (125 Shaft Horse Power) as standard
Length	2000mm - 2400mm overall
Width	1500mm
Height	1490mm
In Air Weight	2250kg
In Seawater	Weight Neutral
Fwd/Aft Bollard Pull	670kgf
Lateral Bollard Pull	645kgf
Vertical Bollard Pull	460kgf
Fwd/Aft Surface Speed	3.5 knots
Lateral Surface Speed	2.5 knots
Vertical Surface Speed	2.5 knots
Payload	160kg with manipulators fitted
Through Frame Lift	1000kg @3g at work skid attachment points
Propulsion	4 x 300mm horizontal and 2 x 300 vertical hydraulic thrusters
Thruster Ctrl Manifold	One intelligent, 7 station servo control with thrusters isolation
Hydraulic Ctrl Manifold	One intelligent, 12 way bi-directional 15 l /min proportional control manifold NG3. 6 x bi-directional solenoid valves c/w cross relief / pivot gauge and manual. Flow adjust on A/B ports for grabber 6 x bi-directional proportional valves Remote flow adjust from surface
Hi-Flow Hydraulic	Capability to fit one intelligent, 4 station
Control Manifold	Bi-directional proportional control manifold NG6
Auto Functions	Heading, Depth, Roll and Altitude
Heading Control	±1.0 Degrees
Depth Control	±0.01%
Altitude Control	±100mm
Telemetry	16 x data channels plus 8 x video channels via single mode fibre
Lighting	Up to 6 x 250W lamps
Equipment Interface	Two intelligent, equipment pressure compensated junction box for interfacing acoustic and third party equipment

VEHICLE EQUIPMENT FIT AS STANDARD

Manipulator	1 x Schilling Robotics Orion 7P
Grabber	1 x Schilling Robotics Rigmaster
Camera Pan and Tilt	1 x Electric c/w Position feedback
Camera Tilt	1 x Electric c/w Position feedback
Colour Camera	1 fitted as standard
Low Light Camera	1 fitted as standard
Observation Camera	1 x Monochrome
Sonar	1 x Tritech Super Seaking DFS
Bathymetric System	1 x Tritech Seaking 701
Emergency Flasher	1 x Novatech ST400 Strobe

TETHER MANAGEMENT SYSTEM

Operating Conditions	Up to and including Sea State 6 (3g)
Depth Rating	2000 metres sea water
Tether Capacity	250m of neutral or 350m of heavy tether, 400m x 27mm
Hydraulic Power	8.5kW (11.4 Shaft Horse Power) as standard
Diameter	1600mm
Height	2275mm
In Air Weight	2500kg
In Seawater Weight	2000kg
Telemetry	6 x data channels plus 3 x video channels via single mode fibre
Depth Measurement	1 x Paroscientific Digiquartz sensor
Lighting	4 x 250W lamps
Video	2 x Monochrome cameras

CONTROL CONTAINER AND EQUIPMENT

Control Container	1 x A60. 4839mm (16ft.) ISO rated for Class 1 Division 2 (Zone II) operations
Pilot/Co-Pilot Control	Ergonomic control desk panel with video wall
Power Room	Integrated power room to house high voltage transformer units, control switch gear and external interfaces
Incoming Supplies	1 x 440Vac, 60Hz, 3 Phase main supply, 1 x 240Vac, 50/60Hz, 1 Phase auxiliary supply

'A' FRAME ASSEMBLY

Type	Hydraulically powered 'A' frame c/w umbilical sheave, damped snubber and rotating frame
Safe Working Load	7000kg
Design Factor	3g
Deployed Reach	5590mm from main pivot
Dimensions	5200mm (L) x 2700 (W) x 8795mm (H – erected)
Weight	13,800kg nominal

UMBILICAL WINCH

Type	Hydraulically powered from built in power unit
Safe Working Load	7000kg on bottom layer
Design Factor	3g
Storage Capacity	2250m of 35mm diameter umbilical
Line Speed	Average of 30 metres per minute
Braking	Independent Emergency braking system
Dimensions	2700mm (L) x 2900 (W) x 3200mm (H)
Weight	20,000kg nominal with 2250m of umbilical installed
Control	Local and remote from Pilot control station

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Unit 12 Wellheads Place Wellheads Industrial Estate Dyce Aberdeen AB21 7GB
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A Superior Energy Services Company

TAB 7.E

RELIABLE, POWERFUL, ADAPTABLE

HEAVY DUTY WORK CLASS ROV

QUANTUM

The Quantum from SMD uses knowledge gained from building the worlds most powerful trenching ROVs to offer a Construction Class vehicle designed for those seeking an ultra stable platform capable of operating in high current conditions. Designed to cope with power intensive deepwater tasks, Quantum is the ultimate subsea construction and survey tool.

Latest Curvetech ROV building blocks used throughout

150HP & 200HP Power Pack Options

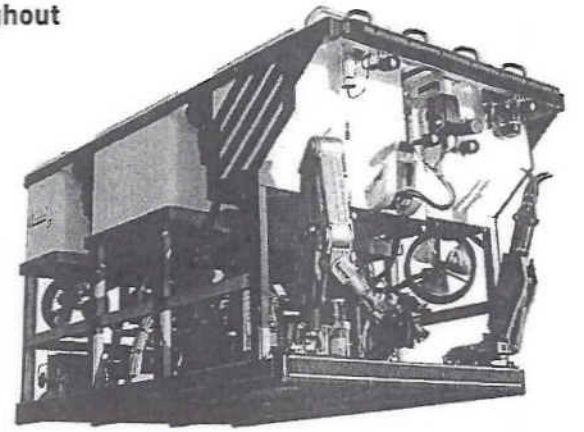
Up to 1100kg Bollard Pull

124LPM Tooling Hydraulics

350kg Payload

SMD DVECS Digital Telemetry

HDTV & Gigabyte telemetry options



SMD AutoROV advanced control modes; AutoHOLD ROV DP, AutoSTEP X, Y, Z, AutoTRACK Waypoint Manager

Option for DriROV built-in ROV simulator

SMD CUSTOMISATION SERVICE

SMD understand that every customer is different and therefore have individual needs from their systems. In order to meet our customer's specific requirements SMD can customise the Quantum using our range of standard components to suit preference and performance requirements.

Please contact us today to discuss a tailored Quantum system.

SPECIFICATIONS

QUANTUM

Depth rating
- Standard 3000msw
- Optional 500, 1000, 2000, 4000msw

Dimensions
- Length ..... ≤3500mm
- Width ..... ≤2000mm
- Height ..... ≤2000mm

Weight in air (std) 4750kg

Payload 350kg

Through Frame Lift 3000kg

Aft TDU mounting 1000kg

Side mounting 500kg

	Standard	Optional
Bollard Pull		
Forward/aft	900kgf	1100kgf
Lateral	900kgf	1100kgf
Vertical (up)	650kgf	900kgf
Surface Performance		
Forward	3.2kn	3.5kn
Lateral	3.0kn	3.2kn
Vertical	2.0kn	2.5kn
Auto Functions	Heading Depth Altitude ROV DP	
Thruster Configuration		
Horizontal vectored	4x Curvetech HTE 380BA	4x Curvetech HTE 420BA
Vertical	4x Curvetech HTE 300BA	- -
Hydraulic Power (Total) (150kW)	150hp (110kW)	200hp
Isolated Tooling Power	58hp (43kW)	82hp (61kW)

Spare Hydraulic Channels
- Standard 19 (15LPM), 4 (35LPM), 1 (66LPM)
- Optional 29 (15LPM)

Video Capability
- Standard ..... 8 channels composite (All with Focus and Zoom)
- Optional ..... HDTV

Gyro
- Standard ..... FOG, Gyro Compass
- Optional ..... NS FOG

Lighting
- Standard ..... 12 x 120Vac @ 250W
- Optional ..... 2 x 120Vac @ 400W HID

Camera pan/tilt
- Standard ..... 2 x Electric/Hyd
- Optional ..... Additional units

Camera Tilt ..... 1 x Electric/Hyd

Instrument Power 6.0kVA

Manipulator ..... 1 x 7F (pos feedback heavy duty)

Grabber ..... 1 x 5F (rate, heavy duty)

Control Cabin
- Standard ..... 16ft/20ft, A60 ISO Zone II 3G

Control System
- Standard ..... SMD DVECS ROV Control Hardware
dual touchscreens
8 x 19" TFT Video Wall
- Optional ..... Customer choice
Dual or single joystick control
HDTV video

Incoming power supplies 380V-480Vac
3 phase 60Hz/50Hz

TMS Control/Interface ..... SMD Tophat, SMD Garage

- SMD launch equipment including A-frames and winches
- Options for up to Sea State 7 operation
- Active or passive heave compensation
- Aramid/SWA umbilical choices

SMD
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TAB 7.F

ENGINEERING EXCELLENCE UNDERWATER

WORK CAPABILITY IN A COMPACT PACKAGE

GENERAL PURPOSE WORK CLASS ROV

The Quasar from SMD is for those who wish to have the current holding capability and instrument interfaces of Quantum but in a smaller more agile package. Quasar is an excellent all round performer capable of survey, construction and drill support operations.

Latest Curvetech ROV building blocks used throughout

100HP & 125HP Power Pack Options

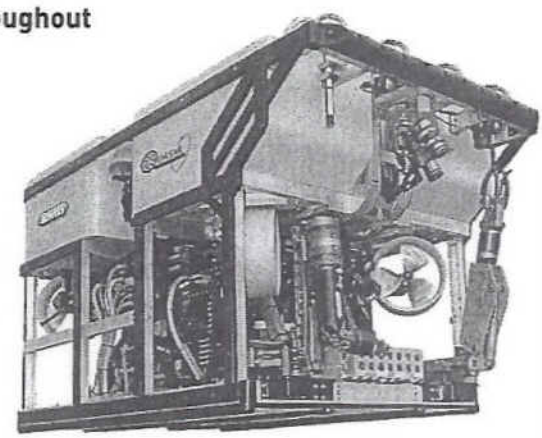
Up to 800kg Bollard Pull

Optional 78LPM Tooling Hydraulics

250kg Payload

SMD DVECS Digital Telemetry

HDTV & Gigabyte telemetry options



SMD AutoROV advanced control modes; AutoHOLD ROV DP, AutoSTEP X, Y, Z, AutoTRACK Waypoint Manager

Option for DriROV built-in ROV simulator

CUSTOMISATION SERVICE

SMD understand that every customer is different and therefore have individual needs from their systems. In order to meet our customer's specific requirements SMD can customise the Quasar using our range of standard components to suit preference and performance requirements.

Please contact us today to discuss a tailored Quasar system.

SYSTEM

SPECIFICATIONS

QUASAR

GENERAL

Depth rating
- Standard 3000msw
- Optional 500, 1000, 2000, 4000msw

Dimensions
- Length ..... ≤3100mm
- Width ..... ≤1800mm
- Height ..... ≤1800mm

Weight in air (std) 3500kg

Payload 250kg

Through Frame Lift 2000kg

Aft TDU mounting 500kg

PERFORMANCE

	Standard	Optional
Bollard Pull		
Forward/aft	800kgf	-
Lateral	800kgf	-
Vertical (up)	400kgf	550kgf
Surface Performance		
Forward	3.2kn	-
Lateral	3.0kn	-
Vertical	2.0kn	2.2kn
Auto Functions	Heading	-
	Depth	-
	Altitude	-
	ROV DP	-
Thruster Configuration		
Horizontal vectored	4x Curvetech HTE 380BA	-
Vertical	2x Curvetech HTE 300BA	3x Curvetech HTE 300BA
Hydraulic Power (Total)	125hp (93kW)	100hp (75kW)
Isolated Tooling Power	-	36hp (27kW)

STANDARD INFORMATION

Spare Hydraulic Channels
- Standard 7 (15LPM), 1 (66LPM)
- Optional 19 (15LPM), 4 (35LPM)

Video Capability
- Standard ..... 4 channels composite
- Optional ..... 8 channels composite HDTV

Gyro
- Standard ..... FOG, Gyro Compass
- Optional ..... NS FOG

Lighting
- Standard ..... 6 x 250W, 110Vac
- Optional ..... 12 x 250W, 110Vac

Camera pan/tilt
- Standard ..... 1 x Electric/Hyd
- Optional ..... 2 x Electric/Hyd

Camera Tilt ..... 1 x Electric/Hyd

Instrument Power
- Standard 3.6kW
- Optional 6.0kW

Manipulator ..... 1 x 7F (pos feedback heavy duty)

Grabber ..... 1 x 5F (rate, heavy duty)

OPTIONAL

Control Cabin
- Standard ..... 16ft/20ft, A60 ISO Zone II 3G

Control System
- Standard ..... SMD DVECS ROV Control Hardware dual touchscreens 8 x 19" TFT Video Wall
- Optional ..... Customer choice dual or single joystick control

Incoming power supplies ..... 380V-480Vac 3 phase 60Hz/50Hz

TMS Control/Interface ..... SMD Tophat, SMD Garage

TOPSIDE EQUIPMENT

- SMD launch equipment including A-frames and winches
- Active or passive heave compensation
- Aramid/SWA umbilical choices

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TAB 7.G

Select a Category

Select a Year

July 2010

SMD to supply Hallin Marine with Quantum XPs and new Hanger LARS

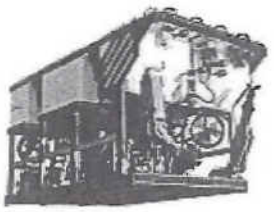
SMD is pleased to announce a contract for supply of two complete Quantum XP construction class ROV systems to Hallin Marine. The two high specification systems include Quantum XP 200hp ROVs, Tophat TMSs, umbilical winches and vessel mounted control consoles. A new gantry launcher will also be supplied for launching the systems from dedicated ROV hangers. The gantries, designed and manufactured by SMD, position the ROV/TMS stack far from the vessel edge by utilizing a multistage telescoping action. The low profile, top hung design maximizes the tool skid carrying capacity of the ROV whilst leaving a clear floor area for maintenance.

The Quantum XP is SMD's flagship construction class ROV, designed to undertake the most demanding construction, IRM and survey tasks. The ROV boasts a multitude of spare high flow hydraulic and Ethernet data channels and includes SMD's ROV dynamic positioning system – AutoROV - as standard.

Commenting on the award, Mark Collins, Global ROV Sales Manager at SMD said: "Hallin Marine has been an extremely important long standing customer to SMD. This latest award - for their ninth and tenth SMD system – demonstrates Hallin's commitment to SMD's high quality Work Class vehicles. In addition, the supply of specialist launch equipment further demonstrates Hallin's confidence in SMD to engineer and deliver a tailored solution when required".

SMD is one of the world's leading subsea engineering companies designing and manufacturing Work Class ROVs, trenching systems, subsea mining machines and tidal generation devices. They have a worldwide customer base operating in oil and gas, telecoms, mining, salvage,

CLICK TO ENLARGE



renewables, defence and scientific markets. SMD has offices in UK, USA and Singapore.

Hallin Marine's West division's managing director, Mike Arnold, said: 'We are pleased to be working with SMD again and we have worked closely with them to arrive at a neat and well engineered solution.
'Having purchased their Quantums in the past we know they are excellent high performance vehicles that have outstanding reliability, and are more than happy to be using them again.'

For more information, please contact:

Mark Collins
Global Sales Manager - ROVs
Email: mark.collins@smd.co.uk
Tel: +44 (0)191 234 2222
Fax: +44 (0)191 234 0444

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TAB 8.A

PERRY SLINGSBY SYSTEMS

A MEMBER OF THE TRITON GROUP

Experience, Dedication, Vision

Contact Us

Locations • Technical Support

From offices and agents around the globe, Perry Slingsby Systems offers a worldwide support network that is available to customers 24 hours a day, 365 days a year. Production is carried out at our Kirkbymoorside facility, near York, England, in a 48,000 sq. ft. plant. Sales functions are conducted from the sales and service offices in Houston, Texas, Aberdeen and Singapore.

Contact Perry Slingsby Systems today for your most challenging deepwater missions.

Locations

Click here to contact us using our online submission form.

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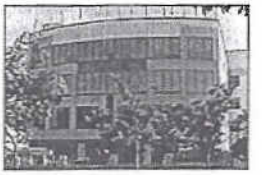

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▸map

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Technical Support

The Perry Slingsby Systems Customer Service Hotline is manned 24 hours a day, 365 days a year, to provide comprehensive and uninterrupted technical support and emergency parts sales.

Contact:

UK: +44 (0) 7774 632 114

USA: +1 561 346 1522

Singapore: +65 9663 8310

Parts Sales & Service:

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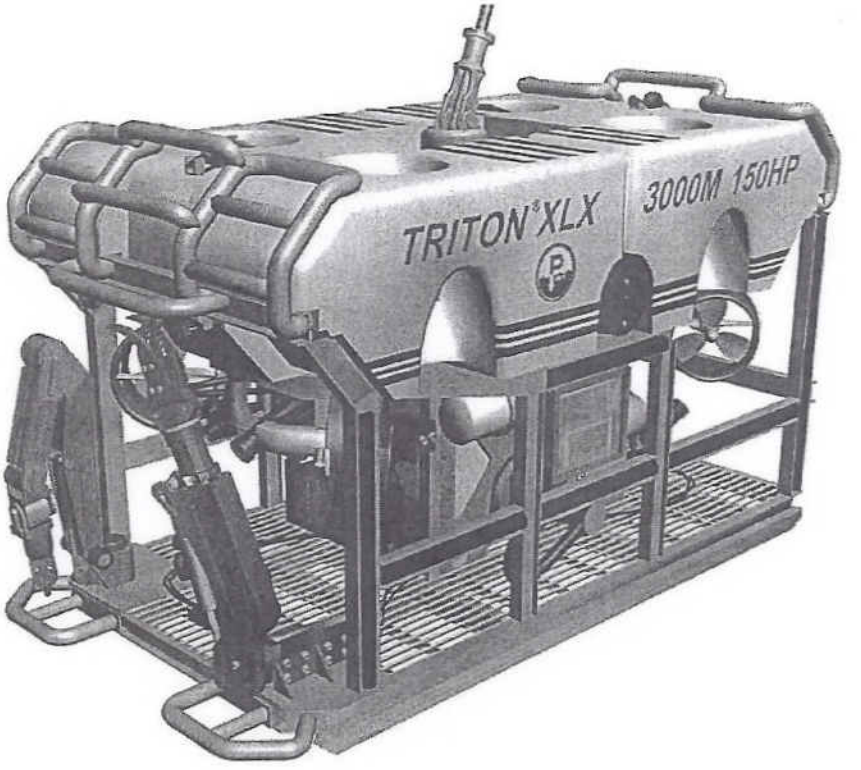
TAB 8.B

Triton® XLX



Heavy Duty Work Class ROV	
Depth Rating	3000/4000 MSW
Power	150-250 HP
Through Frame Lift	3000 kg
Control System	ICE ™ Real Time Control System with Gb Telemetry and Graphical Diagnostics
Control Modes	Heading, Depth, Altitude and Auto Position ™
Payload Capacity	250-550 kg

Specifications

Dimensions

Length:	3226 mm
Width:	1803 mm
Height:	2000-2148 mm
Depth Rating:	3000-4000 m
Weight in Air:	4900/5600 kg
Payload Capacity:	250-550 kg
Power Pack (Shaft/HP)	150-250
Thruster Horizontal:	4 x 380 mm ∅
Thruster Vertical:	4 x 300 mm ∅
Turning Rate:	40 deg. per second
Auto Heading Control:	Automatic to ± 2.0 degree
Pitch and Roll Control	± 5.0 degrees
Depth Control	Automatic to ± 150 mm
Altitude Control	Automatic to ± 150 mm
Bollard Pull (Nominal)	
Forward:	1100 kgf
Lateral:	1100 kgf
Vertical:	900 kgf
Through Frame Lift:	3000 kgf

Standard Equipment
-Gyro/Fluxgate Compass
-Pitch/Roll Sensor
-Digiquartz Depth
-Doppler Velocity Log-ROV DP
-Auto Functions (Heading/Depth/Altitude/Position)
-16 Station Proportional NG3 Main Manifold
-14 Station Proportional Thrusters Manifold-6 spare functions
-12 Station Proportional Tooling Manifold
-500 watt lights on dimming circuits available (6)
Circuits x/2 x 250 watt lights per standard (6)

Interfaces For
- Manipulator (Left/Right)
-Sonar
-Hydraulic Interfaces
-Electric Tool Interfaces

Telemetry
- Realtime Video Channel (8)
-Spare Fiber Optic Wavelengths (4 total)
-Devoted Serial Channels for Gyro, Digiquartz
-Standard survey interfaces 12 (8 x RS232 4 x RS485)
Various options up to 44 serial channels
-Voltage feedback for input power and all switching controls
-Current sensing on each channel
-1 Gb Ethernet survey mux
-Various AC and DC sensor with up to 42 power channels

Power Distribution
-215 KVA Transformer for Vehicle Hydraulics (1)
-8.5 KVA Transformer for Vehicle Electronics (1)
-15 KVA Transformer for TMS-HPU (1)
-2 KVA Transformer for TMS Electronics (1)
-Ground fault detection circuits
-Deck cable interface
-CB, OL and current/voltage sensor

Control System
-Utilizes the evolutionary ICE™ Integrated Control Engine
-Fully redundant Windows® based HMI Computers
-Dedicated real-time controllers
-Intuitive Graphic User Interface (GUI)
-Advanced graphical interactive diagnostics
-User configurable GUI
-Ergonomic pilot/co-pilot control consoles and touch screen control interfaces
-4 x 40" HD Plasma video wall

System Options

Main Umbilical
-Armored/Soft

Surface Handling
-'A' Frame/Winch to Customer specification

Control Cabin
-Certified/Zone Rated

Control Console
-Advanced Console or Integrated Chair Control
-Video Wall (Four 40" LCD Monitors)
-Surface Communications
-Manipulator Control

Tether Management System
-Tophat or Garage
-350 or 650 m Tether (Tophat)
-750 or 1000 m Tether (Garage)

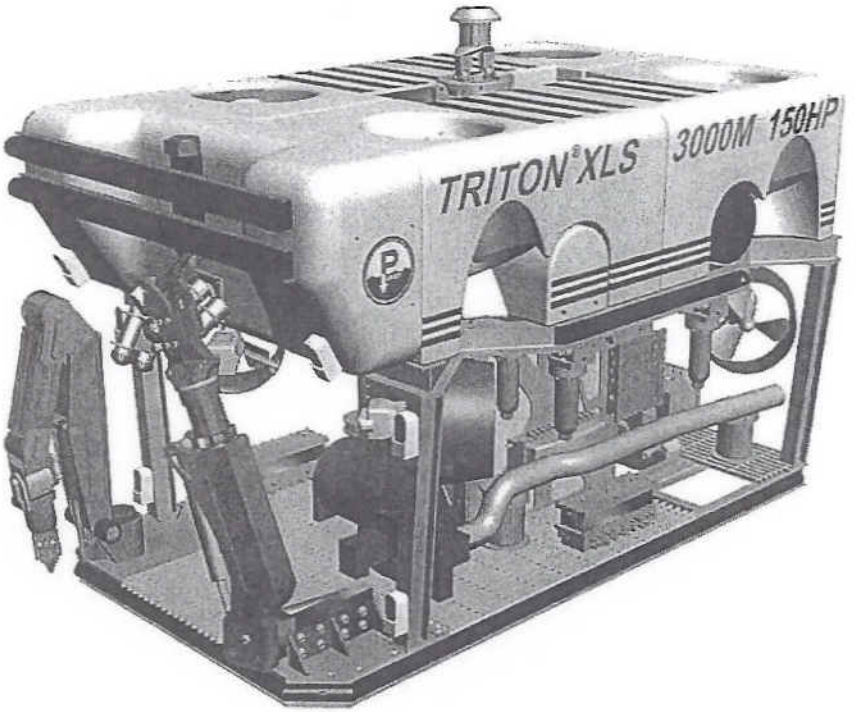
Workskids
-Survey & Bathymetric suites
-Suction Pile
-Variable Ballast
-Jetting Module
-Tool Interface Module
-Telemetry

Data Sheet: A001-350-078 Issue 2

The specification details are illustrative for marketing purposes only. Actual equipment may be different as a result of product improvement or other reasons. Specific interface and performance information should be reconfirmed at time of order placement.

TAB 8.C

Triton® XLS



Heavy Duty Work Class ROV	
Depth Rating	3000/4000 m
Power	150 HP
Through Frame Lift	3000 kg
Control System	Single Mode Fiber Optic PC Based
Payload Capacity	300 kg

Specifications

Dimensions

Length	3000 mm
Width:	1850 mm
Height:	1890/4000 mm
Depth Rating:	3000/4000 m
Weight in Air:	4400 kg
Payload Capacity:	350 kg
Power Pack:	100/150 Shaft HP
Thrusters Horizontal:	4 x 380 mm ∅
Thrusters Vertical:	4 x 305 mm ∅
Bollard Pull (Nominal)	
Forward:	1100 kgf
Lateral:	1100 kgf
Vertical (up):	1130 kgf
Lift Capacity:	3000 kg

Standard Fit
-Gyro/Fluxgate Compass
-Pitch/Roll Sensor
-Digiquartz Depth Gauge
-Auto Functions (Heading/Depth/Altitude/Position)
-General Function Valve Pack (10 Function)
-Lighting System (3000 watts total)
-Doppler Velocity Logger-ROV DP

Interfaces For
-Manipulator (Left/Right)
-Sonar
-Hydraulic Tool Interfaces

Telemetry
-Real-time Video Channels (8)
-Spare Fiber Optic Interface Card Slot (2)
-Customer Solenoid Valve Drivers (Pre-wired) (9)
-Customer Digital Out (8)
-Customer Digital In (8)
-Customer Analog Out (8)
-Customer Analog In (8)
-Full Duplex RS232 @115pbs Data Channels (4)
-Full/Half Duplex RS485/422/232 @115pbc Channels (4)
-Voltage meters for input power and all switching controls
-Auto Fiber Switch to Spare Fiber

Power Distribution
-140 KVA Transformer for Vehicle Hydraulics (1)
-6.5 KVA Transformer for Vehicle Electronics (1)
-7.5 KVA Transformer for TMS-HPU (1)
-Ground Fault Detection Circuits
-Deck Cable Interface

Available Equipment
Four Function Thruster Manifold (proportional valves) (2)
Ten Function Auxiliary Valve Manifolds (2)
High Flow Proportional Hydraulic Manifold
500 watt lights on dimming circuits available (6)
Circuits w/2x250 watt lights per standard (6)
Pan and Tilt - Standard (1)
High Accuracy Sensor, 0.1% over full scale for depth control (auto depth) and depth determination
Pressure/flow Control Manifold
High Flow Proportional Hydraulic Manifold

SYSTEM OPTIONS
-Main Umbilical
-Armored/Soft
-Surface Handling
-'A' Frame/Crane System
-Winch to Customer Specification
-Control Cabin
-Certified/Zone Rated
-Control Console
-2 to 5 Bay Ergonomically Designed
-Graphics/Vision/Sonar Monitors
-Video Overlay/Switching/Recording
-Surface Communications
-Manipulator Control
-Tether Management System
-Tophat or Garage
-635 Meters Tether (Tophat)
-750 Meters Tether (Garage)
-3000/4000 Meters Depth Rating
-Workskids
-Survey & Bathymetric suites
-Suction Pile
-Variable Ballast
-Jetting Module
-Tool Interface Module

Data Sheet: A001-350-055 Issue 4

The specification details are illustrative for marketing purposes only. Actual equipment may be different as a result of product improvement or other reasons. Specific interface and performance information should be reconfirmed at time of order placement.

TAB 8.D

ROVs and Trenchers

Experience, Dedication, Vision

PERRY SLINGSBY SYSTEMS

A MEMBER OF THE TRITON GROUP

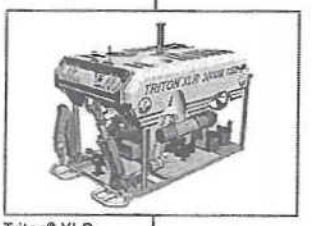
Triton® XLR (Medium-Duty Work Class)

The Triton® XLR is designed to provide a "medium-duty, work-class solution" for applications in the 75HP to 125HP range. Building upon Triton XLX, the XLR offers a common design basis with common components. Triton XLR offers an economical option for applications such as diver support, drill support, trenching support, or supporting Triton XLX operations.

TXLR features:

- 25HP auxiliary system
- Tooling manifold
- Survey system
- Fully integrated with the next-generation Type IV TMS
- Graphical diagnostics within the ICE control system

The Triton XLR is available in either a 3,000 or 4,000-meter version, both having a 150kg payload, depending on configuration and the capacity for a 1,000kg work package interface.



Triton® XLR

Triton® XLS

Triton® XLS

With over 60 systems delivered and a proven history in reliability and efficiency, the Triton® XLS is currently the world's most successful, advanced work-class ROV. Building on the success of the Triton series, the XLS incorporates more thrust, payload and space; features that clients have been quick to capitalize on.

All components and controls are proven PSS or Triton® designs, with their inherent reliability and robustness. Eight high-performance thrusters (four vertical and four horizontal) provide symmetrical thrust in all directions. With the highest standard payload of 250kg wet weight (with standard equipment and manipulators installed) and the largest inside frame volume, the Triton XLS can carry more sensors and tooling than ever before. The control system features additional serial I/O (eight channels, expandable to 16) and video (eight channels) for more sensors and cameras in a single canister design.

The 3,000kg lifting capability of the Triton XLS provides the platform for a wide variety of tooling modules, including the most advanced pipeline connection systems and trenching skids. The vehicle is equipped with all the power delivery, instrumentation and telemetry management systems to support turnkey construction operations in virtually any water depth.

Triton® XLS working underwater

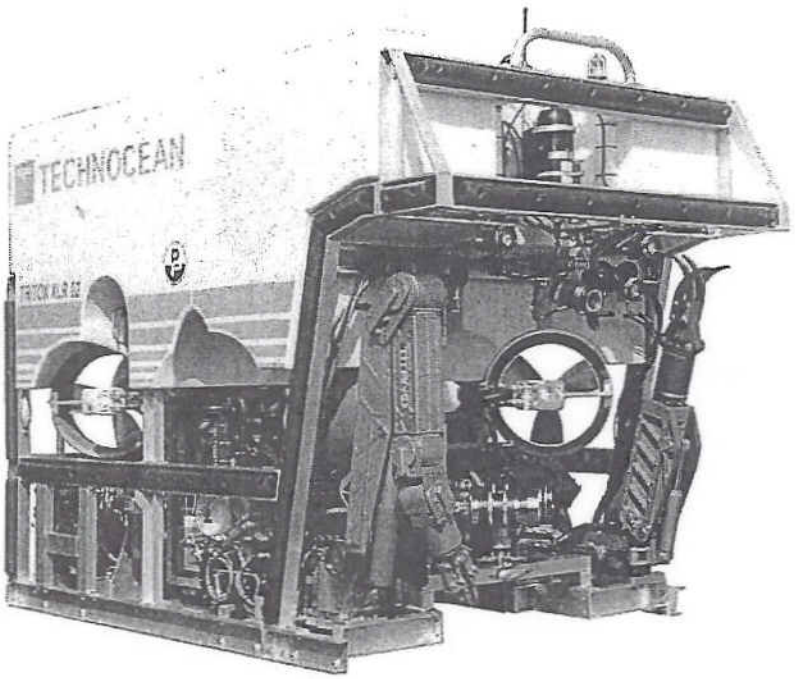
Triton® XLX Pilot Chairs

Outline Vehicle Specifications

ROV Systems	TRITON® XLX	TRITON® XLR	TRITON® XLS
General			
Depth Rating (msw)	3,000-4,000	3,000-4,000	3,000-4,000
Power (SHP)	150-250	75-125	100-150
Payload Capacity (kg)	250-550	150	250
Vehicle Size & Weight			
Width (mm)	1,803	1,350	1,778
Length (mm)	3,226	2,490	3,300
Height (mm)	2,000/2,140	1,600/1,720	1,940
Vehicle Weight (kg)	4,800/5,500	2,650/3,000	4,500/5,200
Through Frame Lift (kg)	3,000	1,000	3,000
Bollard Pull & Thrusters			
Forward (kgf)	1,100	620	950
Lateral (kgf)	1,100	620	950
Vertical (Up) (kgf)	900	475	1,040
Thrusters Horizontal (mm)	4 x 380	4 x 300	4 x 380
Thrusters Vertical (mm)	4 x 300	2 x 300	4 x 300
System Infrastructure			
Control Cabin	Certified/Zone Rated		
Telemetry	Single Mode		
Camera Interfaces	8+	8	8
Lighting Interfaces	12 x 250W	8 x 250W	12 x 250W
Subsurface Handling	TMS/Cage	TMS/Cage/Garage	TMS/Cage
Surface Handling	"A"-frame/Crane System/Winch to Customer Specification		

TAB 8.E

Triton® XLR - Intervention ROV (IROV)



Triton XLR in 3000m configuration

- Submarine rescue "first response"
- Equipment salvage
- Cutting, lifting, survey
- Subsea investigations
- Compact & powerful
- Commercial standard
- Interface to all underwater survey equipment
- Station-keeping in 3 knot currents

Intervention ROV	
Depth Rating	2000 / 3000 / 4000 msw
Power	125 hp
Through Frame Lift	2000 kg with option for 3000 kg
Control System	ICE™ Real Time Control System with GHz Optical Link, Ethernet Telemetry and Graphical Diagnostics
Control Modes	Heading, Depth, Altitude and Auto Position™
Payload Capacity	150 kg with option for 250 kg

Specifications

Dimensions	
Length:	2500 mm (including manipulators)
Width:	1700 mm
Height:	1700 mm (2000m option)
Weight in Air:	2900 – 3600 kg
Payload Capacity:	150 kg (250 kg option)
Through Frame Lift:	2000 kgf (3000 kgf option)
Power Pack:	125 hp (shaft)
Thruster Horizontal:	4 x 380 mm ∅
Thruster Vertical:	3 x 380 mm ∅
Auto Heading Control:	± 2.0 degrees
Auto Pitch and Roll Control:	± 5.0 degrees
Auto Depth Control:	± 150 mm
Auto Altitude Control:	± 150 mm

Bollard Pull (Nominal)	60Hz supply	50Hz supply
Forward:	>850 kgf	>740 kgf
Lateral:	>850 kgf	>740 kgf
Vertical:	>565 / 850 kgf	>500 / 745 kgf

Surface Speed (Nominal)	60Hz supply	50Hz supply
Forward:	3.7 knots	3.5 knots
Vertical:	2.8 / 3.5 knots	2.6 / 3.3 knots

Standard Equipment
-Near SIT (1), Colour Zoom (1), Fixed B/W (1) Cameras
-Tritech Super SeaKing Sonar and SCU
-Tritech Intelligent Gyro Compass incl. Pitch & Roll Sensing
-Digiquartz Depth Sensor
-Auto Functions (Heading, Depth, Altitude, Auto Position)
-6 x 250W AC Light (Dimmable in Pairs)
-Hydraulic Pan & Tilt Unit
-12 Station Main Manifold,15 lpm DCV or 8 lpm Proportional DCV
-Piloted Hi-Flow Tooling Manifold, 2 off 80 lpm tooling outlets
-7 Function Manipulator (Right)
-5 Function Grabber (Left)

Standard Video, Telemetry & Power Channels
-Standard Realtime Composite Video Channels (8)
-Total Channels: Serial (18), Switched Power (16)
-Dedicated Serial & Power Channels for Gyro, Digiquartz, Altimeter/DVL, Sonar, Manip, Responder Trigger, Manifolds

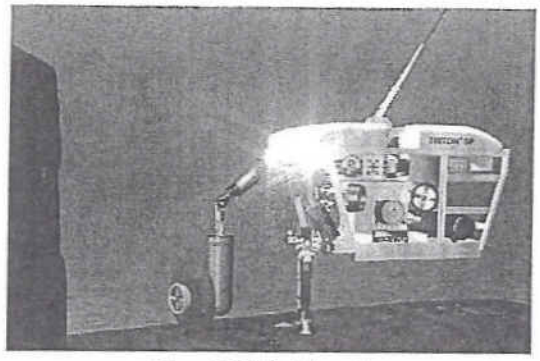
Control System
-Utilizes the revolutionary ICE™ Integrated control engine
-Intuitive Graphic User Interface (GUI)
-Video Wall (2 x 40" HD LCD Monitors)

Main Umbilical
-Armoured/Soft

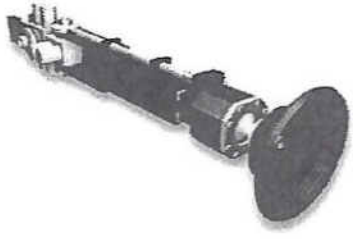
Surface Handling
-'A' Frame/Crane System and Winch to Customer specification

Tether Management System
-Top-hat or Garage types
-440m dia. 35mm or 750m dia. 27mm Tether (Type 4 TMS)

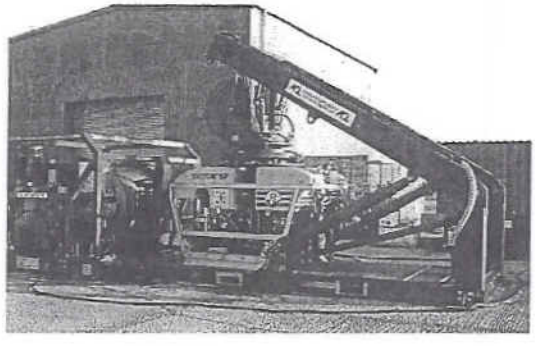
Data Sheet: A001-350-094 Issue 1



The IROV delivering ELSS pods to a DISSUB



PSS suction foot option - Effective grip on smooth hulls - one of many standard tools available



IROV configured with an ultra compact surface handling system For air transport worldwide (example of NATO IROV)

The specification details are illustrative for marketing purposes only. Actual equipment may be different as a result of product improvement or other reasons. Specific interface and performance information should be reconfirmed at time of order placement.

TAB 9.A

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Powerful things come in small packages....

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CUSTOMER SURVEY

About sub-Atlantic

Since our formation in 1997, Sub-Atlantic Limited has emerged as the market leader in the design and manufacture of small to medium sized Electric ROV Systems and also ROV Thrusters and Components that are used in the manufacture of hydraulic work-class ROVs.

We have achieved this valued position through a mixture of innovation, determination and hard work, but more so, listening to our customers and translating their needs back into our products.

Sub-Atlantic products are about Reliability and Simplicity, providing to our Customer's the means to minimise operational costs and maximise profit. Our new Mohican and Comanche are setting new standards in electric ROV performance. The 3000 Volts, 400 Hertz transmission system allows these vehicles to operate over very long, but small diameter cables. The Comanche has been supplied in a 6,000 metre / 20,000 feet configuration.

Our Hydraulic Thrusters sales are testimony to their performance and reliability, being supplied to the vast majority of Work-Class ROV builds around the World.

We are located in the United Kingdom in the City of Aberdeen which is regarded as Europe's Oil Industry capital. Located in a modern, purpose built manufacturing facility, we are in a prime location to support our North Sea customers and support our international customers through our worldwide network of distributors and services centres.

LATEST NEWS

Sub-Atlantic Wins Major Contract for Leading European Scientific Project

World leading ROV manufacturer Sub-Atlantic Ltd has won a contract to supply a Comanche ROV system for scientific research in a deal worth just over £1million....

Record week for Sub-Atlantic Ltd as sales top £2.5million

Sub-Atlantic Ltd has netted orders for six electric remotely operated vehicle (ROV) systems with five different international customers during an unprecedented week of sales activity....

PRODUCT QUICK FIND

NEW Products

ROV Comparison
- Mojave
- Navajo
- Mohawk
- Mohican
- Super Mohawk
- Comanche

Tether Management Systems
- Tether Management System - Cage Type Size 1, 2 & 3

Thrusters
- Hydraulic Thrusters
- Brushless DC Electric Thrusters
- Brushless AC Electric Thrusters
- Thrusters Guards

Hydraulic Products
- Hydraulic Power Unit - 15-280 kW
- Hydraulic Power Unit - 1.3 Kw
- Valve Pack / HPU Combined - 6 Station Solenoid
- General Function Valve Pack
- Servo Valve Pack - 8 Station
- Compensators - 270cc, 370cc, 860cc & 2700cc
- Compensator / Reservoir - 13.5 Litre
- Dirty Oil Pack (IHPU)

Pan & Tilt Units
- Pan & Tilt Unit - 24 Vdc and 110 Vac
- Rotator / Tilt Unit - 24 Vdc
- Rotator Actuator - 24 Vdc x 50 Nm Torque

Control Systems
- subCAN - Available for Upgrade to Comanche and Mohican Systems

Tooling and Accessories
- Manipulator Skids
- Torque Tool Skids
- Pipeline Survey Skids
- Cleaning / Manipulator Skids
- Cleaning Brushes - 440 Vac, 300 Vdc and 600 Vdc

MOJAVE COMANCHE MOHICAN SUPER MOHAWK MOHAWK NAVAJO subCAN

UKPS DPS OFFSHORE vmax SEAFLOOR VisualSoft

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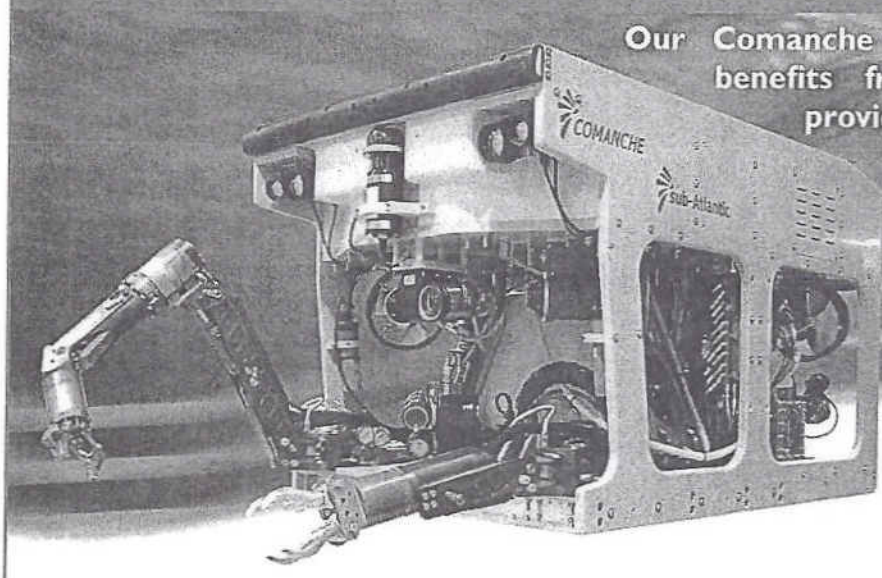
TAB 9.B

COMANCHE Small Work ROV System



Our Comanche Work-Class electric ROV benefits from enhanced capabilities provided by a powerful control system, proportional work-class manipulator arms, tooling hydraulic system, survey interfaces and generous payload capacity

- **Two 7 Function Work-Class Manipulator Capability**
- **2,000 / 3,000 / 6,000 Metre (6,500 / 10,000 / 20,000 Feet) Depth Ratings**
- **3000 Volt, 400 Hz Power System**
- **Long, Small Diameter, Low Drag Tether Capability**
- **15 kW / 20 HP Hydraulic Power Unit**
- **12 or 16 Station GFVP**
- **Seven 100 kgf / 220 lbf Brushless DC Thrusters using Statorshield™ Technology**
- **Auto-Functions**
- **Up to 250 kg / 550 lbs Payload**
- **Multiple Video Channels**
- **Multi-Sensor Interface**
- **Deep Live Boat or TMS Operation**
- **New SubCan™ Control System**

Comanche incorporates a fully electric, seven thruster propulsion system, configured to provide high thrust and lifting capability. It uses a 3000 Volt, 400 Hz power transmission system from surface to ROV resulting in a small tether, main lift cable and launch/recovery system. This transmission system makes it particularly suited for long tether excursions and deep live-boating operations. Comanche is equipped with additional power sources to allow the use of a 15 kW / 20 hp hydraulic power unit for running tools and work skids and for rig support intervention tasks. When compared with hydraulic work-class systems, the Comanche provides important customer benefits with regard to capital and operational expenditure, simplicity of use and requires less deck space.

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Live Boat or TMS Operation

The Comanche can be free-flown in 'live boating' mode or with our cage type TMS systems (see TMS data sheet). The small diameter tether allows long cable excursions.

Compact Control

Surface equipment consists 3 units

- Surface Control Unit (SCU)
- Hand Control Unit (HCU)
- PDU (Power Distribution Unit).

The SCU is generally supplied as a portable flight case system. Alternatively, the 8U x 19" rack mount control module can be supplied loose for fitting into customers own control rack.

The HCU (top), SCU (left) and PDU (right) are compact for operation in small control spaces. The three units are linked by interconnecting cables with plugs and sockets

Comanche System Specification

ROV General Specification

Depth Rating	2000 msw (6560 fsw) standard (deeper options)
Payload (2000msw exc. manipulators)	185 kg (410 lb) standard to 250kg (551 lbs) lead ballast
Height	1250 mm (49.2 in.)
Length	2100 mm (82.7 in.)
Width	1300 mm (51.2 in.)
Mass in Air (2000msw)	based on 185 kg (410 lb) payload - 1130 kg (2490 lb)
Max. Thrust @ 0 Knots with zero voltage losses:	
Forward	225 kgf (496 lbf)
Reverse	225 kgf (496 lbf)
Lateral	225 kgf (496 lbf)
Vertical	up to 225 kgf (496 lbf)
Max.Velocity/Operational Current (zero tether excursion):	
Forward	1.5 m/s (3.0 Kt)
Reverse	1.5 m/s (3.0 Kt)
Lateral	1.25 m/s (2.5 Kt)
Vertical	0.75 m/s (1.5 Kt)
Turning Rate	120 Degrees per Second (approx)
ROV Power Requirements	440 Vac 3ph 50/60 Hz 35 kVA
Thrusters	7 Total, 4 vectored horizonals and 3 verticals
Pan & Tilt Unit	1 x Electric Heavy Duty
Tilt Unit	1 x Electric Heavy Duty
Auxillary Hydraulic System	4 kW (5.3 HP) or 15 kW (20 HP) options
Valve Pack	12 or 16 Station General Function Valve Pack
Manipulator 1	Orion 7-Function with Rate or Proportional Control
Manipulator 2	Orion 4 or 7-Function Rate Control
ROV Control System	SubCan
Frame	Polypropylene with aluminium alloy central load frame

Surface Equipment General Specification

SCU

Height	355 mm (14.0 in.)
Width	483 mm (19.0 In.)
Depth	450 mm (17.7 In.)
Mass	12 kg (27 lb)
SCU Power Requirements	220/240 Vac 50/60 Hz 2 kVA

HCU

Height	160 mm (6.3 in.)
Width	480 mm (18.9 In.)
Depth	230 mm (9.1 In.)
Mass	1.5 kg (3 lb)

TPU

Height	650 mm (25.6 in.)
Width	630 mm (24.8 In.)
Depth	505 mm (19.9 In.)
Mass	(approx.)50 kg (330 lb)

Tether and Main Lift Cable Dimensions

Tether (standard)	25.5 mm / 1.0 in. diameter
Main Lift Umbilical (standard 3000 Volt system)	25.5 mm / 1.0 in. diameter

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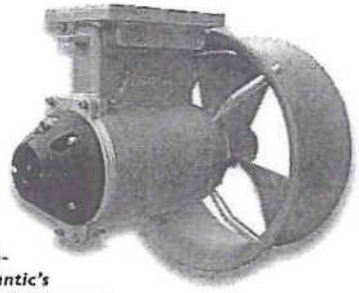
Reliable Thrusters

Comanche uses a 7 thruster configuration to provide maximum horizontal and vertical lifting capability.

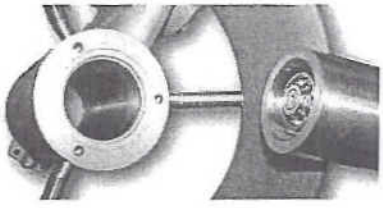
- 4 x SPE250 horizontal thrusters in a 45 degree vectored configuration producing very high all round thrust.
- 3xSPE250verticalthrusters,2vectored outward at front to clear the vehicle lower deck (leaving it free of cut-outs in way of tools and skids) and a single pitch thruster at the rear to counteract manipulator loading effects.



Sub-Atlantic's SPE250 high-reliability brushless DC thruster develops 100 kgf (220 lbf) of static thrust in both directions. It incorporates our unique 'Statorshield™ technology that allows the thruster to continue working in the event of water ingress past the shaft seal.

Statorshield™ Technology Equates to Reliability

Subsea thrusters are prone to water entering through the shaft seals and causing short circuit failure of the stator windings . Statorshield™ technology eliminates this



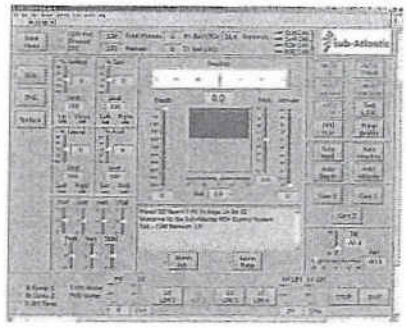
problem by the introduction of an internal sealed diaphragm located between the rotor and stator, creating two separate isolated and sealed volumes (Rotor cavity and Stator cavity). Water cannot reach the stator and electronics through the shaft seal preventing a catastrophic failure due to shaft seal leakage. Operation can continue until the machine is recovered when the rotor cavity can be flushed, seals replaced and refilled with oil.

SubCan™ Control System

Comanche deliveries from 2008 will include our newest technology SubCan™ control system.

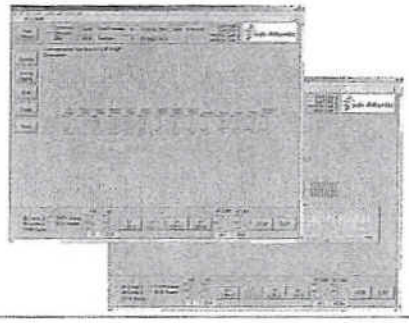
Simple, Intuitive Control GUI

The topside graphical user interface and the hardware controller are designed in such a way as to enable the operator to control the ROV in the simplest and most effective manner. ROV control



feedback such as heading, pitch, roll, etc. are displayed on a 17 inch touch screen monitor. The touch screen also enables the operator to access setup and diagnostic information relating to the inner workings of the control system. The GUI pages are arranged in a hierarchical order with the top page providing the 'day to day' control of the ROV. The top page displays various alarm information for rapid fault diagnosis of the control system sub-assemblies and components. Diagnostic information from each control sub-system, ROV, TMS and Surface can also be accessed from this page.

The status of the surface and sub-sea communication can be monitored from certain GUI pages. At the most detailed level, information regarding the control system health is available on various GUI pages. For example the individual voltages, currents and temperatures can be

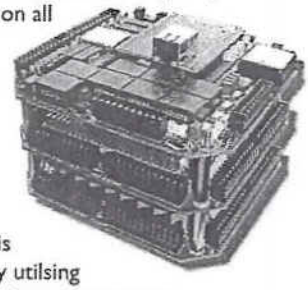


monitored for each of the main control system PCBs.

Robust, Flexible and Compact Electronics

The subsea part of the control system consists of three stacked PCBs that are expandable to increase capacity. The basic stack provides the following capacity:

The printed circuit boards (PCB) are protected on all I/O from over voltage, reverse voltage and over current. This is achieved by utilsing transient voltage suppressors, fuses, self healing fuses and internally protected high side drivers.



Hub PCB

1 off Ethernet 10/100 BaseT.
1 off RS485/RS232 to 115200 Baud.
4 off RS232 to 115200 Baud.
3 off CAN (Controller Area Network) to 1M bit/s
4 off switch-able power channels, 8 amps each, to 24VDC.
Isolate-able ground fault system.
Single axis rate gyro.

I/O PCB 1

1 off RS485/RS232 to 115200 Baud.
1 off RS232 to 115200 Baud.
2 off CAN (Controller Area Network) to 1M bit/s.
12 off analogue outputs, +/-10VDC @ +/-5ma, 16 bit resolution.
24 off digital outputs, 24VDC @ 1 amp, high side driver, maximum 20 amps.
4 off solid state relay outputs, +/-15VDC and high impedance, 100mA.
8 off analogue inputs, +/-10VDC, 0-5VDC software selectable, 12 bit resolution.
16 off digital inputs, contact closure to activate.
5V supply to 100mA.

I/O PCB 2

1 off RS485/RS232 to 115200 Baud.
1 off RS232 to 115200 Baud.
2 off CAN (Controller Area Network) to 1M bit/s.
16 off relay outputs, SPDT, NO, NC, C, 250VAC to 5 amps.
16 off analogue inputs, +/-10VDC, 0-5VDC software selectable, 12 bit resolution.
5V supply to 1A.

Common to all PCBs

Up to 16 jumper selectable addresses.
Voltage current and temperature feedback.
All the communication, power and I/O channels are over voltage and over current protected.

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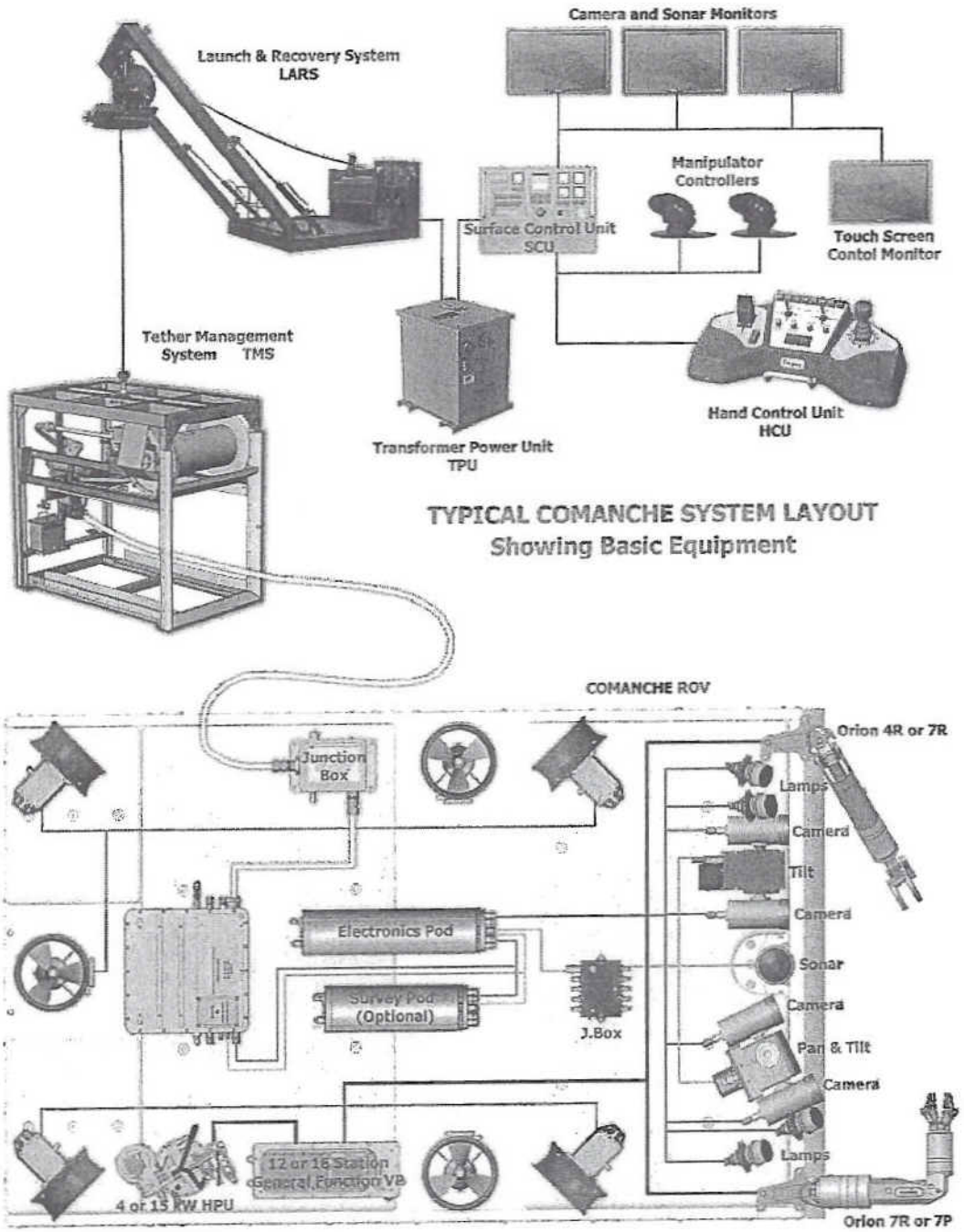
The Sub-CAN control system is a modular design based around the multi-drop network CAN (Controller Area Network). Modules can be added or taken away depending upon the control system requirements; providing commonality of parts and spares.

Robust Communication Link

Communication between the topsides software and the main sub-sea control system PCB employs a 16 bit CRC (cyclic redundancy check) to ensure maximum robustness of communicated instructions and feedback.

Increased Diagnostic Feedback

The Sub-CAN control system provides diagnostic feedback of voltage, current and temperature on each individual control system PCB as well as ground fault detection on both high and low voltages, enabling rapid fault finding.



TYPICAL COMANCHE SYSTEM LAYOUT
Showing Basic Equipment

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Fibre Optic Telemetry

Surface/ROV communication is via a Focal 907plus telemetry module. This fibre optic module incorporates 4 x video, 4 x RS233 and 2 x RS485 for transmission through a single firbe. Ethernet, ECL and other various telemetry interfaces are also available. Additional modules can be added to increase capability.

Electronics Pod

All the main vehicle electronics are housed in a single 3,000 metre / 10,000 feet rated pressure pod with electrical and fibre connectors fitted on one of the end caps. The internal electronics rack is fitted to the end cap and is quickly removable for fast access.

Survey Pod

Comanche can be supplied with a survey pod which allows easy intefacing of multiple sensors to the ROV. The survey pod includes multiple electrical connectors for RS232, RS485 and power. The pod is generally configured to suit specific customer requirements.

Lighting

- 4off250-Watthalogenlamps,dimmer controlled on 2 circuits with a fast access lamp fuse pod.
- Additionallightingsuchas HID can be provided.

Camera Facilities

- Tilt unit.
- Pan & Tilt Unit.
- 3 - simultaneous video channels per telemetry module.

Junction Box

- A dedicated junction box is provided for the fast re-termination of the tether.

Vehicle Power Outlet

- The transformer box provides a 600 Vdc power outlet to drive external equipment up to 715 kW (20 hp).
- Optional drive pod can be supplied to drive ac motors.

Frame

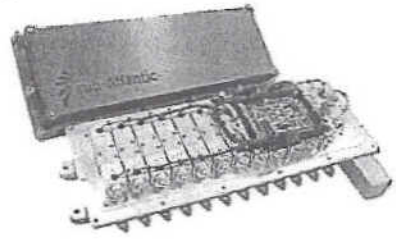
- High impact resistance & buoyant polypropylene.
- Central load frame in aluminium alloy suitableforallmanipulatorloadingsand through-frame-lift of 0.75 Tonnes
- Optional bullet for live-boating.

Buoyancy

- Fourseparatemoduleswithclosedcell micro-spheres,
- Rated 2000 msw (6560 fsw).
- Options to 6000 msw / 19,680 fsw.

Hydraulic System

Comanche can be supplied with either a 4kW/5.4HP or 15 kW/20HP hydaulic systems with 12 or 16 station valve packs.



12 Station General Function Valve Pack.

Manipulators

The frame is designed to accept 2 x Schilling Orion manipulators, generally configured with 1 x 7-Function proportional or rate arm and 1 x 4-Function rate grabber.

Surface Equipment

SCU (Surface Control Unit)

- 2 off 15"TFT Colour monitors
- Light dimmers
- Automaticdepth,headingandaltitude controls
- Tether/Umbilical turns counter
- Video overlay system
- Earth leakage protection system

HCU (Hand Control Unit)

- 2 x control joysticks
- Light dimmer controls
- Camera and Tilt controls
- Digital switches
- Auto-function control
- Joystick trims
- Thruster power trims
- TMS tether pay in/out

PDU (Power Distribution Unit)

- Power inverter and filtering
- 3000 Volt transformer
- Line insulation current monitor
- Deck cable entry gland

Tether

- The Comanche uses an 21 mm / 0.83 in. diameter tether. A larger neutral tether is also available.

Main Lift Umbilical

- Sub-Atlantic ROVs use a common 25.5 mm / 1.0 in. diameter umbilical suitableforallouropenframevehicles, simplifyingsparesandinterchangeability between systems.

Sensors & Equipment

The Comanche ROV system will support a range of sensors and equipment, typically:-

- Cameras, Sonar's, Oceanographic Sensors,
- Work class hydraulic manipulators
- Tool skids, survey skids, hydraulic power units to 15 kW / 20 hp, torque tools,.

Tether Management System

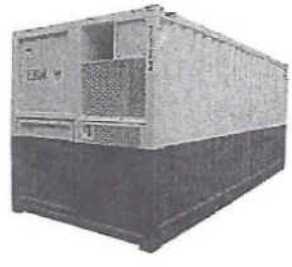
Available in three sizes, Sub-Atlantic's cage type TMS is reknown in the industry for ruggedness, reliability and simplicity.

- Size 3 suitable for Comanche
- 500 metres capacity of 21 mm diameter tether
- Stainlesssteeltelescopicframeallowing underslung tool skids on ROV
- Fully electric, single drive motor

Refer to Cage Type TMS data sheet.

Launch & Recovery Systems and Control Cabins

- Launch and recovery systems can be supplied to different depth requirements and formats.
- Various sizes and configurations available
- A60 and Zoned specifications



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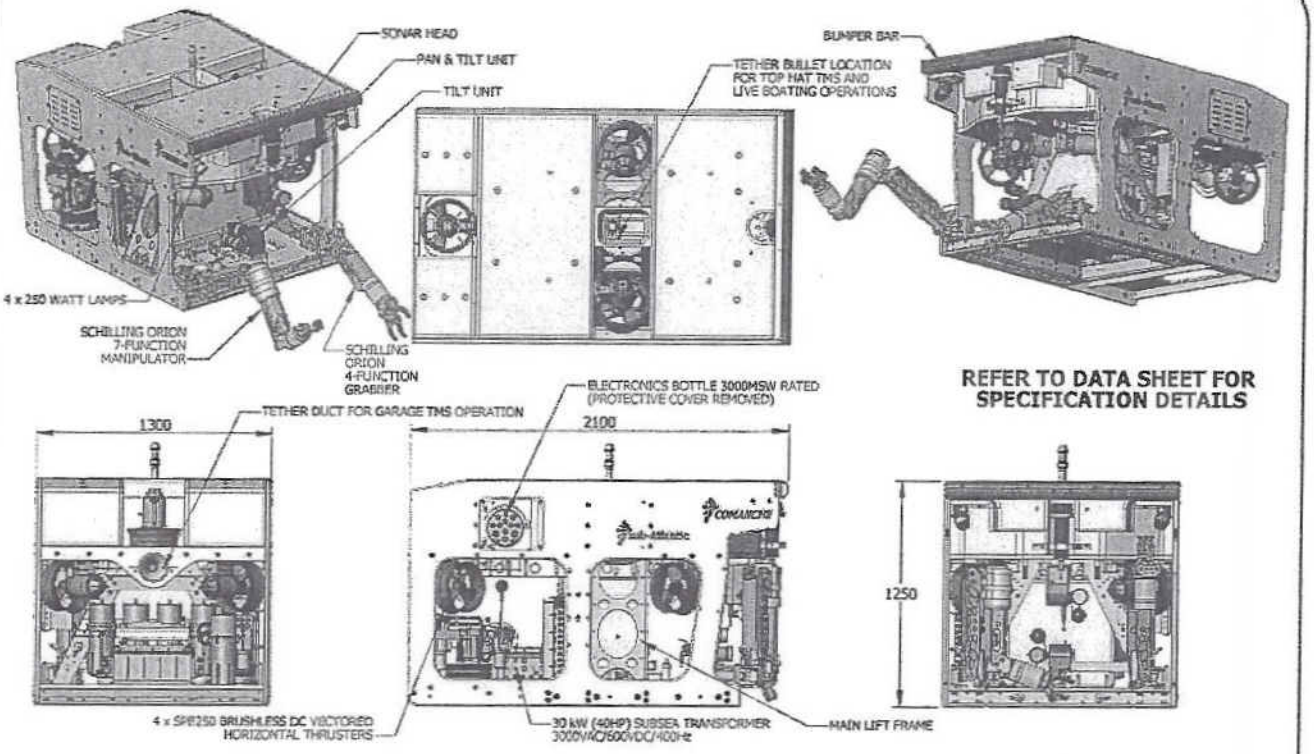
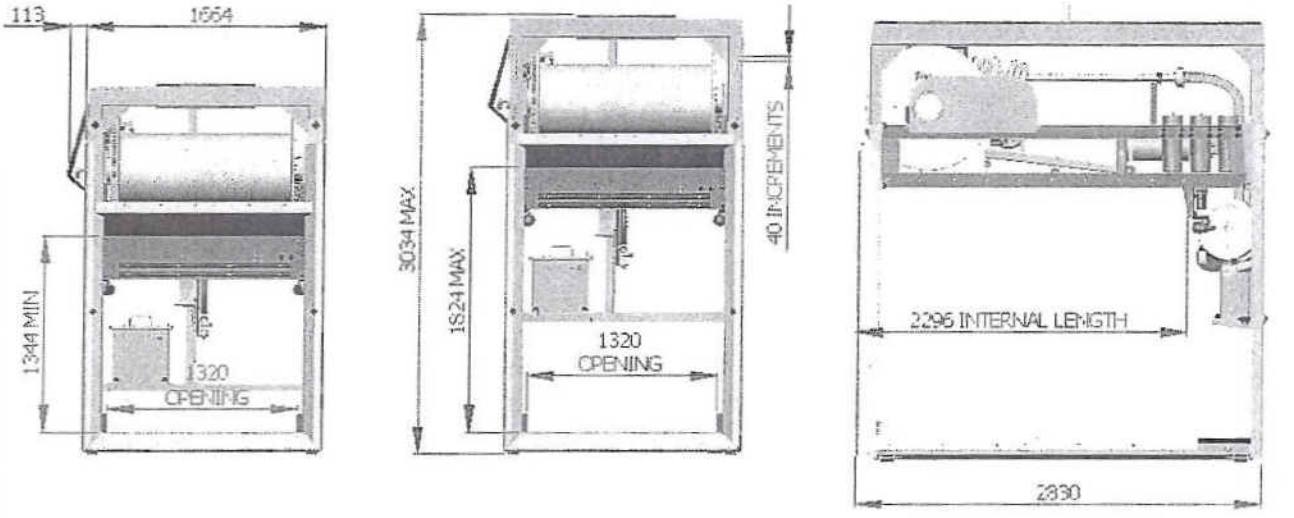


REFER TO DATA SHEET FOR SPECIFICATION DETAILS

Comanche ROV Dimensions



Size 3TMS Dimensions

The specification details are illustrative for marketing purposes only. Actual equipment may be different as a result of product improvement or other reasons. Specific interface and performance information should be reconfirmed at time of order placement.

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T: +44 1224 798660 **F:** +44 1224 798661 **E:** sales@sub-atlantic.co.uk

Sub-Atlantic Inc. 10642 West Little York, Suite 100, Houston, TX 77041-4014-USA
T: +1 713 329 8730 **F:** +1 713 329 8299 **E:** sales@sub-atlantic.com

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CONSTRUCTION AND ENGINEERING

February 04, 2011 12:28 PM ET

Sonsub AS

Snapshot | People

COMPANY OVERVIEW

Sonsub AS provides subsea construction services to the offshore oil and gas industry. The company develops, manufactures, and operates a fleet of remotely operated vehicles, remote intervention systems, and construction equipment for providing subsea field development, inspection, repair, and maintenance services. The company was incorporated in 1992 and is based in Sola, Norway. Sonsub AS operates as a subsidiary of Saipem SpA

Vingvegen 1
Sola, 4050
Norway

Phone: 47 51 64 99 00
Fax: 47 51 64 99 01

Founded in **1992**

KEY EXECUTIVES

Sonsub AS does not have any Key Executives recorded.

SIMILAR PRIVATE COMPANIES BY INDUSTRY

Company Name	Region
Risa AS	Europe
Maritime and Mechanical Technology	Europe
Semar AS	Europe
Asane Byggmesterforretning As	Europe
Kb Gruppen Kongsvinger As	Europe

RECENT PRIVATE COMPANIES TRANSACTIONS

No transactions available in the past 12 months.

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Business-to-Business Marketing
Small Business Marketing
Cross-Cultural Marketing
Social Media Marketing
Affiliate Marketing

Stock Quotes

Stock, Fund, or ETF Go Company Lookup

ADS BY GOOGLE

TAB 10.B

EXHIBIT 8

List of Eni's subsidiaries for year 2009

Subsidiary	Country of Incorporation	Eni's share of net profit (%)
EXPLORATION & PRODUCTION		
Eni Angola SpA	Italy	100.00
Eni East Africa SpA	Italy	100.00
Eni Medio Oriente SpA	Italy	100.00
Eni Mediterranea Idrocarburi SpA	Italy	100.00
Eni Timor Leste SpA	Italy	100.00
Ieoc SpA	Italy	100.00
Società Adriatica Idrocarburi SpA	Italy	100.00
Società Ionica Gas SpA	Italy	100.00
Società Oleodotti Meridionali - SOM SpA	Italy	70.00
Società Padana Energia SpA	Italy	100.00
Società Petrolifera Italiana SpA	Italy	99.96
Tecnomare - Società per lo Sviluppo delle Tecnologie Marine SpA	Italy	100.00
Agip Caspian Sea BV	Netherlands	100.00
Agip Energy and Natural Resources (Nigeria) Ltd	Nigeria	100.00
Agip Karachaganak BV	Netherlands	100.00
Agip Oil Ecuador BV	Netherlands	100.00
Burren Energy (Bermuda) Ltd	Bermuda	100.00
Burren Energy Congo Ltd	British Virgin Islands	100.00
Burren Energy (Egypt) Ltd	UK	100.00
Burren Energy India Ltd	UK	100.00
Burren Energy Ltd	Cyprus	100.00
Burren Energy Plc	UK	100.00
Burren Energy (Services) Ltd	UK	100.00
Burren Resources Petroleum Ltd	Bermuda	100.00
Burren Shakti Ltd	Bermuda	100.00
Eni AEP Ltd	UK	100.00
Eni Algeria Exploration BV	Netherlands	100.00
Eni Algeria Ltd Sàrl	Luxembourg	100.00
Eni Algeria Production BV	Netherlands	100.00
Eni Ambalat Ltd	UK	100.00
Eni America Ltd	USA	100.00
Eni Angola Exploration BV	Netherlands	100.00
Eni Angola Production BV	Netherlands	100.00
Eni Australia BV	Netherlands	100.00
Eni Australia Ltd	UK	100.00
Eni BB Petroleum Inc	USA	100.00
Eni Bukat Ltd	UK	100.00
Eni Bulungan BV	Netherlands	100.00
Eni Canada Holding Ltd	Canada	100.00
Eni CBM Ltd	UK	100.00
Eni China BV	Netherlands	100.00
Eni Congo Holding BV	Netherlands	100.00
Eni Congo SA	Congo	100.00
Eni Croatia BV	Netherlands	100.00
Eni Dación BV	Netherlands	100.00
Eni Denmark BV	Netherlands	100.00
Eni Elgin/Franklin Ltd	UK	100.00
Eni Energy Ltd (in liquidation)	UK	100.00
Eni Energy Russia BV	Netherlands	100.00
Eni Gabon SA	Gabon	99.96
Eni Ganal Ltd	UK	100.00
Eni Gas & Power LNG Australia BV	Netherlands	100.00
Eni Ghana Exploration and Production Ltd	Ghana	100.00

Eni Hewett Ltd	UK	100.00
Eni India Ltd	UK	100.00
Eni Indonesia Ltd	UK	100.00
Eni International NA NV Sàrl	Luxembourg	100.00
Eni Investments Plc	UK	100.00
Eni Iran BV	Netherlands	100.00
Eni Iraq BV	Netherlands	100.00
Eni Ireland BV	Netherlands	100.00
Eni JPDA 03-13 Ltd	UK	100.00
Eni JPDA 06-105 Pty Ltd	Australia	100.00
Eni Krueng Mane Ltd	UK	100.00
Eni Lasmo Plc	UK	100.00
Eni LNS Ltd	UK	100.00
Eni Mali BV	Netherlands	100.00
Eni Marketing Inc	USA	100.00
Eni MHH Ltd (in liquidation)	UK	100.00
Eni Middle East BV	Netherlands	100.00
Eni Middle East Ltd	UK	100.00
Eni MOG Ltd (in liquidation)	UK	100.00
Eni Morocco BV	Netherlands	100.00
Eni Muara Bakau BV	Netherlands	100.00
Eni Norge AS	Norway	100.00
Eni North Africa BV	Netherlands	100.00
Eni Oil Algeria Ltd	UK	100.00
Eni Oil do Brasil SA	Brazil	100.00
Eni Oil & Gas Inc	USA	100.00
Eni Oil Holdings BV	Netherlands	100.00
Eni Pakistan Ltd	UK	100.00
Eni Pakistan (M) Ltd Sàrl	Luxembourg	100.00
Eni Papalang Ltd	UK	100.00
Eni Petroleum Co Inc	USA	100.00
Eni Petroleum US Llc	USA	100.00
Eni PetroRussia BV	Netherlands	100.00
Eni Popodi Ltd	UK	100.00
Eni Rapak Ltd	UK	100.00
Eni Resources Ltd	UK	100.00
Eni TNS Ltd	UK	100.00
Eni Transportation Ltd	UK	100.00
Eni Trinidad and Tobago Ltd	Trinidad & Tobago	100.00
Eni TTO Ltd	UK	100.00
Eni Tunisia BEK BV	Netherlands	100.00
Eni Tunisia BV	Netherlands	100.00
Eni UFL Ltd	UK	100.00
Eni UHL Ltd	UK	100.00
Eni UKCS Ltd	UK	100.00
Eni UK Holding Plc	UK	100.00
Eni UK Ltd	UK	100.00
Eni ULT Ltd	UK	100.00
Eni ULX Ltd	UK	100.00
Eni USA Gas Marketing Llc	USA	100.00
Eni USA Inc	USA	100.00
Eni US Operating Co Inc	USA	100.00
Eni Venezuela BV	Netherlands	100.00
Eni West Timor Ltd	UK	100.00
Eni Yemen Ltd (ex Burren Energy (Yemen) Ltd)	UK	100.00
First Calgary Petroleums LP	USA	100.00
First Calgary Petroleums Ltd	Canada	100.00
First Calgary Petroleums Partner Co ULC	Canada	100.00
First Calgary Petroleums UK Ltd	UK	100.00
Hindustan Oil Exploration Co Ltd	India	47.18
Ieoc Exploration BV	Netherlands	100.00
Ieoc Production BV	Netherlands	100.00
Lasmo Sanga Sanga Ltd	Bermuda	100.00

Nigerian Agip Exploration Ltd	Nigeria	100.00
Nigerian Agip Oil Co Ltd	Nigeria	100.00
OOO 'Eni Energhia'	Russia	100.00

GAS & POWER

Acqua Campania SpA	Italy	31.98
Compagnia Napoletana di Illuminazione e Scaldamento col Gas SpA	Italy	55.40
Eni Gas & Power Belgium SpA	Italy	100.00
Eni Gas Transport Deutschland SpA	Italy	100.00
Eni Hellas SpA	Italy	100.00
EniPower Mantova SpA	Italy	86.50
EniPower SpA	Italy	100.00
GNL Italia SpA	Italy	55.57
LNG Shipping SpA	Italy	100.00
Seacom SpA	Italy	100.00
Snam Rete Gas SpA	Italy	55.57
Società EniPower Ferrara Srl	Italy	51.00
Società Italiana per il Gas pA	Italy	55.57
Stoccaggi Gas Italia SpA - Stogit SpA	Italy	55.57
Toscana Energia Clienti SpA	Italy	100.00
Travagliato Energia Srl	Italy	100.00
Adriaplin Podjetje za distribucijo zemeljskega plina doo Ljubljana	Slovenia	51.00
Distribuidora de Gas Cuyana SA	Argentina	45.60
Distrigas NV	Belgium	100.00
Distri RE SA	Luxembourg	100.00
Eni Gas & Power Belgium SA	Belgium	100.00
Eni Gas & Power GmbH	Germany	100.00
Eni Gas Transport GmbH	Germany	100.00
Eni Gas Transport International SA	Switzerland	100.00
Eni G&P France BV	Netherlands	100.00
Eni G&P Trading BV	Netherlands	100.00
Finpipe GIE	Belgium	63.33
Gas Brasiliano Distribuidora SA	Brazil	100.00
GreenStream BV	Netherlands	75.00
Inversora de Gas Cuyana SA	Argentina	76.00
Société de Financement et de Participation SA	Belgium	100.00
Société de Service du Gazoduc Transtunisien SA - Sergaz SA	Tunisia	66.67
Société pour la Construction du Gazoduc Transtunisien SA - Scogat SA	Tunisia	100.00
Tigáz-Dso Földgázelosztó kft	Hungary	50.08
Tigáz Tiszántúli Gázszolgáltató Zártkörûen Mûködõ Részvénytársaság	Hungary	50.08
Transfin SA	Belgium	100.00
Trans Tunisian Pipeline Co Ltd	Channel Islands	100.00

REFINING & MARKETING

Costiero Gas Livorno SpA	Italy	65.00
Ecofuel SpA	Italy	100.00
Eni Fuel Nord SpA (ex AgipFuel Nord SpA)	Italy	100.00
Eni Rete oil&nonoil SpA (ex Agip Rete SpA)	Italy	100.00
Eni Trading & Shipping SpA	Italy	100.00
Petrolig Srl	Italy	70.00
Petroven Srl	Italy	68.00
Raffineria di Gela SpA	Italy	100.00
Agip Austria GmbH	Austria	100.00
Agip Ceská Republika Sro	Czech Republic	100.00
Agip Deutschland GmbH	Germany	100.00
Agip Lubricantes SA	Argentina	100.00
Agip Romania Srl	Romania	100.00
Agip Schmiertechnik GmbH	Germany	100.00
Agip Slovenija doo	Slovenia	100.00
American Agip Co Inc	USA	100.00

Eni Benelux BV (ex Agip Benelux BV)	Netherlands	100.00
Eni Ecuador SA (ex Agip Ecuador SA)	Ecuador	100.00
Eni France Sàrl (ex Agip France Sàrl)	France	100.00
Eni Hungaria Zrt (ex Agip Hungaria Zrt)	Hungary	100.00
Eni Iberia SLU (ex Agip Iberia SLU)	Spain	100.00
Eni Oil Ceská Republika Sro (ex Agip Oil Ceská Republika Sro)	Czech Republic	100.00
Eni Oil Slovensko Spol Sro (ex Agip Oil Slovensko Spol Sro)	Slovakia	100.00
Eni Slovensko Spol Sro (ex Agip Slovensko Spol Sro)	Slovakia	100.00
Eni Suisse SA (ex Agip Suisse SA)	Switzerland	100.00
Eni Trading & Shipping BV	Netherlands	100.00
Eni Trading & Shipping Inc	USA	100.00
Esain SA	Ecuador	100.00

PETROCHEMICALS

Polimeri Europa SpA	Italy	100.00
Dunastyr Polisztirolgyártó Zártkoruen Mukodo Részvénytársaság	Hungary	100.00
Polimeri Europa Benelux SA	Belgium	100.00
Polimeri Europa France SAS	France	100.00
Polimeri Europa GmbH	Germany	100.00
Polimeri Europa Ibérica SA	Spain	100.00
Polimeri Europa UK Ltd	UK	100.00

ENGINEERING & CONSTRUCTION

Intermare Sarda SpA	Italy	43.48
Saipem Energy Services SpA	Italy	43.48
Saipem SpA	Italy	43.48
Servizi Energia Italia SpA (ex Saipem Energy Italia SpA)	Italy	43.48
Snamprogetti Chiyoda SAS di Saipem SpA	Italy	43.44
Andromeda Consultoria Tecnica e Representações Ltda	Brazil	43.48
BOSCONGO SA	Congo	43.48
BOS Investment Ltd	UK	43.48
BOS - UIE Ltd	UK	43.48
Entreprise Nouvelle Marcellin SA	France	43.48
ER SAI Caspian Contractor Llc	Kazakhstan	21.74
ERS - Equipment Rental & Services BV	Netherlands	43.48
European Marine Contractors Ltd (in liquidation)	UK	43.48
European Marine Investments Ltd (in liquidation)	UK	43.48
European Maritime Commerce BV	Netherlands	43.48
Global Petroprojects Services AG	Switzerland	43.48
Katran-K Llc	Russia	43.48
Moss Maritime AS	Norway	43.48
Moss Maritime Inc	USA	43.48
Moss Offshore AS	Norway	43.48
North Caspian Service Co	Kazakhstan	43.48
Petrex SA	Peru	43.48
Petromar Lda	Angola	30.44
PT Saipem Indonesia	Indonesia	43.48
Saigut SA De Cv	Mexico	43.48
Saimexicana SA De Cv	Mexico	43.48
Saipem America Inc	USA	43.48
Saipem Asia Sdn Bhd	Malaysia	43.48
Saipem (Beijing) Technical Services Co Ltd	China	43.48
Saipem Contracting Algerie SpA	Algeria	43.48
Saipem Contracting (Nigeria) Ltd	Nigeria	42.59
Saipem Discoverer Invest Sàrl (ex Frigstad Discoverer Invest Ltd)	Luxembourg	43.48
Saipem do Brasil Serviços de Petroleo Ltda	Brazil	43.48
Saipem Drilling Co Private Ltd (ex Saipem Aban Drilling Co Private Ltd)	India	43.48
Saipem Holding France SAS	France	43.48
Saipem India Projects Ltd	India	43.48
Saipem International BV	Netherlands	43.48

Saipem Luxembourg SA	Luxembourg	43.48
Saipem (Malaysia) Sdn Bhd	Malaysia	17.99
Saipem Maritime Asset Management Luxembourg Sàrl	Luxembourg	43.48
Saipem Mediteran Usluge doo	Croatia	43.48
Saipem Misr for Petroleum Services SAE	Egypt	43.48
Saipem (Nigeria) Ltd	Nigeria	38.88
Saipem Perfurações e Construções Petrolíferas Unipessoal Lda	Portugal	43.48
Saipem (Portugal) Comércio Marítimo. Sociedade Unipessoal Lda	Portugal	43.48
Saipem (Portugal) - Gestão de Participações SGPS Sociedade Unipessoal SA	Portugal	43.48
Saipem SA	France	43.48
Saipem Services México SA De Cv	Mexico	43.48
Saipem Services SA	Belgium	43.48
Saipem Singapore Pte Ltd	Singapore	43.48
Saipem UK Ltd	UK	43.48
Saipem Ukraine Llc	Ukraine	43.48
SAS Port de Tanger	France	43.48
Saudi Arabian Saipem Ltd	Saudi Arabia	26.09
Sigurd Rück AG	Switzerland	43.48
Snamprogetti Canada Inc	Canada	43.48
Snamprogetti Engineering BV	Netherlands	43.48
Snamprogetti France Sàrl	France	43.48
Snamprogetti Ltd	UK	43.48
Snamprogetti Lummus Gas Ltd	Malta	43.05
Snamprogetti Netherlands BV	Netherlands	43.48
Snamprogetti Romania Srl	Romania	43.48
Snamprogetti Saudi Arabia Co Ltd Llc	Saudi Arabia	43.48
Société de Construction d'Oleoducs Snc	France	43.48
Sofresid Engineering SA	France	43.48
Sofresid SA	France	43.48
Sonsub AS	Norway	43.48
Sonsub International Pty Ltd	Australia	43.48
Sonsub Ltd (in liquidation)	UK	43.48
Star Gulf FZ Co	United Arab Emirates	43.48
Varisal - Serviços de Consultadoria e Marketing Unipessoal Lda (ex Varisal - Serviços de Consultadoria e Marketing Lda)	Portugal	43.48

OTHER ACTIVITIES

Ing. Luigi Conti Vecchi SpA	Italy	100.00
Syndial SpA - Attività Diversificate	Italy	100.00

CORPORATE AND FINANCIAL COMPANIES

Agenzia Giornalistica Italia SpA	Italy	100.00
Eni Administration & Financial Service SpA (ex Società Finanziamenti Idrocarburi - Sofid - SpA)	Italy	99.62
Eni Corporate University SpA	Italy	100.00
EniServizi SpA	Italy	100.00
Serfactoring SpA	Italy	48.81
Servizi Aerei SpA	Italy	100.00
Banque Eni SA	Belgium	100.00
Eni Coordination Center SA	Belgium	100.00
Eni Finance USA Inc	USA	100.00
Eni Insurance Ltd	Ireland	100.00
Eni International BV	Netherlands	100.00
Eni International Resources Ltd	UK	100.00

TAB 10.C

26 Jan 2011 Saipem awarded new drilling contracts worth US$320 million PDF

25 Jan 2011

Press Release

PDF

21 Jan 2011

Saipem: Financial Calendar 2011

PDF

Photo Gallery

Saipem on the Stock Exchange

Saipem Ord. - Time: 5:30 PM

Last	% Chg
37.47	-0.50%

Data Source Borsa Italiana
Powered by Teleborsa

Financial calendar

February 10, 2011

Preliminary consolidated financial statements at December 31, 2010

Feb 2011

Mo	Tu	We	Th	Fr	Sa	Su
	01	02	03	04	05	06
07	08	09	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

Saipem Addresses

Documentation

- Interim Report at September 30 2010
- 2009 Sustainability Report
- Transactions involving interests held by board directors and statutory auditors and transactions with related parties

Qualification management

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MISSION

Pursuing satisfaction of our clients in the energy industry, we tackle each challenge with safe, reliable and innovative solutions. We entrust our competent and multi-local teams to provide sustainable development for our company and for the communities where we operate

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TAB 10.D

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Construction vehicles engineered for fast deployment in heavy seas

Mark McPherson
Jennifer Williams
Sonsub

The newly developed *Innovator Leviathan* is Sonsub's most powerful heavy work class ROV to date, providing high levels of power and control for deepwater operations.

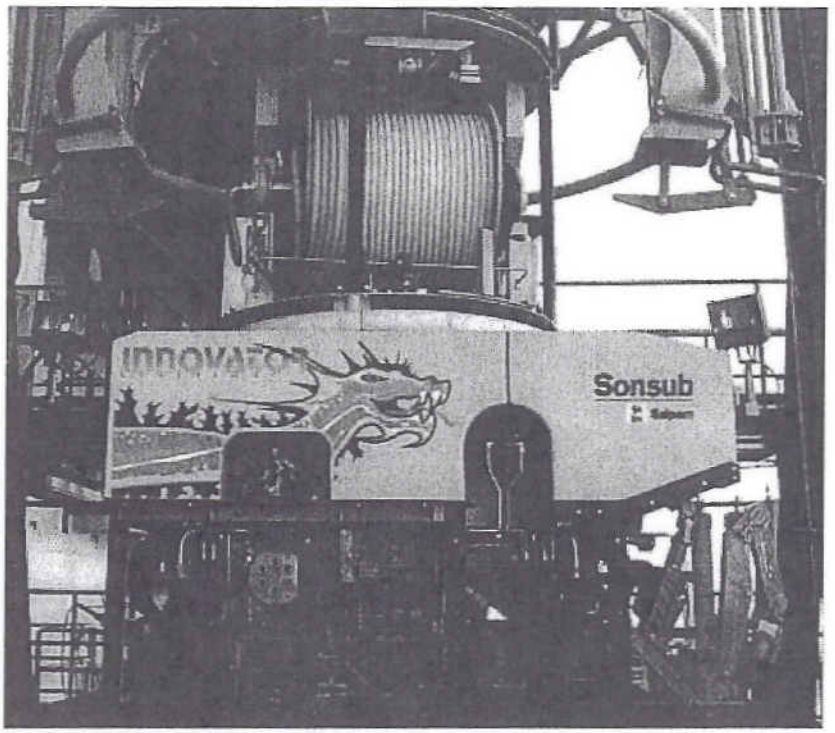
In 2007, Sonsub, the subsea division of Saipem, announced that the first of these newbuild, 250-hp (186-kW) ROVs would be delivered by the end of the year, adding to the company's worldwide fleet of over 60 vehicles.

The first three units have since been deployed on Saipem's IRM vessel *Chloe Candies* and the ROV support vessel *HOS Mystique* in the Gulf of Mexico, with one vehicle also performing basic platform drill support for a major operator. A further two followed in 2008 onboard the Sonsub multi-purpose subsea construction vessels *Normand Cutter* and *Bourbon Pearl*, operating in the North Atlantic and Mediterranean regions, with a sixth on its way to Saipem's new plough support and construction vessel *Far Samson* which was due to be launched in the second quarter of this year.

These new generation systems have been built in Houston under the guidance of Sonsub's research and development team in Venice, Italy, and with special features driven by the Aberdeen and Stavanger divisions. They have undergone four months of engineering and three months of configuration testing, and are designed to operate continuously despite harsh weather, high current, or extended dive conditions, while retaining the established advantages of the Innovator class.

With an upgrade to 250 hp dual-shaft electric motor, the *Innovator Leviathan* is capable of delivering high levels of power through seven hydraulic thrusters – four 17-in. (43-cm) horizontal and three 15-in. (38-cm) vertical – allowing the ROV to operate in currents of up to 4.5 knots. Enhanced control for harsh operating conditions is facilitated by mechanical thruster repositioning providing 30°, 45°, or 60° thrust angle with respect to the fore-aft vehicle axis, while the vertical thrusters also have pitch and roll control.

Other features include a state-of-the-art heavy weather launch and recovery system (LARS), and a new, fully electric umbilical winch incorporating active heave compensation. This provides the capability to launch and recover the vehicles in higher sea states than would previously have been considered with the *Innovator 150*, along with higher speed deployment to working depth (up to 120 m/s, or 393 ft/s) and safer docking with the tether management system (TMS).



Sonsub's *Innovator Leviathan*.

Being electric as opposed to hydraulic, the winches also run more quietly than the previous systems, making deck operations safer as well as healthier, with the new A-frame allowing secure deployment from a higher freeboard.

Finally, inside the control van the ROV interface is upgraded to include a touch screen human-machine-interface (HMI), providing a higher level of ergonomics for the pilots.

According to Sonsub operations manager John Ewen, "The overall design enhances the operating capability of the ROV system and allows safer operation when working at the higher end of the allowable weather parameters."

Acting as a stable work platform for all of Sonsub's future subsea intervention and support systems, the *Innovator Leviathan* has many other operational and control features to help minimize subsea downtime.

This new level of ROV capability has allowed the *Bourbon Pearl* to operate recently in what was Sonsub's most northerly work site to date, performing electromagnetic offshore exploration for PetroMarker in the Barents Sea from a base in Hammerfest in northern Norway. Sonsub AS General Manager Mark Underhill says: "With increased activity north of Hammerfest, it is important to have heavy weather capability on our vessels to maintain productivity, even during the summer months in the Barents Sea where we can experience hostile conditions."

The Sonsub ROV newbuild program is committed to producing 20 additional Innovator systems, including the new *Leviathan*, over the next few years. ○

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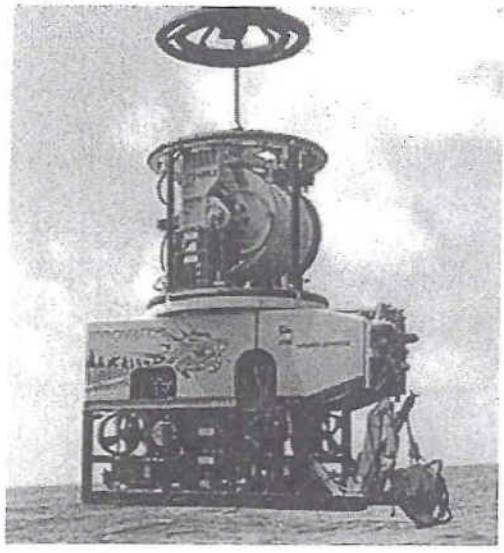
TAB 10.E

saipem



Innovator 250

January 18, 2010; h 12:00

Heavy duty work ROV with heavy weather LARS

Dimensions:
Height 213 cm, Width 163 cm, Length 345 cm

Power:
250 HP electric motor

Depth rating:
3,000 m

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TAB 10.F

azrobotics
The A to Z of Robotics

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ALL AZOROBOTICS

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Adhesives, Sealants & Coatings
Specialty Adhesives

Specialty Adhesives Master Bond

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AB23 8JX
UNITED KINGDOM
PH: 44 (1224) 843434
Fax: 44 (1224) 843435
Email: enquiries@sonsub.co.uk
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Bulk Wholesale Liquidator
Internet's Largest Liquidator Buy and Sell Wholesale Items www.liquidation.com

Services information

Primary activity
Device/Component Manufacturer
Remotely operated vehicle

Company Background

Sonsub is a worldwide leading provider of subsea construction services to the offshore oil and gas industry and a fully integrated division of the Saipem Group. With design and manufacturing facilities in Houston (USA) and Venice (Italy), we have the ability to completely develop and build our own systems, including Innovator heavy work class ROVs, providing a maximum 250hp in water depths of up to 4,000m.

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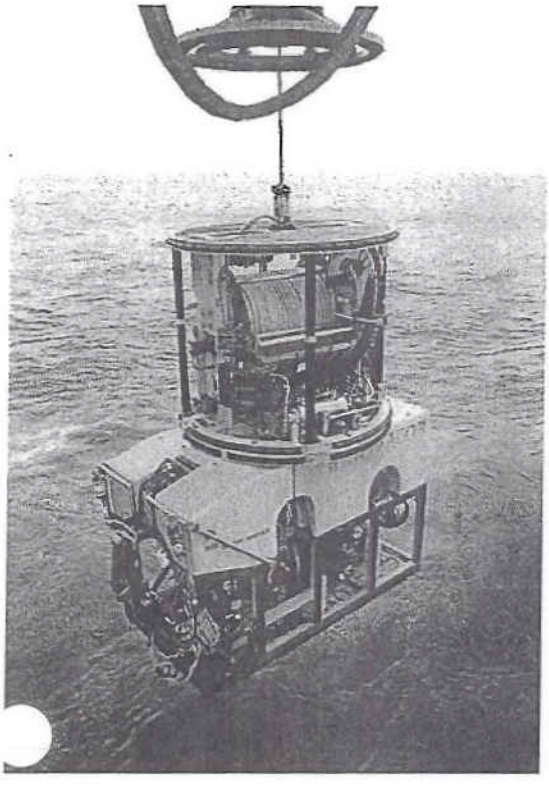
TAB 10.G

saipem



Innovator
January 17, 2010; h 12:00

Heavy duty work ROV

Dimensions:
Height 195 cm, Width 152 cm, Length 297 cm

Power:
200 HP electric motor, 150 total shaft output dual motor

Depth rating:
3,000 m

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TAB 11.A

Company Overview

Total Marine Technology is a privately owned and operated West Australian Company situated at our premises in Bibra Lake Western Australia. The Company was formed in 1999 to provide Work Class Remotely Operated Vehicles (ROV's) designed specifically for the offshore drilling and production industry. Total Marine Technology currently employees over sixty (60) personnel offshore and eighteen (18) shore based staff to provide all the necessary support and systems to our offshore operations.

Our organisation is the only company manufacturing and operating ROV's in Australia and New Zealand. Our state of the art manufacturing and repair facility is able to support the companies operations with spare parts and back up units that is the envy of our competitors. Our philosophy is simple, the people that manufacture the ROV also operate so our crews are not only highly trained in operating the vehicles, they also understand how the systems work.

As the Nomad Class ROV was designed and manufactured in house we are able to offer vehicles purposely built for drilling that have proven to be more reliable and cost efficient. We are leading the industry with our technology in drill support and production units and with our extensive research and development program we will continue to develop our systems.

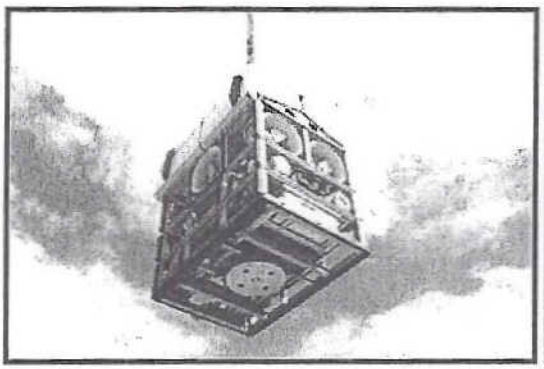
Our ROV manufacturing and operation team has been together for the last 16 years and have built some 12 work class ROVs that have worked in many of the countries in Asia, from China to New Zealand and Australia. For most of this year, we have operated on several Diamond Offshore rigs including the "Ocean Bounty", "Ocean Epoch", "Atwood Falcon", "Sedco 703" and the "Doo Sung".

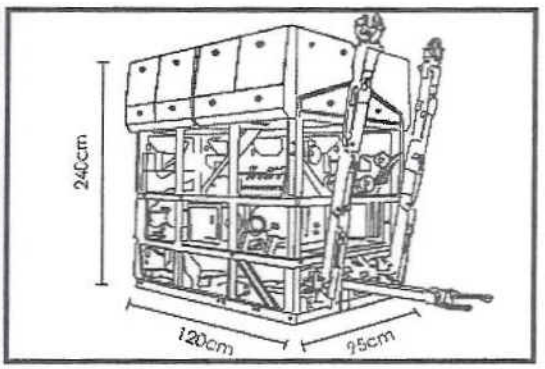
With our proven track record and our experience with the Nomad ROV in the drilling industry we are able to provide a first class service to your organisation.

Total Marine Technology © 2010

TAB 11.B

Nomad ROV System





Nomad Images

Shipping Size and Weight Manifest

ROV Highlights

Nomad Specifications

ROV General

Depth Rating	1500 Meters
Length	2.5 Meters
Width	1.6 Meters
Height (Drill Support Mode)	2.4 Meters
Weight (Drill Support Mode)	2,800 Kgs
Payload	1000 Kg
Frame Lift	3500 Kgs

Propulsion

Horsepower	150

Forward	1000 Kg
Astern	1000 Kg
Vertical Up / Down	1000 Kg
Lateral	1000 Kg

Camera and Sensor Package

Lights -6	2000 Watts (Available)
Camera 1	Instrumentation Camera -CCD Camera
Camera 2	Arm Camera - CCD Camera
Camera 3	Arm Camera - CCD Camera
Camera 4	Pan and Tilt Camera - Semi Low Light/ Zoom Camera
Camera 5	Tooling Camera - CCD Camera
Camera 6	Top Down View Camera - CCD Camera
Sonar System	Imaginex 881A
Water Temperature	0 to 38° Celcius
Flux gate compass and gyro	
Cement detector probe	0-2000 Meter (MSW)

Arms

T3 Schilling	Option
Port Manipulator	8 Function (TMT)
Starboard Manipulator	8 Function (TMT)
Grabber	2 Function (TMT)

Clump Weight

Winch (line pull)	8000 Kgs
Winch (drum capacity)	50 Meters
Clump Weight	500 Kgs

Tools to Assist Drilling

- Ax Ring Tool
- Guide Wire Cutter
- Guide Post Cutter
- Dredge
- Rig Floor Monitor

Control Van / Workshop

Length	6.1 Meters
Width	2.4 Meters
Height	2.75 Meters
Weight	5000 Kgs
Zone One	Standard

Launch & Recovery System

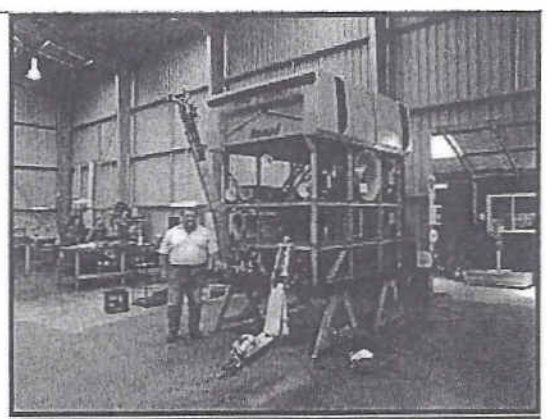
Over ther Side Hydraulic A-Frame Fixed Rig Sliding Door

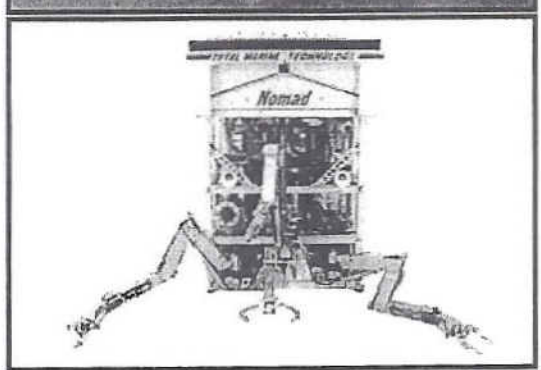
Equipment Description

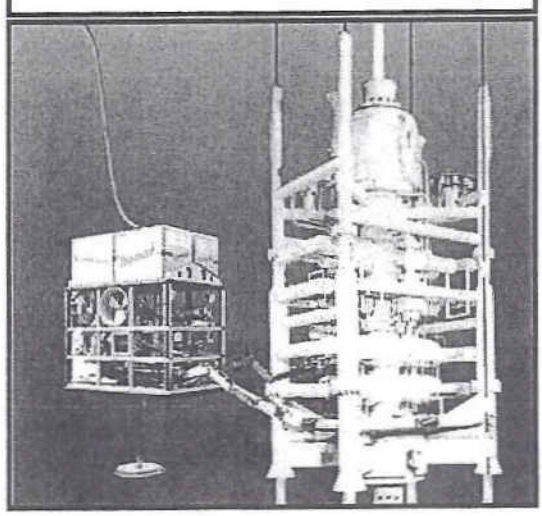
The Nomad (work class) ROV system has the following information that defines the current system configuration. Many other tooling options are available upon request.

System Includes

- 150 Horsepower ROV rated to 2000 MSW
- Deck Winch with rendundant HPU,with fibre optic, armoured umbilical
- Main winch able to be fully operated in local or remote mode
- 2x VHS digital recorders and 1x DVD recorder
- 4x monitors in ROV control room for viewing ROV and deck activity
- 1x Drill Floor monitor
- 2x Deck cameras for the LARS and winch area
- TMT Full matrix Video Switching System
- Fibre Optic Video and data transmission in main umbilical with a 3rd party interface
- High-resolution color camera (pan and tilt mounted) (Flys eye)
- 3x Color Pencil Cameras deployed on flying leads around the ROV
- 2x Manipulator mounted, color cameras
- Imaginex 881-A High resolution scanning sonar
- Precision instruments depth gauge
- KVH Digital Heading Sensor (with Dinsmore magnetic heading sensor back-up
- Auto depth / Auto heading, temperature sensor with fulltime batheymetry display
- 2 x 8-function rate feed manipulators
- 1 x 2-function grabber
- Hydraulic cutter for wire rope (up to 1" diameter)
- Hydraulic cutter for fibre rope (up to 1" diameter)
- 8" dredge / jet pump
- AX/VX Ring gasket replacement tooling
- Hydraulic rotary grinder/cutter/buffer
- Control Van (Zone Rated)
- Maintenance area at back of control shack with bulkhead seperation
- Complete inventory of system spares including tether
- Mechanical and electronics tools







and test equipment
- Rig Harmonised power conditioned electrical supply
- T3 manipulator deployment platter
- 1x Hydraulic 2 pass hot stab set rated to 2500psi

Total Marine Technology © 2010

TAB 11.C

TYPHOON

HEAVY DUTY WORK CLASS ROV

SPECIFICATIONS

SPECIFICATIONS:	
Depth Rating	3000 metres
Length	2.0 metres
Width	1.6 metres
Height (Drill Support Mode)	2.0 Metres
Weight (Drill Support Mode)	3800 kgs
Payload	800 kgs
Frame Lift	3500 kgs

PROPULSION:	
Forward	1000 kg
Astern	1000 kg
Port / Starboard	800 kg
Vertical Up / Down	800 kg

RECORDING EQUIPMENT:	
Lights	Hi Power LED & Halogen
Cameras	16x Multidrop HD Colour Var. Zoom + Focus
Sonar System	Imaginex
Video Recorder	Hard disk & DVD

ARMS:	
Longitudinal Deployment Platters	x 3
Grabber	2 Function (TMT)

SEABED REFERENCE POSITIONING SYSTEM	
Winch (line pull)	8000 kgs
Winch (drum capacity)	50 metres
SRPS Weight	500 kgs

HYDRAULIC PACKS:
150 Horse Power

TOOLS TO ASSIST DRILLING:
Gasket Ring Tool
Guide Wire Cutter
Guide Post Cutter
Mini Dredge / Megga Digga
Rig Floor Monitor
Smart Torque Tool
Plate Handling Tool
Smart Level
CP Probe

CONTROL VAN / WORKSHOP:	
Length	6.1 metres
Width	2.4 metres
Height	2.75 metres
MGM	15000 kgs
Zone One	Standard
Workshop	Integrated

UMBILICAL WINCH:	
Umbilical Diameter	0.042 metres
Drum Capacity	2000 metres
Length	3.5 metres
Width	2.5 metres
Height	3.1 metres
Weight (incl 2000m umbilical)	25t
Dual VSD Electric Drive	74 kw

LAUNCH & RECOVERY SYSTEMS: (OPTIONS)
Over the Side Hydraulic A-Frame
Dynacon
TMS
Fixed Rig Sliding Door

SapuraCrest Petroleum

tmt AUSTRALIA

Total Marine Technology Pty Ltd

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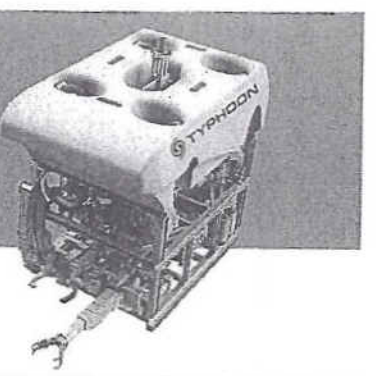
TYPHOON

HEAVY DUTY WORK CLASS ROV



OVERVIEW

The Typhoon is a 150HP heavy work class ROV with 3000m depth rating. It has been designed by ROV operators for ROV operators with an emphasis on reliability, easy maintenance, low cost and ease of use. Compared to other ROV's in its class, the Typhoon has a number of unique features.

FEATURES

Hydraulic Accumulator

HPU failsafe that allows the ROV to disengage the sub, finalise tooling functions and stow arms in the event of hydraulic power loss.

Seabed Reference Positioning System (SRPS)

Increases visibility by eliminating the need for vertical thrust near the ocean floor. The ROV can use the SRPS for precise vertical positioning and for heavy lift assistance.

Nodal Electronic Architecture

Expandable RS485 control network with a range of quick-change PCB's for different applications. PC independent failsafe master controller.

20' Control Van / Workshop

Most compact deck footprint for heavy work class ROV with integrated workshop, control cabin and electrical compartment.

Electric Winch

Fully redundant dual electric drive winch.

Manipulators

Extra z-function for all 3 manipulators, plus permanent 2-function grabber. Titan 4 (8f+1z), Hercules (7f+1z) and Rigmaster (5f+1z) manipulators provided with on-shore backup units and full service workshop.

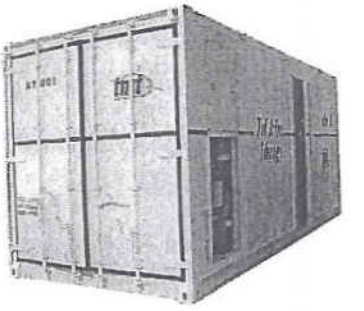
Tooling Interface

High flow tooling ports with controllable pressure and flow. Wide range of off the shelf tooling, including: combo plate handling/ smart torque tools, smart/standard torque tools, gasket installation and removal tool, rope and wire cutters, water-blasters, mini dredge/megga digga, Imenco latch release, hot-stabs, 50t linear override, chain camera, intensifier, scrubbers and cleaners.

Instrumentation

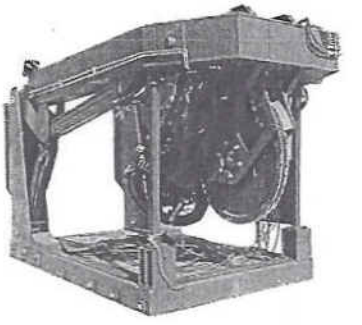
Smart level, metrology scanner, ph meter, densitometer, soil sampler, x-ray NDT, ultrasonic NDT and hydrophone.

CONTROL VAN



WINCH SYSTEM

LARS



SapuraCrest Petroleum

tmt AUSTRALIA

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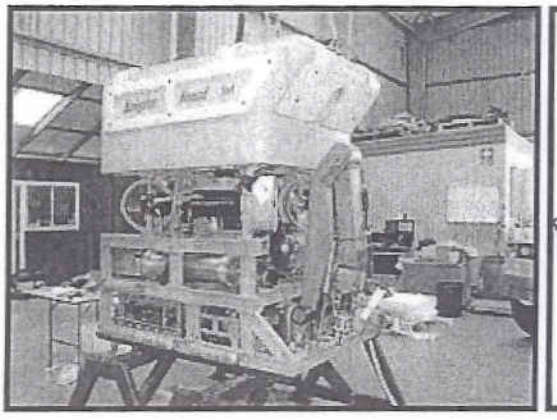
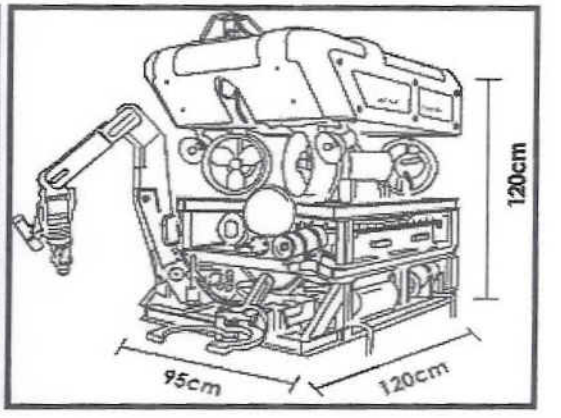
TAB 11.D

Nomad Navigator





Navigator Images

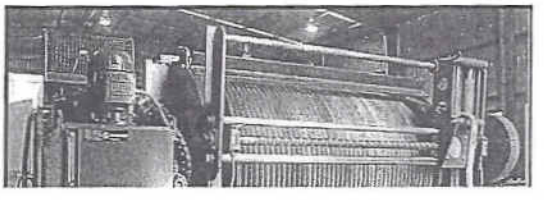
Shipping Size and Weight Manifest

ROV Highlights

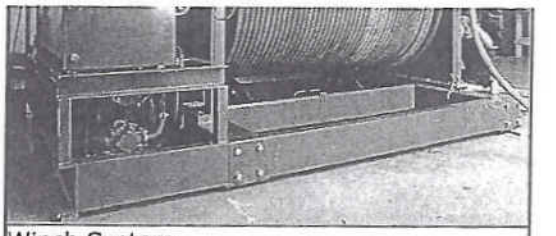
Navigator Specifications

ROV General

Depth Rating	600/3000 Meters
Length	1.2 Meters
Width	0.95 Meters
Height (Free Swimmer)	1.2 Meters
Weight (Free Swimmer)	400 Kg
Height (Extra Thruster)	1.34 Meters



Height (Extra Thruster)	1.94 Meters
Weight (Extra Thruster)	600Kg
Payload	200/400 Kgs
Frame Construction	AL
System Power	Electrical 440V

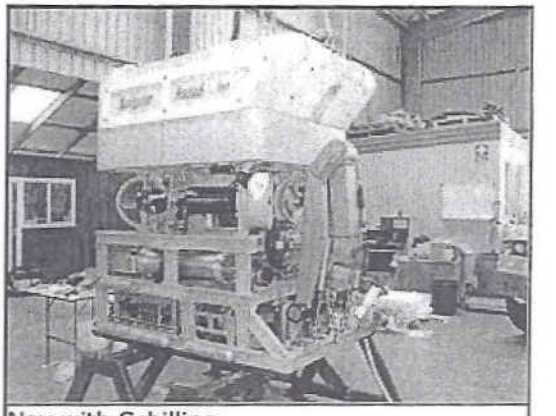

Winch System

Propulsion

Horsepower	75
Forward / Aft (Bollard Pull)	0-440 Kg
Port / Starboard (Bollard Pull)	0-370Kg
Vertical Up / Down	110 / 220 Kg
Lateral	1000 Kg

Camera and Sensor Package

Fly Eye Camera	Multiple cameras whereby 5 cameras form a semi-sphere to substitute a pan and tilt camera
Auxiliary Cam	1x CCD Low light camera


Nav with Schilling

Tooling

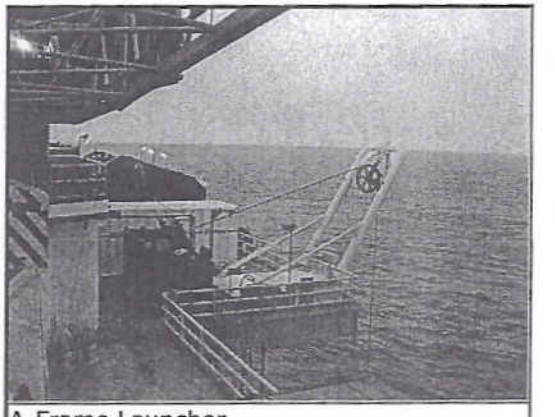
Manipulator	6 Function (TMT)
Grabber	2 Function (TMT)
T3 Pack	T3 7-Function + Grabber 2-Function

Control Van / Workshop

Length	3.0 Meters
Width	2.2 Meters
Height	2.4 Meters
Weight	4000 Kgs
Rating	Unzoned or Zone One / Class 1
Certification	DNV

Launch & Recovery System

Umbilical Diameter	25.6mm
Drum Capacity	660 / 3300 Meters
Base Length	1.35 Meters
Base Width	2.2 Meters
System Height (Extended)	3.8 Meters
System Height (Slowed)	2.95 Meters
Weight	3000 / 14,000 Kgs
System Power	Electrical / Hydraulic


A-Frame Launcher

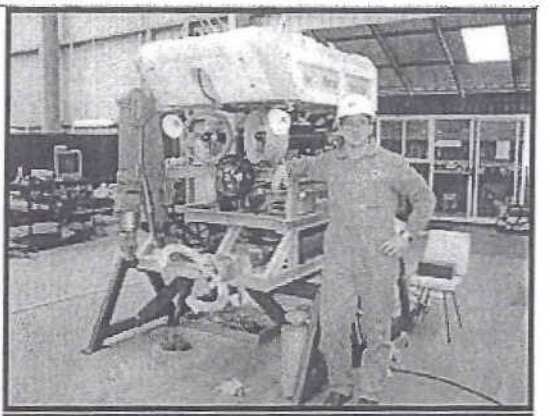
Equipment Description

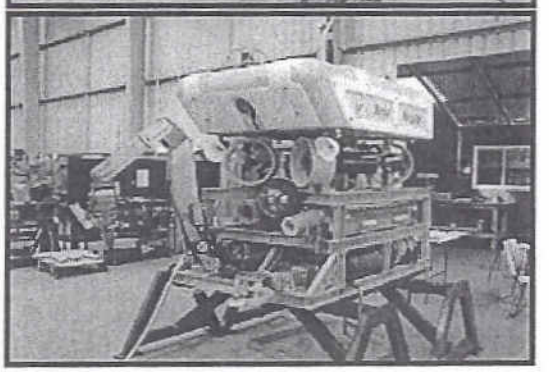
Equipment Description

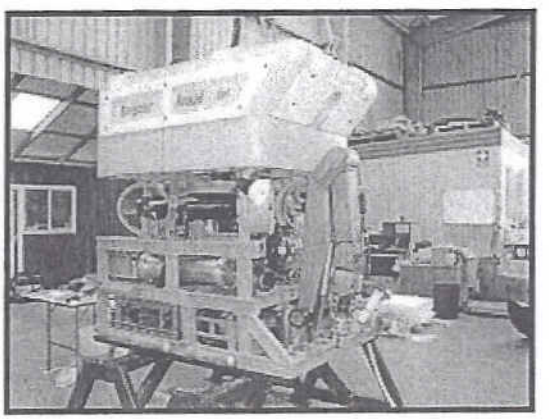
The Nomad Navigator (work class) ROV system was built in 2002. The following information defines the current system configuration. Many other tooling options are available upon request.

System Includes

- 75 Horsepower ROV rated to 400 MSW
- Deck Winch, with fibre optic, armoured umbilical
- Main winch able to be fully operated in local or remote mode
- 2x VHS digital recorders
- 3x monitors in ROV control room for viewing ROV and deck activity
- 2x Deck cameras for the LARS and winch area
- TMT Full matrix Video Switching System
- Fibre Optic Video and data transmission in main umbilical with a 3rd party interface
- High-resolution color camera (pan and tilt mounted) (Flys eye)
- 1x Color Pencil Cameras deployed on flying leads around the ROV
- 1x Manipulator mounted, color camera
- 6x generally mounted camera's
- Imaginex 881-A High resolution scanning sonar
- Precision instruments depth gauge
- KVH Digital Heading Sensor (with Dinsmore magnetic heading sensor back-up
- Auto depth / Auto heading, temperature sensor with fulltime batheymetry display
- 1 x 7-function T3 manipulator
- 1 x 2-function grabber
- Control Van / Workshop
- Maintainece area at back of control shack with bulkhead seperation
- Complete inventory of system spares
- Mechanical and electronics tools and test equipment
- Rig harmonised power conditioned electrical supply
- T3 Manipulator deployment platter







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TAB 12.A

Services & Facilities

Services Complete the Integration Project

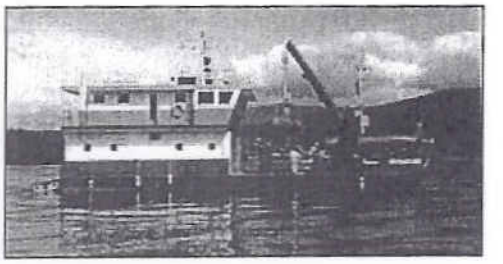
Facilities:

We are located in Port Coquitlam, 25 km east of Vancouver British Columbia, Canada. The companies occupy 2 hectares of land, comprising of 3400 square meters of engineering and assembly shops. The company has a complete facility for the design, fabrication and testing of underwater vehicles, land and space training robotics.

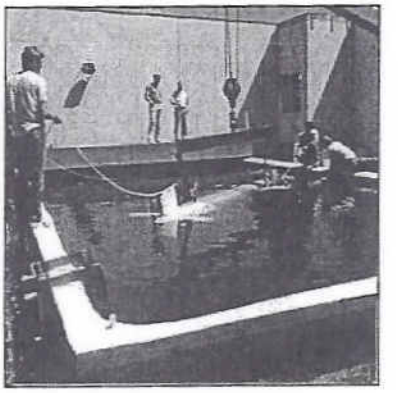
Latest News

- ISE Appoints New AUV Agents
- James McFarlane Honoured as Technology Pioneer
- Canada Acquires ISE Explorer AUVs
- More....

The MV Researcher is a twin screw purpose-built trials vessel. She is fitted with a 10 ton lift crane and a 33 x 23 ft. (10 x 7m) hangar used as a workshop.



ISE has an in-ground pool which is suitable for preliminary testing of vehicles prior to sea trials. The pool is 41 feet in length, 20 feet wide and 15 feet deep (12.5m x 6m x 4.6m).



Services:

- Quality Assurance

We have had an AUV Quality Management System for 25 years. The present system is modeled on the ISO9001:2000 International Standard. A participative style of leadership has been established to involve employees in the decision-making and direction of the quality program with the aim of increasing the employee's commitment to their work and to the customer. The focus of the program continues to be in improving the level of customer satisfaction and lowering the cost of doing so. Learn more about our Quality Assurance Department.

- On-site Training

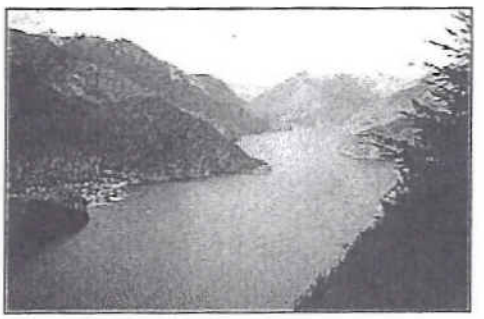
ISE offers detailed operation and maintenance training on all of its systems. This includes classroom training and training at sea. Training can be done at ISE's facility in Port Coquitlam, or at the customer's facilities. Manuals and associated documentation are provided in English and any other language, at the customer's request. ISE also provides dedicated office space for customers during their stay at ISE.

- After Sales Support & Spare Parts

ISE provides world-wide after-sales support to all of its systems. ISE's highly trained engineers can assist customers with installation and maintenance issues, and will provide extensive on-site operations assistance, if needed. ISE is dedicated to providing the customer with the best solution possible and will support the customer before, during and after the system is built.

Local Trials & Testing:

ISE's close proximity to the waters off Vancouver give it access to Indian Arm (pictured right). This fjord is a 10 mile (16 km) long body of sheltered water with depths between 90 and 725 feet (27 - 221 meters), making it ideal for testing sub-sea equipment.
Sea trials requiring deeper water are carried out in Jervis Inlet, a secluded body of water which is approximately 45 miles (72 km) from Vancouver. Here water depths of 2450 feet (747 meters) can be found.



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TAB 12.B

FOR IMMEDIATE RELEASE
March 26, 2009

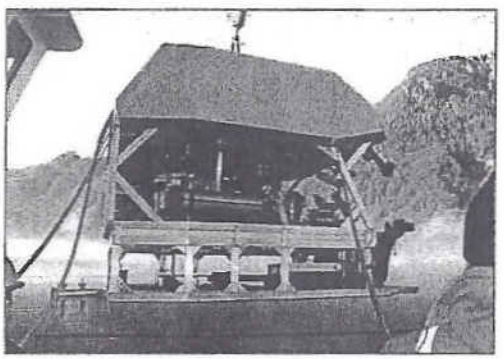
RECOVERING AN ALTERNATE SOURCE OF ENERGY WITH A HIGH PRESSURE RECOVERY VESSEL

PORT COQUITLAM, BC – The recently launched ISE 130HP 4000 meter rated Remotely Operated Vehicle (ROV) is equipped with the first set of deep diving High Pressure Recovery Vessels (HPRV), thermally insulated equipment designed to recover frozen gas hydrates, maintaining the hydrates at their original pressure.

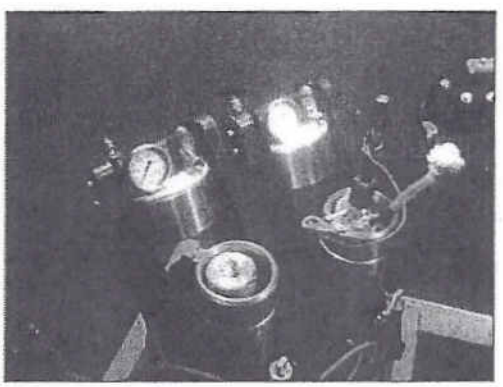
The equipment was developed for the Guangzhou Marine Geology Survey (GMGS), a division of China's Ministry of Land and Resources. GMGS is ready to recover identified gas hydrates in the South China Sea.

Gas hydrates are deposits of frozen methane located on or under the deep ocean floor. These hydrates are a potentially viable energy alternative. With ISE's HPRV, science and research organizations like GMGS are now able to perform the high pressure recovery of the gas hydrates.

This month, GMGS sent personnel to Port Coquitlam, BC to commence training on all aspects of ROV operations including the gas hydrate samplers. Other equipment includes six cameras, Imagenex scanning sonar, science skid, and seven and five functioning manipulators, all controlled by ISE's common control system, ACE. Trainees spent 11 days onboard the ISE trials and training vessel – The Researcher – where they practiced piloting and bottom sampling. Onboard training is followed by technical sessions at ISE's Port Coquitlam office and shop.



GMGS HYSUB 130HP ROV



HPRV in action at depth of 200 meters

ABOUT INTERNATIONAL SUBMARINE ENGINEERING LTD.

Based in British Columbia, Canada, International Submarine Engineering Ltd has been involved in the design and development of autonomous and remotely operated vehicles for over 34 years. ISE's experience is represented by the over 215 underwater vehicles built and delivered to clients in 20 countries.

ISE
International Submarine Engineering Ltd.
1734 Broadway Street, Port Coquitlam, BC V3C 2M8 Canada
Tel 604.942.5223 Fax 604.942.7577
www.ise.bc.ca info@ise.bc.ca

TAB 12.C

ISE
International Submarine Engineering Ltd.
Group of Companies

FOR IMMEDIATE RELEASE
October 13, 2010

ISE DELIVERS NEW HYSUB ROV

PORT COQUITLAM, BC - ISE has delivered a new Remotely Operated Vehicle (ROV) for SNK Ocean Co. Ltd., a Japanese marine services company based out of Tokyo, Japan. SNK has other ISE equipment.

The HYSUB ROV - the "Hakuyo 150-3000" - is designed to perform several functions including cable burial, salvage, research and survey. It is SNK's deepest diving ROV, rated to an operational depth of 3000 meters. It will compliment SNK's existing HYSUB ROV that operates to depths of 2000 meters. The vehicle is equipped with four lateral and three vertical thrusters, two manipulators, a full sensor package, and ISE's customized control system, ACE.

The ROV is also equipped with a custom designed jet skid designed by James Adamson for cable burial operations. The ROV's hydraulic power can be divided into two 75HP circuits when the skid is attached. After locating the cable, the vehicle descends and the jetting legs. A TSS cable skid is used for cable tracking. The forward thrust is 2500 lbs, and the forward speed is 3.7 knots.

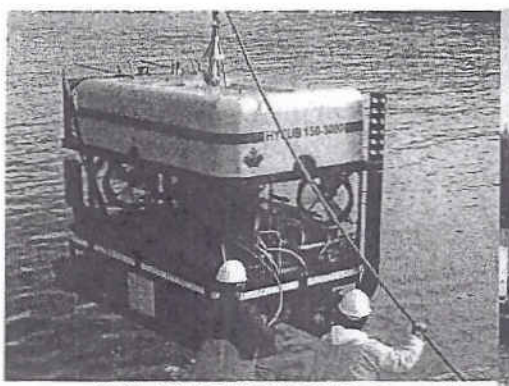
SNK Ocean Co. Ltd.

SNK Ocean Co. Ltd. and ISE have enjoyed a long-standing relationship that extends over 20 years, with ISE delivering SNK's first ROV in 1991. SNK provides marine vehicles including offshore construction equipment, offshore natural resources investigation, wreck and salvage operations. For more information, please contact Mr. K. Wachi, President, SNK Ocean Co. Ltd., email kwachi@snk-ocean.co.jp.

International Submarine Engineering Ltd.

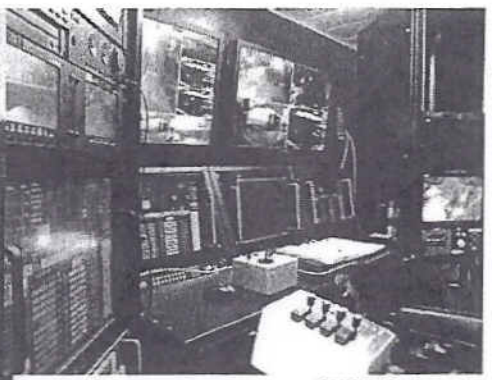
ISE formed in 1974 to design and build underwater vehicles for the subsea industry. During the last 35 years ISE has built remotely operated vehicles (ROVs), manned submersibles, semi-submersibles, robotic manipulators and AUVs. ISE also designs and builds unique solutions for subsea and robotic tasks, and has a customer base spanning the globe. Other notable product achievements include large and small robotic and control systems. Examples of some engineering projects include the Shell SmartPump Refueling robot, and the STM crew training robot for the Canadian Space Agency.

ISE's experience is represented by the over 200 vehicles built and delivered to clients in 20 countries. These vehicles can be found in the offshore petroleum industry, scientific research, telephone cable maintenance, accident investigation, torpedo recovery and other uses.



SNK's 150 HP HYSUB ROV during sea trials

SNK ROV trials and training off ISE's research vessel



SNK ROV Console

For more information, please contact:
James McFarlane, President
International Submarine Engineering Ltd.
1734 Broadway Street, Port Coquitlam, BC Canada V3C 2M8 Tel 604.942.5223 Fax 604.942.7577 james.mcfarlane@ise.bc.ca www.ise.bc.ca

TAB 12.D

FOR IMMEDIATE RELEASE
December 19, 2008

ISE LAUNCHES GMGS ROV FOR TRIALS

PORT COQUITLAM, BC – Amidst -3° C temperature and snow, ISE commenced trials and testing on the China Geological Survey Remotely Operated Vehicle (ROV) for its first test dive in the ISE pool.

Named "Sea Lion", the ROV is an ISE HYSUB 130HP ROV scheduled for delivery in the first quarter of 2009. Sea Lion is the first ROV for Guangzhou Marine Geology Survey (GMGS), a division of China's Ministry of Land and Resources. It has a depth rating of 4000 meters, suitable for reaching the depths required for the mineral exploration the vehicle is designed to perform.

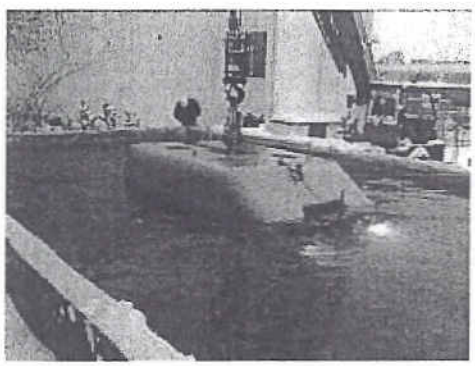
GMGS Console

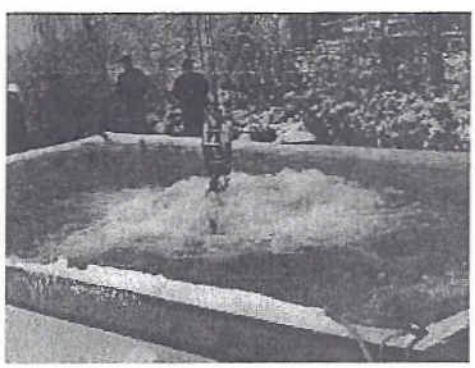
The Sea Lion ROV comes equipped with eight hydraulic thrusters, two ISE Magnum manipulators, six cameras, and a full sensor package. Unique to the ROV is a 4000 meter rated hyperbaric clathrate bucket designed to collect hydrate cores containing methane gasses. The skid mounted bucket maintains the required pressure and temperature conditions similar to the hydrate's geophysical environment.

Sea Lion's propulsion system today is being tested, along with a newly formed power management optimization system. Production is on schedule, and Factory Acceptance Testing will be completed in the next few weeks.

ABOUT INTERNATIONAL SUBMARINE ENGINEERING LTD.

Based in British Columbia, Canada, International Submarine Engineering Ltd has been involved in the design and development of autonomous and remotely operated vehicles for over 34 years. ISE's experience is represented by the over 215 underwater vehicles built and delivered to clients in 20 countries.





ISE
International Submarine Engineering Ltd.
1734 Broadway Street, Port Coquitlam, BC V3C 2M8 Canada
Tel 604.942.5223 Fax 604.942.7577
www.ise.bc.ca info@ise.bc.ca

TAB 12.E

ISE
International Submarine Engineering Ltd.
Group of Companies

FOR IMMEDIATE RELEASE
November 20, 2009

ISE INDUCTED AS TECHNOLOGY PIONEER INTO OFFSHORE ENERGY CENTER HALL OF FAME

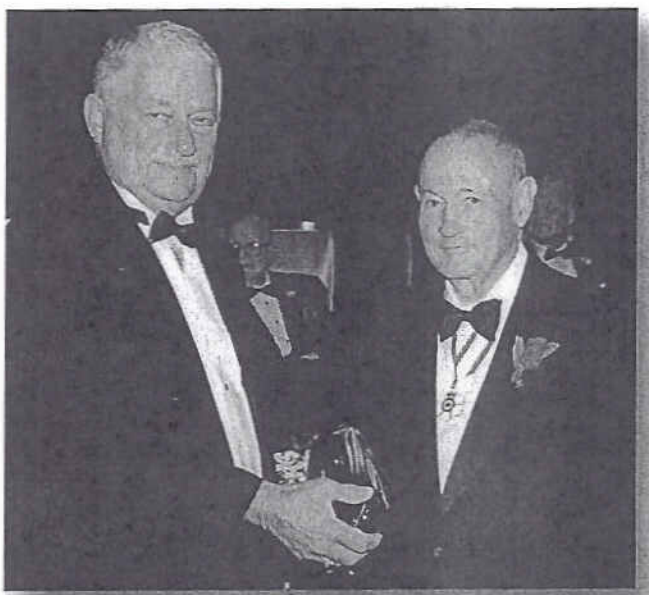
PORT COQUITLAM, BC - Dr. James McFarlane, President of International Submarine Engineering (ISE) was honoured as a Technology Pioneer by the Offshore Energy Center (OEC) 's Hall of Fame in Houston, Texas. The award was presented at the Ocean Star Gala at the Westin Galleria Hotel in Houston on October 10th, 2009.

As a technology pioneer, Dr. McFarlane is one of the industry's key individuals whose innovation has formed the basis of technology and engineering behind Remotely Operated Vehicles (ROVs). In the early 1970's, Dr. McFarlane and his company built the first pipeline inspection ROV which was used on the Piper Alpha Pipeline in the North Sea. ROVs were also built for government programs and research, paving the way for ROV design, equipment and control systems used today.

The development of ISE's HYSUB ROV was the technical foundation used in the oilfields for companies such as Oceaneering. This was followed by HYSUB, TROV, TREC and DART vehicles which ignited ROV development by many other companies.

The Offshore Hall of Fame recognizes the individuals and technologies that took the industry to sea. Established in 1989, the OTC is dedicated to expand the awareness of the vast energy resources available beneath the world's oceans and to chronicle the unique heritage and technological accomplishments of the industry.

E was formed in 1974 to design and build underwater vehicles for the subsea industry. During the last 35 years ISE .s built remotely operated vehicles (ROVs), manned submersibles, semi-submersibles, robotic manipulators and AUVs. ISE also designs and builds unique solutions for subsea and robotic tasks, and has a customer base spanning the globe.

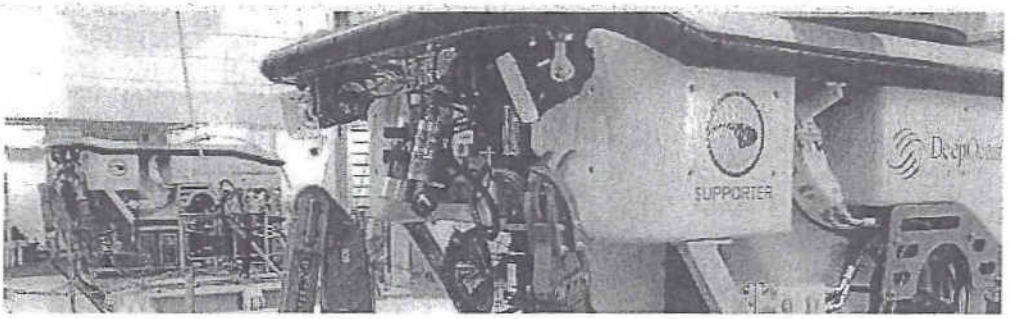


Dr. Jim McFarlane receives the Technology Pioneer Award from Mr. Mark Childers, Chairman, OTC Technology Pioneer Committee

For more information, please contact:
International Submarine Engineering Ltd.
1734 Broadway Street, Port Coquitlam, BC Canada V3C 2M8 Tel 604.942.5223 Fax 604.942.7577 info@ise.bc.ca www.ise.bc.ca

TAB 13.A

KYSTDESIGN
SUB-SEA TECHNOLOGY



SUPPORTER Work Class ROV

SUPPORTER is a work class hydraulic ROV systemfor intervention down to 2000 (3000) meter water deep.

ROV technology

KYSTDESIGN delivers a wide range of hydraulic work class ROV solutions.

Products

K Y S T D E S I G N offers a wide range of products for sub-sea intervention, ranging from complete vehicles to manipulator held tools.

Welcome to KYSTDESIGN

KYSTDESIGN AS is an independent company delivering in-house designed ROV's and subsea intervention technology. The recent SUPPORTER and INSTALLER work vehicle designs, are derived from experience gained through leading benchmark ROV development projects the last 15 years...

Let us introduce you to our world of :

ROV Technology
Custom Designed Intervention Tools
Subsea Hydraulic and Electronic Components
Problemsolving
Engineering & Operation planning

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Achilles®

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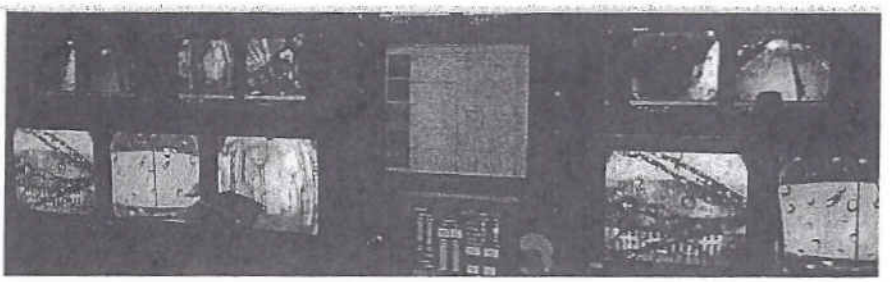
TAB 13.B

KYSTDESIGN
SUB-SEA TECHNOLOGY



This is KYSTDESIGN
Kystdesign is one of the leading ROV producers in the world today.

ROV technology
KYSTDESIGN delivers a wide range of hydraulic work class ROV solutions.

Products
K Y S T D E S I G N offers a wide range of products for sub-sea intervention, ranging from complete vehicles to manipulator held tools.

Customer Support:

24-hour service telephone support - mobil 47 971 68 958

Spareparts and service support world wide

Visit us: Vis større kart

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5525 Haugesund
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Håkon Olaisen
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+47 930 04 136

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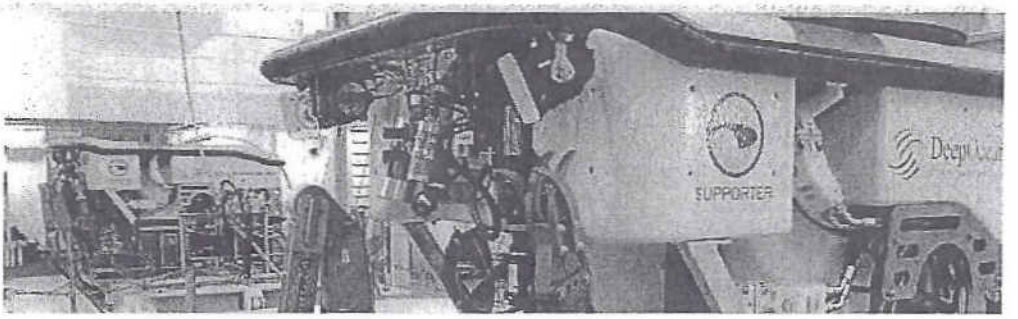
TAB 13.C

KYSTDESIGN
SUB-SEA TECHNOLOGY



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K Y S T D E S I G N offers a wide range of products for sub-sea intervention, ranging from complete vehicles to manipulator held tools.

KYSTDESIGN is one of the leading ROV producers in the world today. KYSTDESIGN consists of multi-discipline engineering teams, with specialists in mechanical design, hydraulic systems, electronics and software development.

Our main products and services include ROVs, ROV tools, tool control systems and software, hydraulic and electronics engineering,structural engineering, lifting equipment, deck structures and sea fastening elements, as well as hydrodynamics and marine engineering.

History

KYSTDESIGN is owned and managed by Erik Kold Bakkevig. KYSTDESIGN AS is an independent company established in 1997 delivering in-house designed ROVs and subsea intervention technology.

KYSTDESIGN worked on expanding its expertise in the apparent gap in the market. From 1997, where KYSTDESIGN achieved revenues of NOK two million, it has experienced steady growth through the years and enjoyed a significant turnover of over NOK 90 million in 2008.

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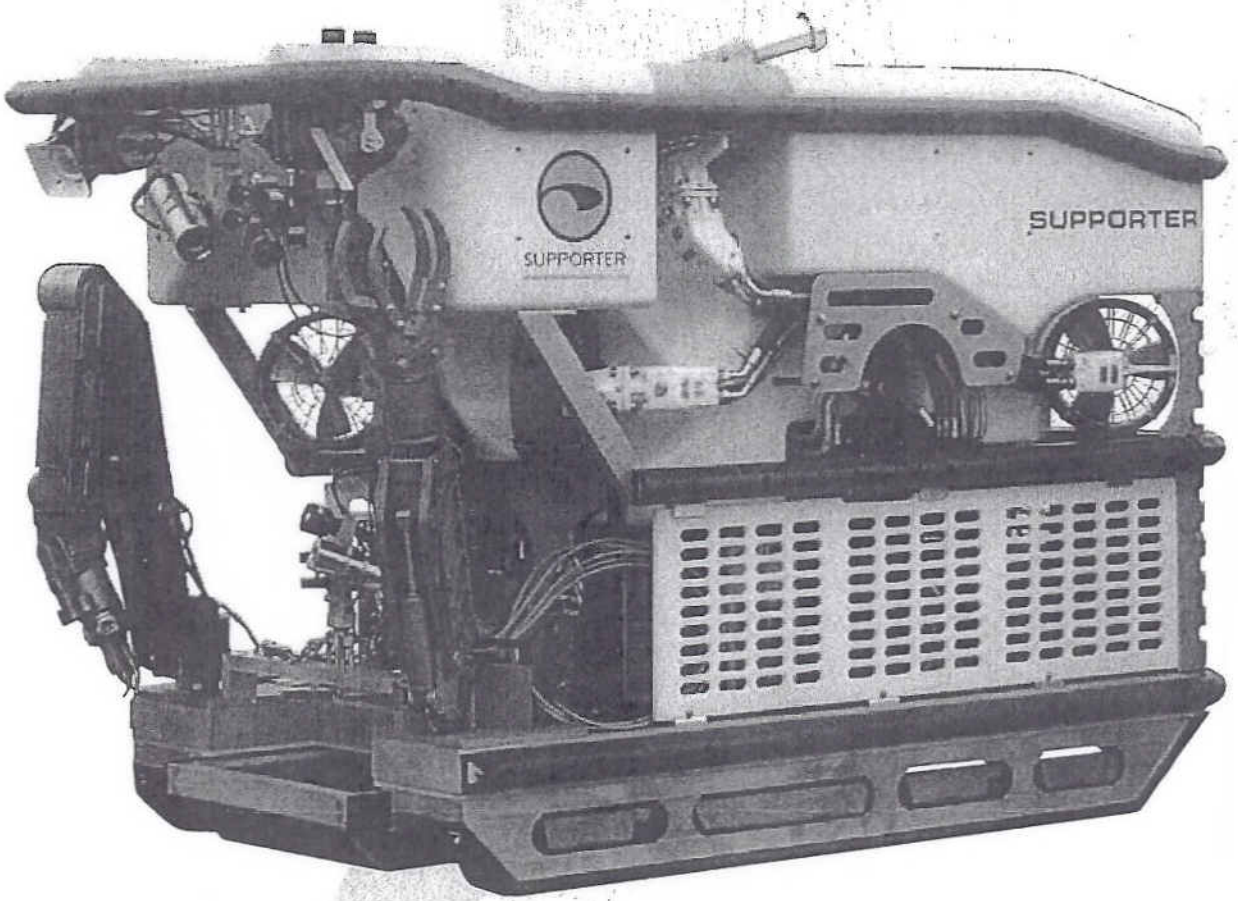
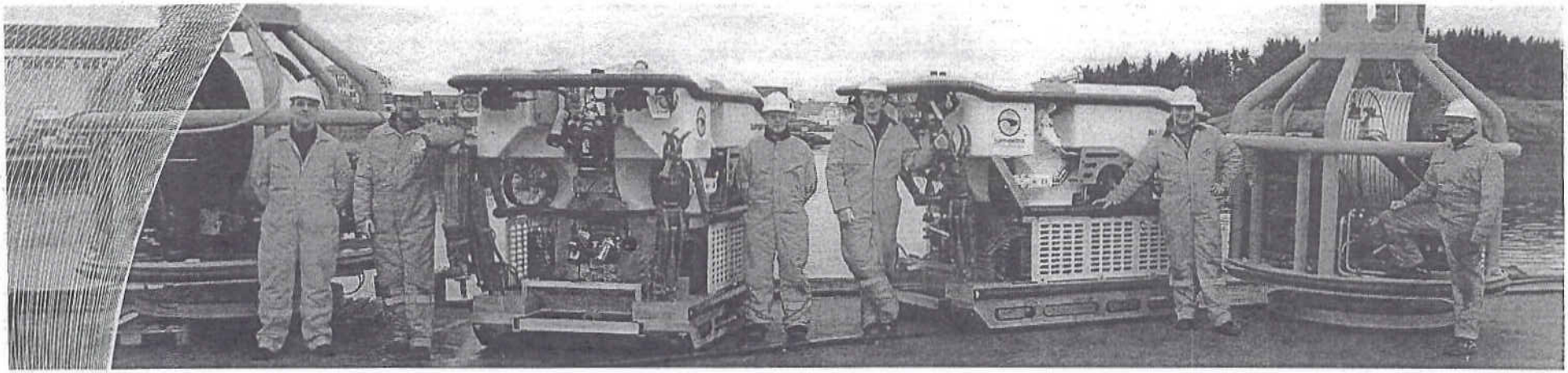
TAB 13.D

SUPPORTER
BY KYSTDESIGN

WORK CLASS ROV - Inspire your future



KYSTDESIGN
SUB-SEA TECHNOLOGY



Leading ROV producer

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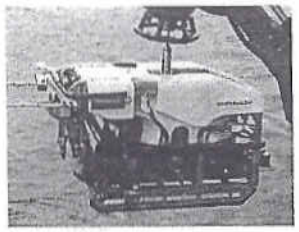
Our main products and services include ROVs, ROV tools, tool control systems and software, hydraulic and electronics engineering, structural engineering, lifting equipment, deck structures and sea fastening elements, as well as hydrodynamics and marine engineering.

SUPPORTER technology

The SUPPORTER vehicle developed by KYSTDESIGN is a unique intervention vehicle as it combines flexibility and capacities only matched by much larger ROV's, within a compact but accessible vehicle envelope. The SUPPORTER technology is refined from years of operational and "hands-on" experience by our designers.



KYSTDESIGN ROV technology is designed for operability

KYSTDESIGN is owned and managed by Erik Kold Bakkevig and Pål G. Eide. KYSTDESIGN AS is an independent company established in the middle of the 90's.

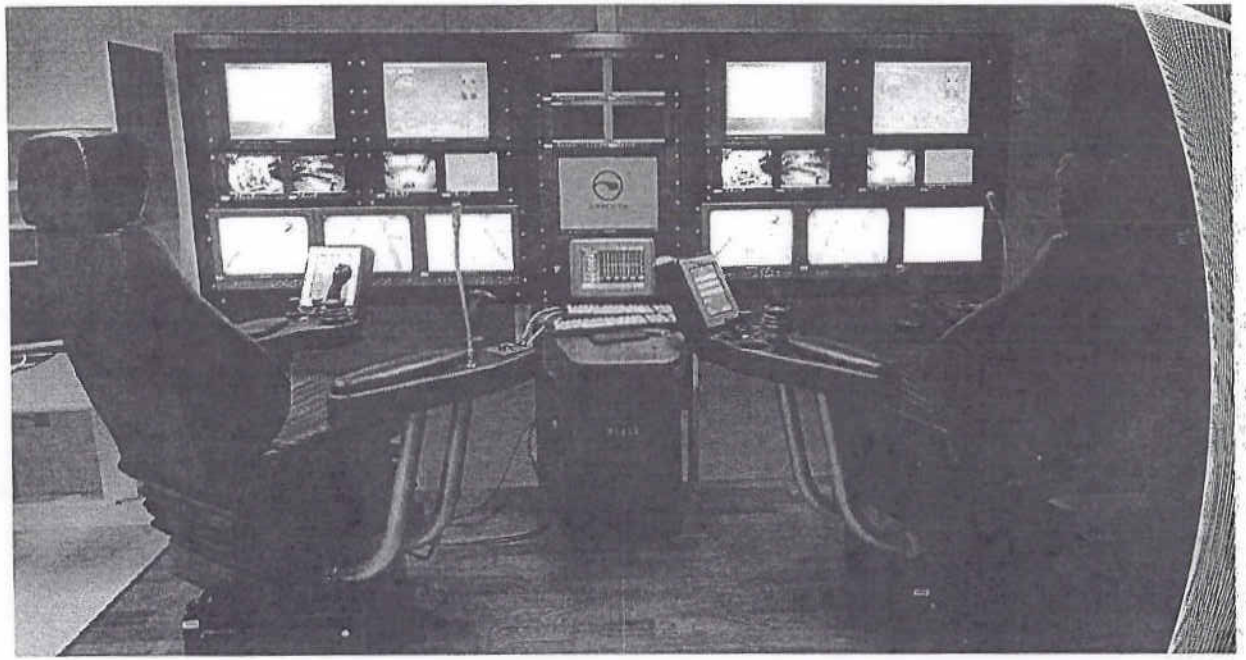
KYSTDESIGN offer today a wide range of hydraulic work class ROV designs. We stick to the use of hydraulics in propulsion and control as we are convinced this is the overall most cost efficient, reliable and powerful solution for vehicles that need to cover a wide range of demanding tasks. Reliable since sub-sea hydraulics and controls, is proven technology based on proven components for use in deep sea areas.

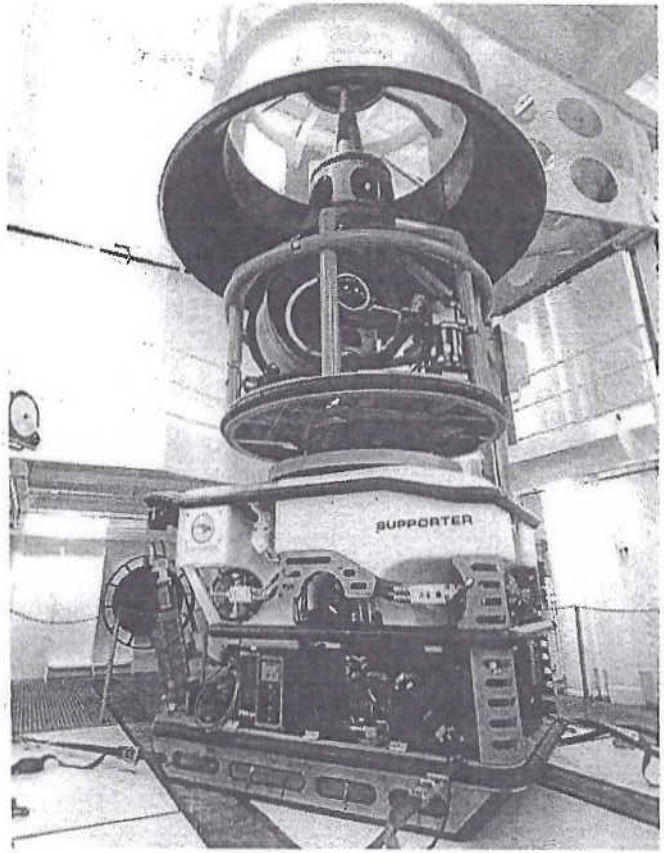
The SUPPORTER can accommodate:

Up to 24 additional tooling hydraulic functions, of which 4 are high flow (75 l/min), and up to 20 additional survey sensors and 8 cameras.

All hydraulic functions are proportionally controlled, and there is ground fault monitoring on all channels in the electronics system.

The ROV control system offers a variety of auto-functions and station keeping capabilities.





Control system

The top-side control system for the KYSTDESIGN ROV's is designed with focus on providing an ergonomic, intuitive and efficient working environment.

Single or dual operation stations can easily be configured to individual needs. Operator task priorities can be switched and shared between stations during operation. We also provide our pilots with well designed ergonomic controls systems to prevent different injuries, for instance lower back injuries.

KYSTDESIGN have looked at different types of ergonomic key factors that can be used to enhance pilot efficiency: man machine interaction and the administrative working space such as layout of screens, touch screen integrated in chairs, control switches and the joy-stick controls.

Our top-side control system is designed through collaboration with the ROV pilots and our "hands on" experience from the ROV-market.

Support & Services

Achieve more than you ever thought possible with total support from KYSTDESIGN.

We offer you as a customer everything from routine maintenance to project engineering support to obtain new skills to your customer. KYSTDESIGN will be there for you, every step of the way.

KEYWORDS ARE:

- Technical Support and services, 24/7
- "Hands-on" training
- ROV pilot simulator courses
- Customized training for advanced operations
- Remote network services onshore or offshore
- Test and documentation

RUE **ROV Manager, Riise Underwater Engineering:**

"The SUPPORTER is compact without impacting accessibility.
The ROV is extremely stable and reliable. Operating the ROV is a pleasure with the vehicle's impressively stable auto-functions. As all the functions available on the SUPPORTER can be operated from a touch screen, it is very easy to use and familiarisation to the ROV's many different functions takes short time.

The ROV is simply designed for efficient operations and simple maintenance

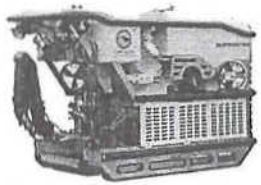
StatoilHydro **StatoilHydro Representative, "Normand Flower ", 2007:**

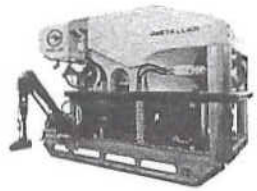
"Normand Flower has made use of two SUPPORTER Work ROVs for a period of 16 months, and the vehicles have functioned very satisfactorily and with a comfortably low down-time rate. The ROVs are robust, flexible and well-suited for IMR operations.

DeepOcean **ROV pilot, Deep Ocean, "Normand Flower", 2007:**

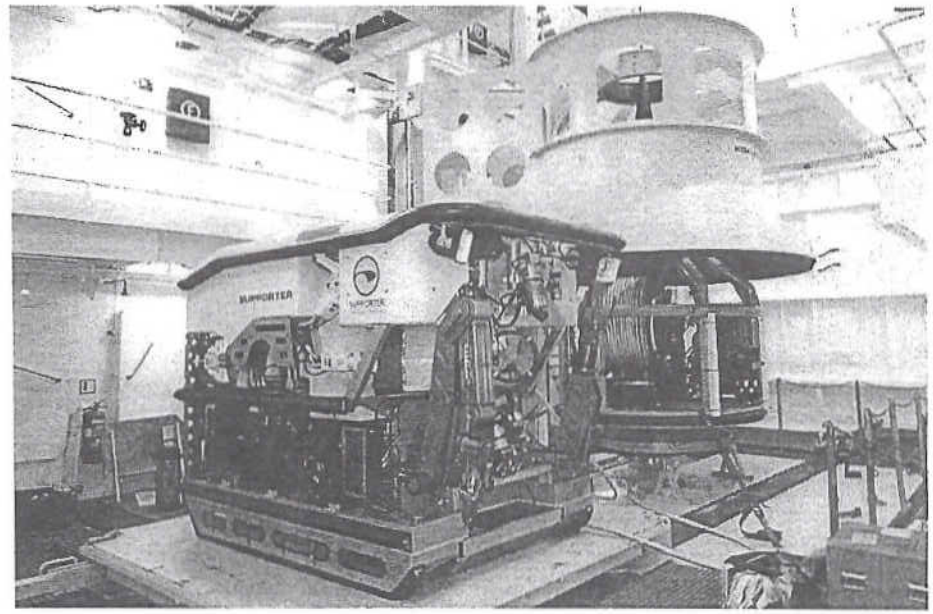
"The SUPPORTER ROV is very stable and reliable to operate. Manoeuvring is simple with the ROV's accurate auto-functions. Operational reliability is so high, that I can't remember the last time I had to perform any repairs. Installing and interfacing project-related equipment in the ROV is very simple, as all functions are easily accessible. All hydraulic connections are easy to reach at the front and can be isolated while working to avoid oil spill. The electronic POD has good access and has plenty of internal space and numerous pre-defined and configurable connection options.

Technical specification





	SUPPORTER	INSTALLER
GENERAL		
Depth rating	2000M (3000M option)	2500M (3000M option)
Power	125 Hp	125 Hp
Thrusters Horizontal	4 x Sub Atlantic SA-300	4 x Sub Atlantic SA-380
Thrusters Vertical	3 x Sub Atlantic SA-300	3 x Sub Atlantic SA-300
Weigth & Load		
Net	2450 Kg	3100 Kg
Incl. skid manips & payload	3050 Kg	3780 Kg
Payload	200 Kg + Skid & Manips	300 Kg + Skid & Manips
Through frame lift	3000 Kg	3000 Kg
Dimensions		
Lenght	2,50 m	3,00 m
Width	1,70 m	1,64 m
Height	1,65 m	1,87 m
Height w. Std. skid	1,90 m	2,20 m
PERFORMANCE		
Surface Performance		
Forward	3,0kn	3,3kn
Lateral	2,0kn	2,0kn
Verical	2,0kn	2,0kn
Bollard pull		
Fore/aft	525 Kg	800 Kg
Lateral	480 Kg	540 Kg
Vertical, up	340 Kg	340 Kg
Vertical, down	580 Kg	580 Kg
Auto Functions	Heading, Pitch, Roll, Detph / Altitude	Heading, Pitch, Roll, Detph / Altitude
DP modes (optional)	Autopos, Autotrack	Autopos, Autotrack
TOOLING		
7-function manipulator	Titan 4	Titan 4
5-function grabber	Rigmaster	Rigmaster
Pan & Tilt	2 x Hydraulic	2 x Hydraulic
Tilt Unit	1 x Hydraulic	1 x Hydraulic
Tool Drawer:	Mounted as standard in skid	Mounted as standard in skid
Isolated HPU		
Pressure:	210 Bar max, adjustable from pilots chair	210 Bar max, adjustable from pilots chair
Flow:	78 lpm	78 lpm
Low flow valves:	20 x 8 lpm, (9 spare) Proportional flow controlled	20 x 8 lpm, (9 spare) Proportional flow controlled
High flow valves:	4 x 75 lpm Proportional flow & pressure controlled	2 x 32 lpm Proportional flow & pressure controlled 1 x 75 lpm, on/off valve
Filters:	Pressure, Return & Water absorbing	Pressure, Return & Water absorbing
ERGONOMIC AND FUNCTIONAL PILOT INTERFACE		
Interface	Touch screen Joysticks & Computer control from the pilotchair One or two pilot chairs (customers choice) Realtime overviewsystem	Touch screen Joysticks & Computer control from the pilotchair One or two pilot chairs (customers choice) Realtime overviewsystem
Control container	(Lxbxh)	(Lxbxh)
TELEMETRY & SENSORS		
Serial connections	32 channels, 115kbps	32 channels, 115kbps
Ethernet	Optional	Optional
Video	Interface for 8 cameras Interface for digital photo camera HDV (optional)	Interface for 8 cameras Interface for digital photo camera HDV (optional)
Gyro	FOG is standard / INS is optional	FOG is standard / INS is optional
Altimeter	Standard	Standard
Depth Sensor	Standard	Standard
Other sensors	17 spare connections	17 spare connections
Spare optical fibers	5	5
Lighting Capacity	10 x 250W dimmable lamps	10 x 250W dimmable lamps



Other products from KYSTDESIGN

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KYSTDESIGN solutions and products, that by many are well known today, are made out of the hands on experience we have built over the last 20 years.

KYSTDESIGN are now used by major underwater contractors such as AGR Group, Deep Ocean, SonSub, Acergy, Riise Underwater, GTO Subsea and Nexans.

KYSTDESIGN ROV designs:

SOLO MK2	Designed by KYSTDESIGN for Stolt Offshore, 1 in operation
INSTALLER	First delivery 2001, 4 in operation - 2008
SUPPORTER	First delivery 2006, 10 in operation - 2008
SURVEYOR	Ongoing concept design of specialised survey vehicle underway
RESEARCHER	Ongoing concept design of ultra-deep water research vehicle

Strandgaten 202 - 5525 Haugesund, Norway - post@kystdesign.no - phone: 0047 52 70 62 50
Visit our website for more information www.kystdesign.no

MEMBER OF

IMCA

KYSTDESIGN
SUB-SEA TECHNOLOGY

TAB 13.E

KYSTDESIGN
SUB-SEA TECHNOLOGY

SUPPORTER Work Class ROV

SUPPORTER is a work class hydraulic ROV systemfor intervention down to 2000 (3000) meter water deep.

ROV technology

KYSTDESIGN delivers a wide range of hydraulic work class ROV solutions.

Products

K Y S T D E S I G N offers a wide range of products for sub-sea intervention, ranging from complete vehicles to manipulator held tools.

INSTALLER Work Class ROV

click for at better view

INSTALLER is a work class hydraulic ROV system, for intervention down to 2500 meter water depth.

The system is characterised by a compact and integrated mechanical architecture, powerful and accessible hydraulic functions and a user friendly real time control system.

Dimension:
3000 x 1500 x 1850 mm (L x B x H) excl. skid
3100kg.w /2500m Buoyancy, excl. Manips and skid
125 Shaft Hp DualPump Sysytem

275_kystdesign-installer.pdf

SUPPORTER Work Class ROV
INSTALLER Work Class ROV
ROV Control Systems
ROV Shackles
Complete Solutions Ready to use
Camerabooms
Cutting Tools
Electronics and Control systems
Handling Systems
Hydraulic Products and Systems
Hydraulic Compensators

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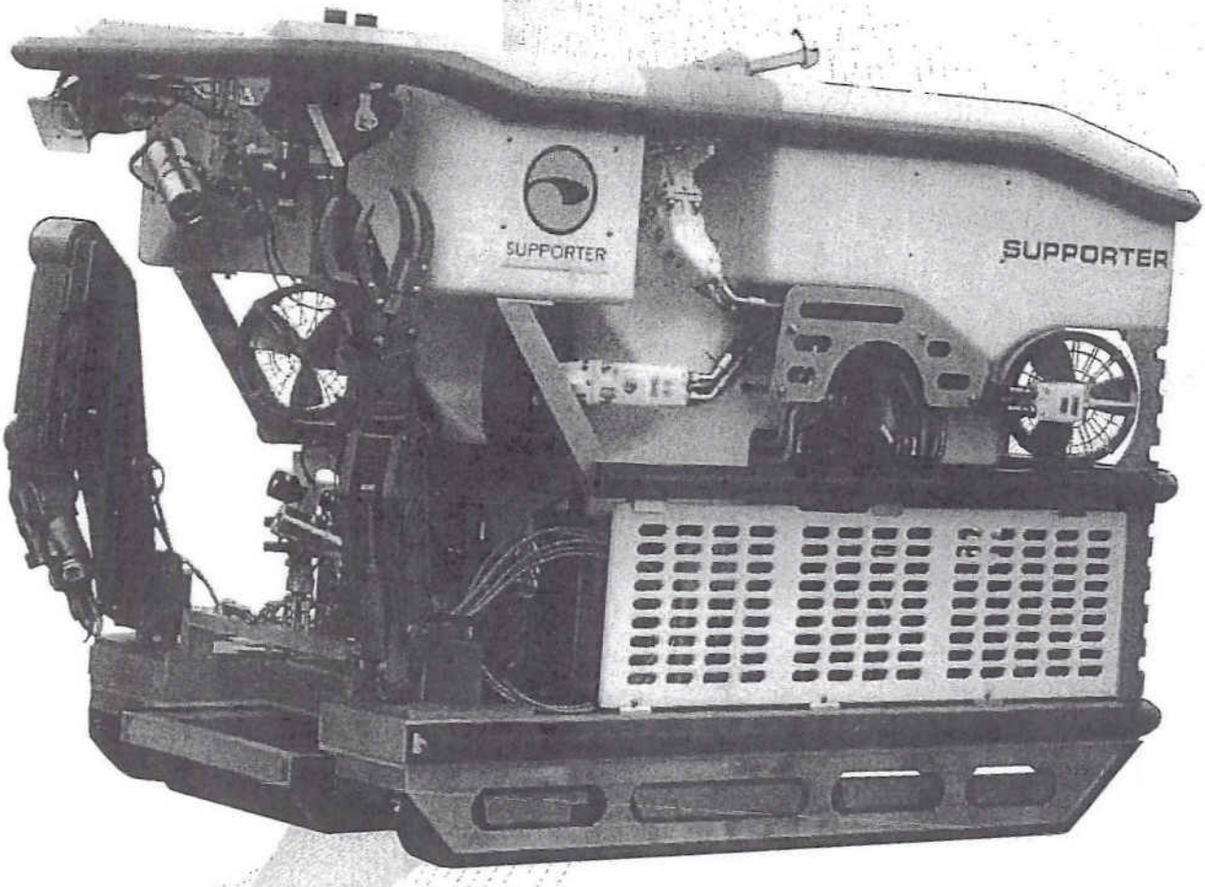
TAB 13.F

SUPPORTER

BY KYSTDESIGN

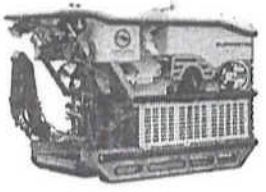
WORK CLASS ROV - Inspire your future

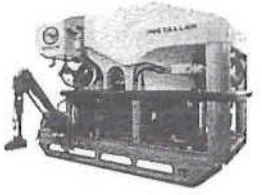


KYSTDESIGN

SUB-SEA TECHNOLOGY

Technical specification





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GENERAL		
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Power	125 Hp	125 Hp
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Through frame lift	3000 Kg	3000 Kg
Dimensions		
Lenght	2,50 m	3,00 m
Width	1,70 m	1,64 m
Height	1,65 m	1,87 m
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PERFORMANCE		
Surface Performance		
Forward	3,0kn	3,3kn
Lateral	2,0kn	2,0kn
Verical	2,0kn	2,0kn
Bollard pull		
Fore/aft	525 Kg	800 Kg
Lateral	480 Kg	540 Kg
Vertical, up	340 Kg	340 Kg
Vertical, down	580 Kg	580 Kg
Auto Functions	Heading, Pitch, Roll, Detph / Altitude	Heading, Pitch, Roll, Detph / Altitude
DP modes (optional)	Autopos, Autotrack	Autopos, Autotrack
TOOLING		
7-function manipulator	Titan 4	Titan 4
5-function grabber	Rigmaster	Rigmaster
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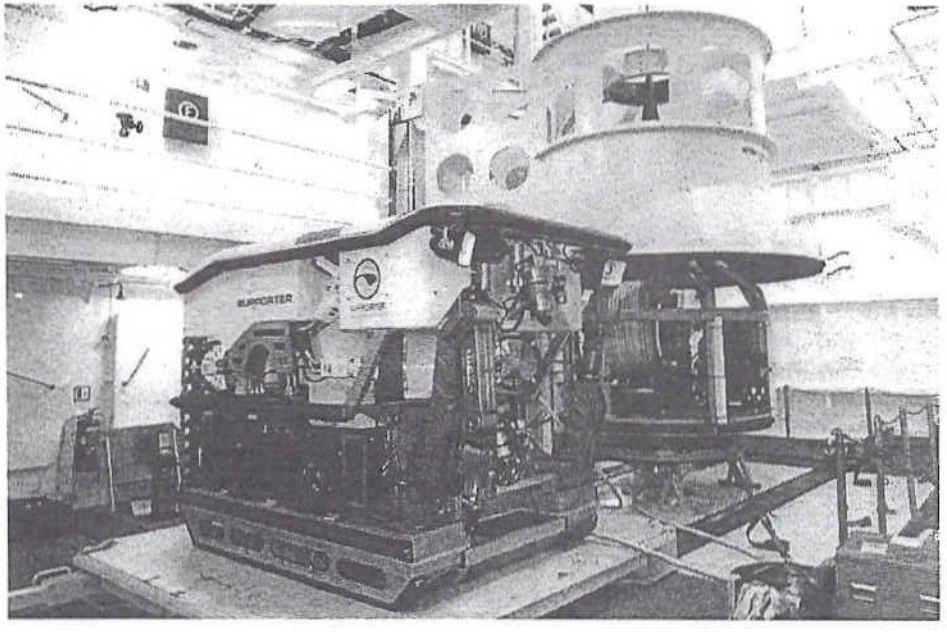
TELEMETRY & SENSORS		
Serial connections	32 channels, 115kbps	32 channels, 115kbps
Ethernet	Optional	Optional
Video	Interface for 8 cameras Interface for digital photo camera HDV (optional)	Interface for 8 cameras Interface for digital photo camera HDV (optional)
Gyro	FOG is standard / INS is optional	FOG is standard / INS is optional
Altimeter	Standard	Standard
Depth Sensor	Standard	Standard
Other sensors	17 spare connections	17 spare connections
Spare optical fibers	5	5
Lighting Capacity	10 x 250W dimmable lamps	10 x 250W dimmable lamps



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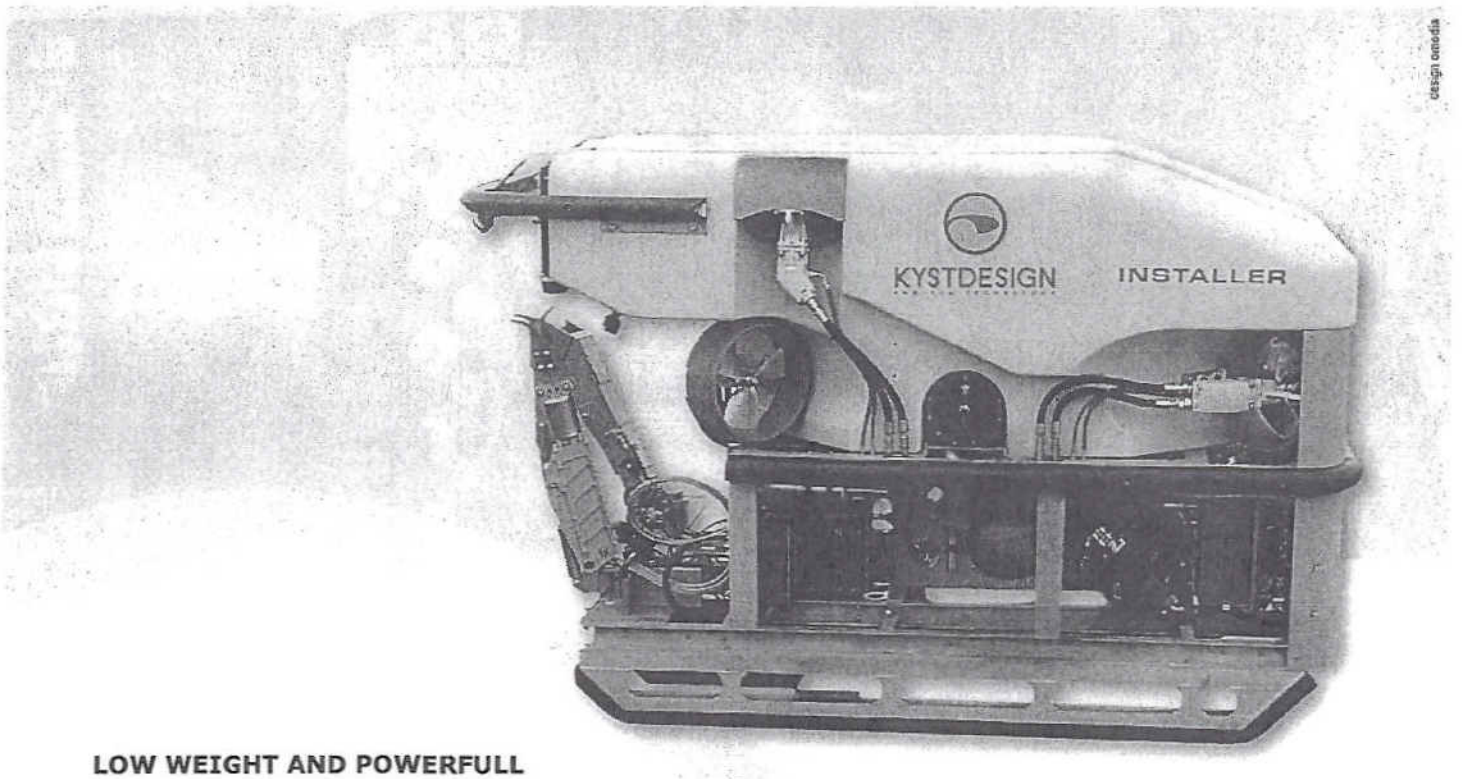
SUPPORTER	First delivery 2006, 10 in operation - 2008
SURVEYOR	Ongoing concept design of specialised survey vehicle underway
RESEARCHER	Ongoing concept design of ultra-deep water research vehicle

TAB 13.G

KYSTDESIGN
SUB-SEA TECHNOLOGY

INSTALLER work class ROV



LOW WEIGHT AND POWERFULL

- 3000x1500x1850mm (LxBxH) excl. Skid
- 3100 kg w/ 2500m Buoyancy, excl. Manips and Skid
- 125 Shaft Hp, Dual Pump System
- >3knots, >800kg bollard pull

EASY INTERFACE FOR TOOLING AND WORK MODULES

- 4 attachment point for underslung work modules
- 20x Propotional directional valves with propotional pressure control on supply line
- 2x 32 l/min propotional pressure and flow controlled valves
- 1x150 l/min valve
- 20x Survey Connectors

HIGH PAYLOAD AND "THROUGH FRAME LIFT" CAPABILITY

- SWL 8 Te Aluminium Frame w/ movable lift point
- 3 Te Through Frame Lift capacity
- 300 kg payload w/ manips, skid and tooling basket fitted

ERGONOMIC AND FUNCTIONAL PILOT INTERFACE

- Touch Screen, Joysticks and Computer Control built into the chair armrests
- Single or dual control station running real-time system

KYSTDESIGN AS • Strandgaten 202 • 5525 Haugesund • Norway • Tel: +47 52 70 62 50 • Fax: +47 52 70 62 01 • www.kystdesign.no

TAB 13.H

SUPPORTER Work Class ROV

SUPPORTER is a work class hydraulic ROV systemfor intervention down to 2000 (3000) meter water deep.

INSTALLER Work Class ROV

INSTALLER is a work class hydraulic ROV system, for intervention down to 2500 meter water depth.

ROV Control Systems

The top-side control system for the KYSTDESIGN ROV's is designed with focus on providing an ergonomic, intuitive and efficient working environment.

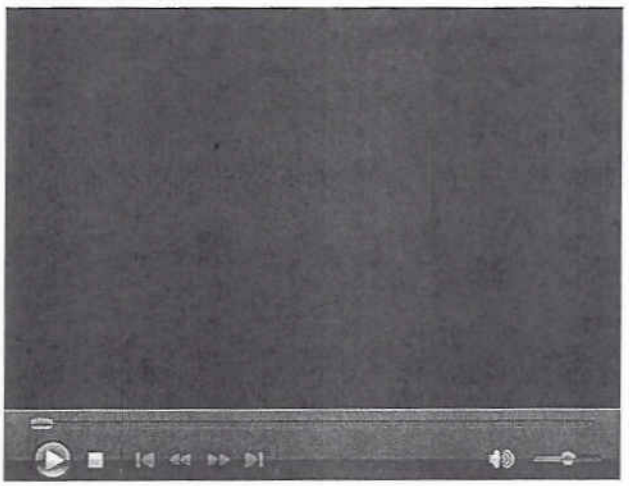
ROV Technology – *Designed for operability*

KYSTDESIGN has delivered 15 systems by september 2009.

ROV Brochure - Click to download PDF

KYSTDESIGN offers a range of hydraulic work class ROV designs. We stick to the use of hydraulics in propulsion and control as we are convinced this is the overall most cost efficient, reliable and powerful solution for vehicles that need to cover a wide range of demanding tasks. Cost efficient since they require the minimum size and weight for vehicles used in IMR operations

Take a look at the animation, presenting the SUPPORTER Work Class ROV



Please send me the animation and the technical specification for SUPPORTER ROV

The SUPPORTER vehicle developed by KYSTDESIGN is a unique intervention vehicle as it combines flexibility and capacities only matched by much larger ROV's, within a compact but accessible vehicle envelope
(LxBxD = 2.5 x 1.7 x 1.65 m).

The SUPPORTER technology is refined from years of operational and "hands-on" experience by our designers. The top-side control system for KYSTDESIGN ROV's is designed with focus on providing an ergonomic, intuitive and efficient working environment. Single or dual operation stations can easily be configured to individual needs. Operator task priorities can be switched and shared between stations during operation.

The SUPPORTER can accommodate up to 24 additional tooling hydraulic functions, of which 4 are high flow (75 l/min), and up to 20 additional survey sensors and 8 cameras. All hydraulic functions are proportionally controlled, and there is ground fault monitoring on all channels in the electronics system. The ROV control system offers a variety of auto-functions and station keeping capabilities

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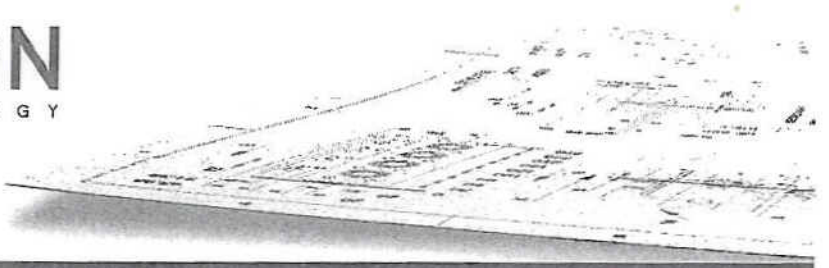
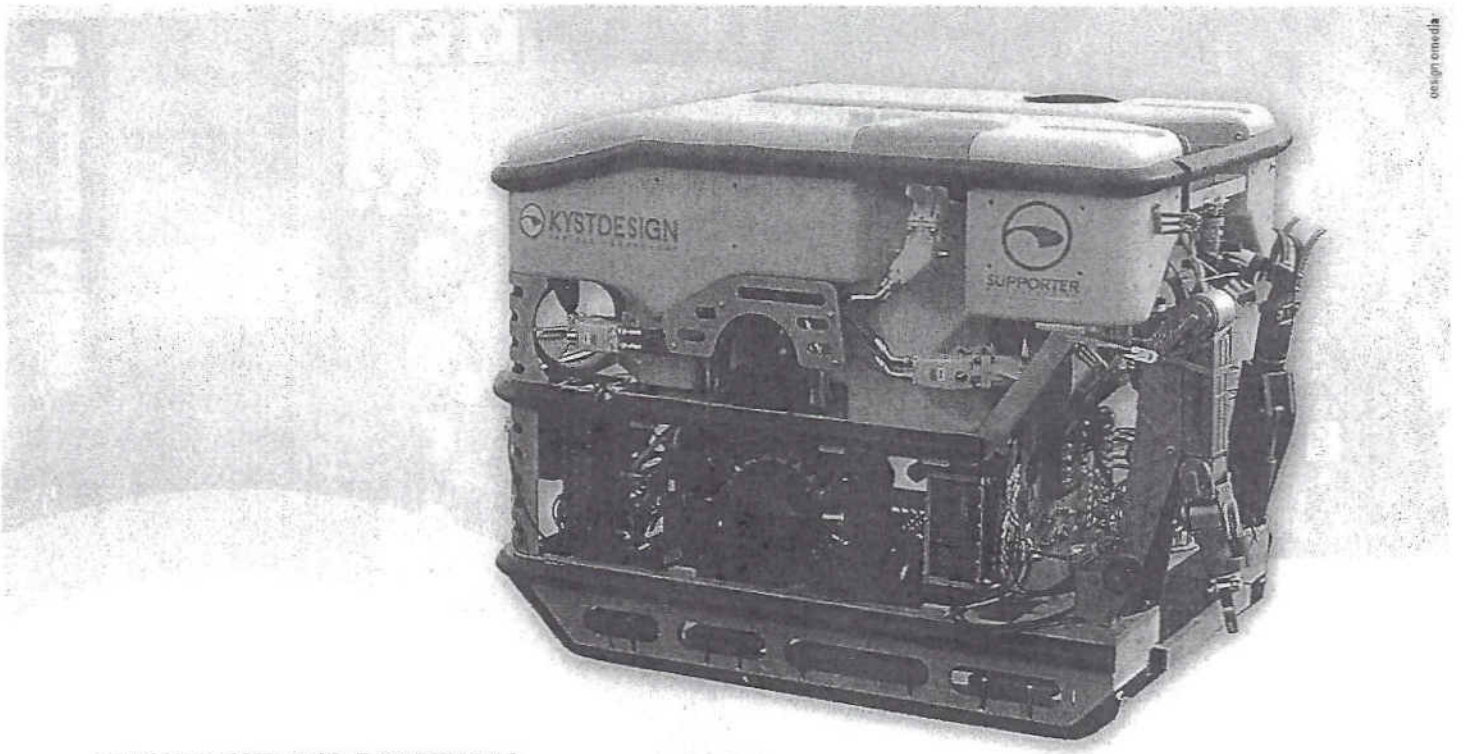
TAB 13.I

KYSTDESIGN
SUB-SEA TECHNOLOGY



SUPPORTER work class ROV



LOW WEIGHT AND POWERFULL

- 2500x1700x1650mm (LxBxH) excl. Skid
- 2450 kg w/ 2000m Buoyancy, excl. Manips, Skid and ballast
- 125 Shaft Hp, Dual Pump System
- >3knots, >530kg bollard pull

EASY INTERFACE FOR TOOLING AND WORK MODULES

- 4 attachment point for underslung work modules
- 20x Proportional directional valves with proportional pressure control on supply line
- 4x 75 l/min proportional pressure and flow controlled valves
- 20x Survey Connectors

HIGH PAYLOAD AND "THROUGH FRAME LIFT" CAPABILITY

- SWL 8 Te Aluminium Frame w/ movable lift point
- 3 Te Through Frame Lift capacity
- 220 kg payload w/ manips, skid and tooling basket fitted

ERGONOMIC AND FUNCTIONAL PILOT INTERFACE

- Touch Screen, Joysticks and Computer Control built into the chair armrests
- Single or dual control station running real-time system

KYSTDESIGN AS • Strandgaten 202 • 5525 Haugesund • Norway • Tel: +47 52 70 62 50 • Fax: +47 52 70 62 01 • www.kystdesign.no

TAB 14.A

ROV Sale

bsea AS is a company that manufactures the in-house developed Merlin workclass ROV. Our focus is ROV design, use of standard industrial components and minimisation of environmental consequences under water operation.

The Merlin ROV system represents a new generation electrical work class ROV and Trencher with extreme performance and increased reliability. The vehicle is based on hardwired electrical propulsion system, composite material frame and intuitive man-machine interface. It will surpass any other ROV system of this class.

TAB 14.B

Merlin WR200 ROV

Electrical Work Class
ROV 200 HP

The most effective and reliable electrical ROV on the market. The Merlin represents a remotely operated vehicle (ROV) work class with deepwater capabilities. The Merlin is designed for working in extremely harsh conditions, delivers performance in water depth to 3000 meters and provides a 200 hp system. In order to get optimum reliability the Merlin has an open frame, double maneuvering systems and a back-up solution that handles all critical functions and processes. The Merlin is designed and built at IKM Subsea AS' production facilities at Bryne, Norway.

See Attachment on right top hand corner of web page for technical specifications of WR200

Merlin WR200 - DATASHEET (pdf)
Introduction movie (external link)

Merlin WR200 is designed to be the most efficient and reliable work class ROV on the market

The Merlin WR200 has the following design features:

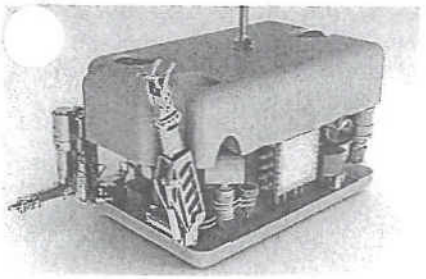
- All electric propulsion system with control and power systems located topside - increased reliability, reduced maintenance and significantly increased power efficiency.
- Open composite material frame filled with enclosed buoyancy material - Strong, light weight, non-corrosive, damage resistant and reduced drag.
- omic work environment with intuitive man-machine interface - or operator control station with dual configurable controls.
- Fully configurable control systems - Independent control of hydraulic as well as electrical tooling.
- The Merlin is the "Greener ROV alternative" - Electrical propulsion minimizes leaks in the hydraulics as experienced with conventional ROVs.

Vedlegg

IKM Subsea Merlin WR2001,45 MB

TAB 14.C

Merlin LR120 ROV



Vedlegg

IKM Subsea Merlin LR1200,77 MB

Electrical Light Work Class
ROV 120 HPThe Merlin LR120 is designed and built at our production facilities at Bryne, Norway. This is a light work class ROV which has a 120 hp system and delivers performance in water depth to 3000 meters. The Merlin LR120 has the facilities to support drilling operations and seabed survey.

Merlin LR120 - the most compact, powerful work class ROV on the market

The Merlin LR120 has the following design features:

- All electric propulsion system with control and power systems located topside - Increased reliability, reduced maintenance and significantly increased power efficiency.
- Reinforced composite material frame filled with enclosed buoyancy material - strong, light weight, non-corrosive, damage resistant and reduced drag.
- Ergonomic work environment with intuitive man-machine interface - Superior operator control station with dual configurable controls.
- Fully configurable control systems - independent control of hydraulic as well as electrical tooling.
- The Merlin is the "Greener ROV alternative", electrical propulsion minimizes leaks in the hydraulics as experienced with conventional

EET

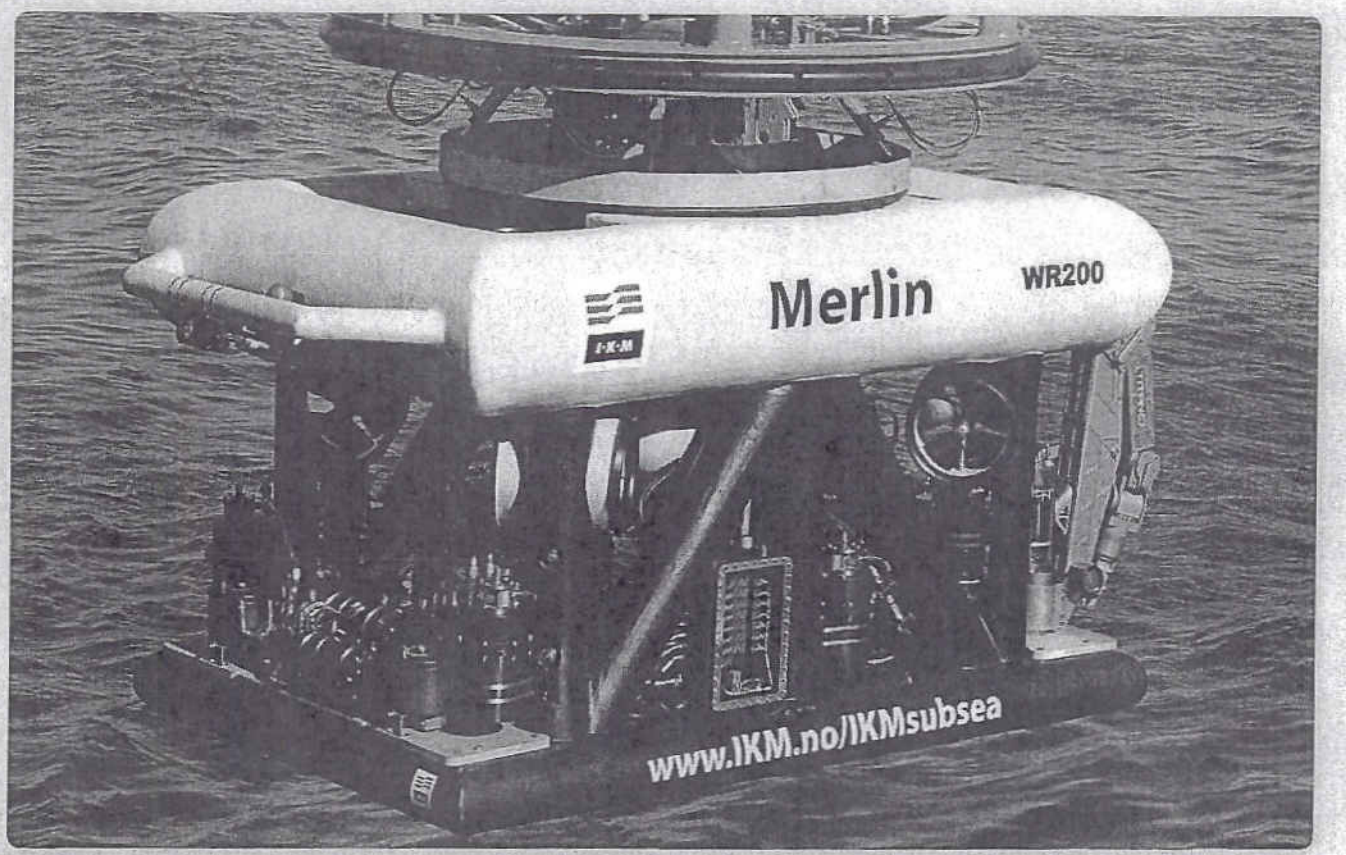
TAB 14.D

Merlin WR200

Electrical Work Class
ROV 200 HP

I·K·M

IKM Subsea AS



Merlin WR200 is designed to be the most efficient and reliable work class ROV on the market

The Merlin WR200 has the following design features:

- ✔ All electric propulsion system with control and power systems located topside - ***Increased reliability, reduced maintenance and significantly increased power efficiency.***
- ✔ Open composite material frame filled with enclosed buoyancy material - ***Strong, light weight, non-corrosive, damage resistant and reduced drag.***
- ✔ Ergonomic work environment with intuitive man-machine interface - ***Superior operator control station with dual configurable controls.***
- ✔ Fully configurable control systems - ***Independent control of hydraulic as well as electrical tooling.***
- ✔ The Merlin is the ***"Greener ROV alternative"*** - Electrical propulsion minimizes leaks in the hydraulics as experienced with conventional ROVs.

Merlin WR200

The Merlin WR200 is a fully electric work class ROV based on proven electric technology. The IKM group has used its diverse expertise in electrical engineering and subsea design to make a quantum leap in ROV technology. The Merlin system is designed to the highest industrial standards for trustworthy subsea performance with minimum maintenance requirements.

The ROV has an open non – corrosive frame coated with GRP, and filled with buoyancy that ensures minimized volume and drag coefficient. The open structure also allows for easy access during inspection and maintenance of the equipment.

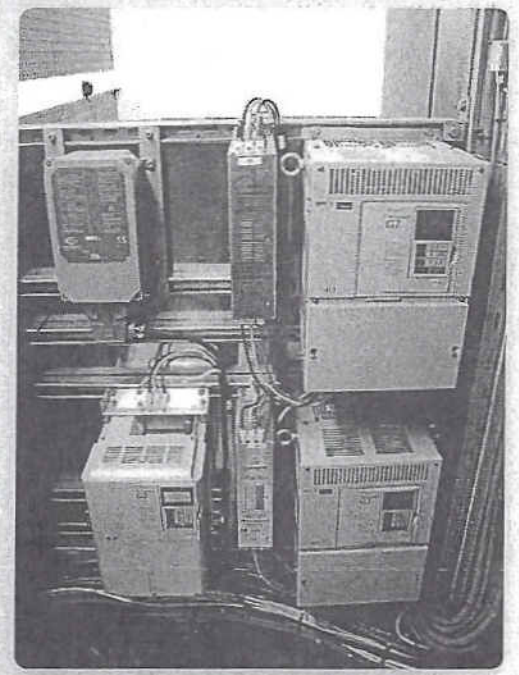
Reliability and operation time are maximized by reducing the number of components subsea and placing more equipment in a controlled air conditioned environment on deck. There are no power converters, advanced driver cards or subsea transformers for the thrusters on the ROV itself.

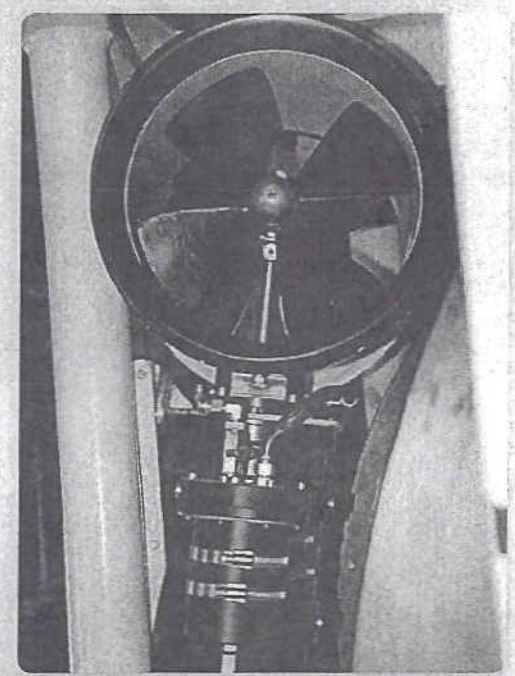
The 8 electrical thrusters are directly and individually powered from topside by frequency converters at 3000 Volts, ensuring the highest degree of redundancy. The ROV is capable of carrying and operating all known tools in the subsea market. It is typically fitted with Shilling Rig Master five function and T4 / Conan seven function manipulator arms.

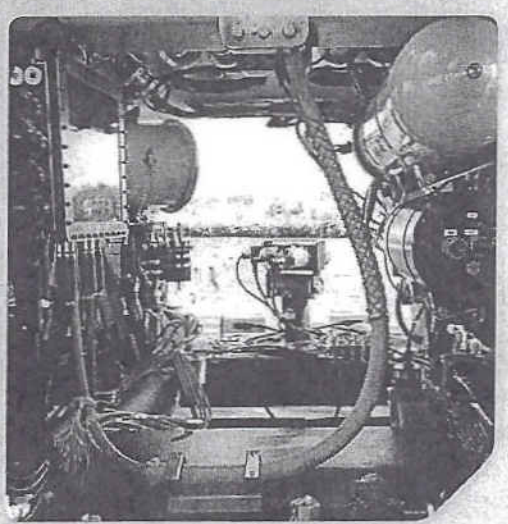
Central to the ROV design are the electrical power, control and propulsion systems as well as the open frame structure. This technology was first developed in year 2000 on the IKM Subsea Trencher System. The concept has since then been further refined and improved to the current level.

All our ROVs are supported by a periodic modularized maintenance program and ROV pilots are certified through the IKM training program.

IKM Subsea AS is a company in the IKM Group and is fully NS-EN ISO 9001:2008 certified.





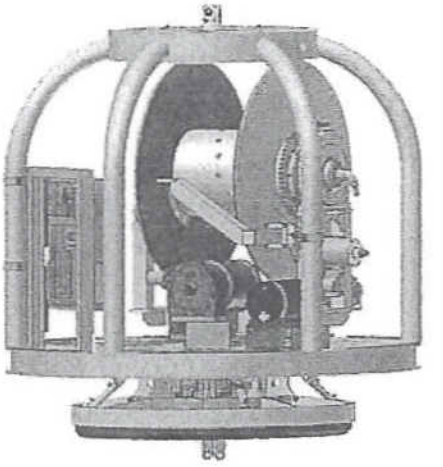


ROV Specifications:

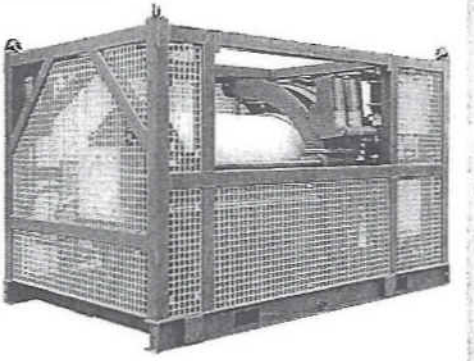
Depth rating	3000 msw
Length	2.8 m
Width	1.8 m
Height	1.7 m
Weight	2800 kg
Manipulator	Shilling T4 / Conan (or client spec.)
Manipulator	Shilling Rig master (or client spec.)
Thrusters	8 off Electrical 12" Dual Counter Rotating Propellers
Configuration	4 off Horizontal (vectored), 4 off Vertical
Pulling force	8 kN Forward / Aft. / Lateral 11 kN Vertical
Auxiliary Tool HPU	1 off 18-30 kW Electrical Hydraulic Power Pack 49-80 l/min adjustable up to 315 bar
Auxiliary ROV HPU	1 off 8-18 kW Electrical Hydraulic Power Pack 20-49 l/min adjustable up to 250 bar
Valve pack 1	8 off proportional NG 3 valves
Valve pack Tool	8 off proportional NG 3 valves & 1 off Ng 10
Subsea Electrical interface	Communication: RS 232, RS 422, RS 485, Ethernet, fiber (HD) Power: 24V, 110V, 3000V
Cameras	1 off Low Light Camera (pan & tilt) 1 off Color & Zoom Camera (pan & tilt) 2 fixed color cameras (on front bar). 2 off Camera Color (one rear, one center for TMS docking) Total number of camera slots: 8 (prepared for add. pan & tilt)
Lights	6 off LED lights individually dimmed
Sensors:	
Depth	Digiquartz & altimeter
Heading	Gyro - as specified by client
Pitch & Roll	+/- 20 degrees
Sonar	MS-1000
Auto functions	Auto Heading / Auto Depth / Auto Altitude
Power Requierments:	
ROV	250 kVA
Control - Container	30 kW, 440V/50-60Hz

This is standard equipment for the Merlin WR200. Different options for lighting, cameras, manipulator arms, tools etc. may be selected.

Our Standard Handling Systems:



TMS:
Malm Orstad
Tophat TMS



Winch:
CETIX WAVERUNNER ™
Electrical winch

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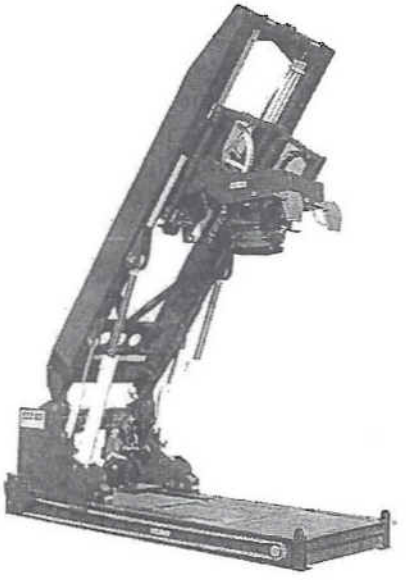


A-Frame:
SEPRO HPL
Narrow dipping A-frame

DESIGN & PRODUKSJON: DATATRYKK AS

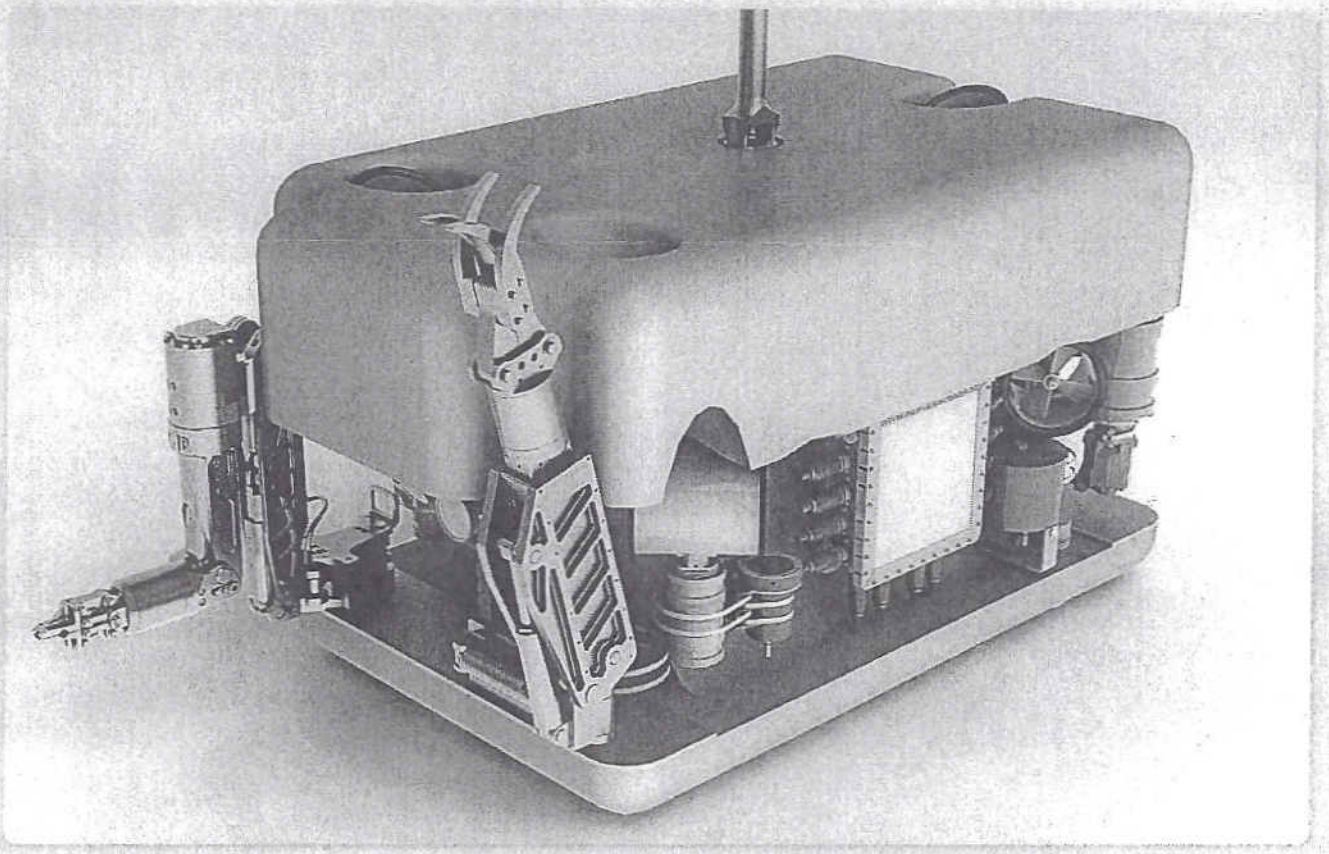
TAB 14.E

Merlin LR120

Electrical Light Work Class ROV 120 HP

I·K·M

IKM Subsea AS



Merlin LR120 - the most compact, powerful work class ROV on the market

The Merlin LR120 has the following design features:

- ✔ All electric propulsion system with control and power systems located topside - ***Increased reliability, reduced maintenance and significantly increased power efficiency.***
- ✔ Reinforced composite material frame filled with enclosed buoyancy material - ***strong, light weight, non-corrosive, damage resistant and reduced drag.***
- ✔ Ergonomic work environment with intuitive man-machine interface - ***Superior operator control station with dual configurable controls.***
- ✔ Fully configurable control systems - ***Independent control of hydraulic as well as electrical tooling.***
- ✔ The Merlin is the ***"Greener ROV alternative"***, electrical propulsion minimizes leaks in the hydraulics as experienced with conventional ROVs.

Merlin LR120

The Merlin LR120 is the most compact, yet powerful ROV system available on the market. The IKM Group has used its diverse expertise in electrical engineering and subsea design to make a quantum leap in ROV technology. The Merlin system is designed to the highest industrial standards and will give trustworthy subsea performance with minimum maintenance requirements.

Central to the ROV design are the electrical power, control and propulsion systems. This technology was first developed in year 2000 on the IKM Subsea Trencher System. The concept has since then been further refined and improved to the current level.

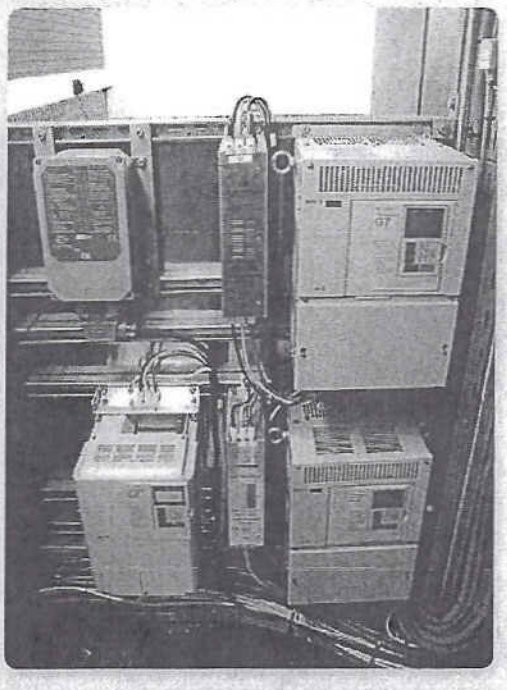
Reliability and operation time are maximized by reducing the number of components subsea and placing more equipment in a controlled air conditioned environment on deck. There are no power converters, advanced driver cards or subsea transformers for the thrusters on the ROV.

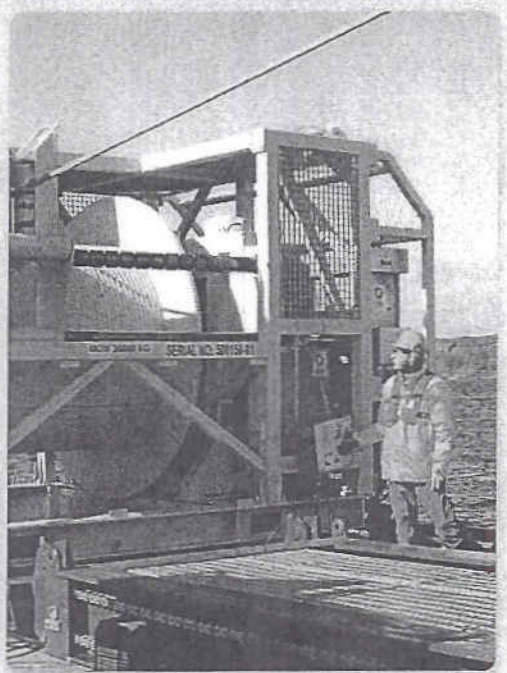
The 7 electrical thrusters are directly and individually powered from topside by frequency converters at 3000 Volts, ensuring the highest degree of redundancy. The ROV is capable of operating most known tools in the subsea market. It is typically fitted with Shilling Orion four function and Orion seven function manipulator arms.

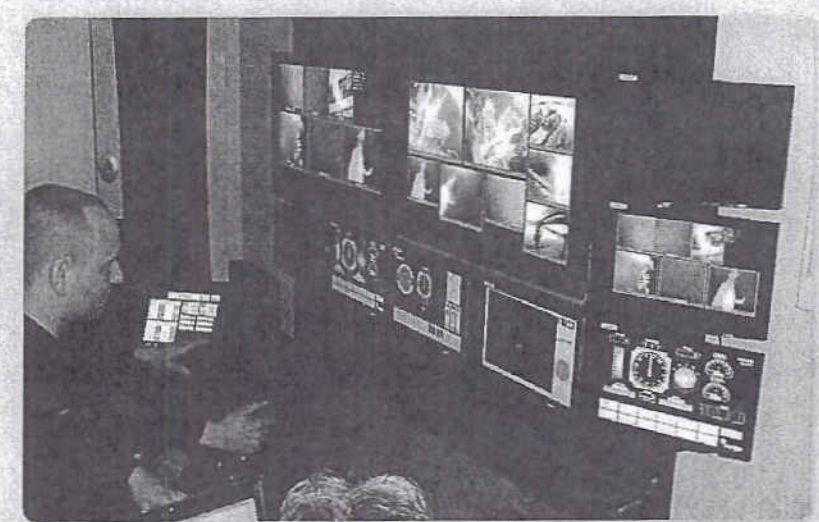
The ROV has a totally reinforced composite frame structure combined with buoyancy material. The high power to volume ratio provides the vehicle with superior station keeping capabilities under harsh current conditions. All components are located around the perimeter of the structure. The combination of few subsea components and easy access permits low cost and expedient inspection and maintenance.

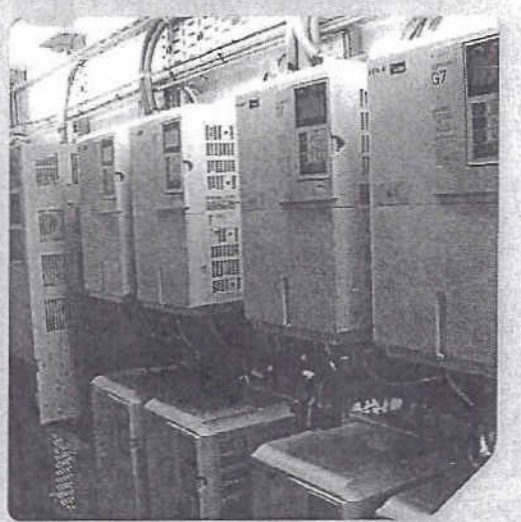
All our ROVs are supported by a periodic modularized maintenance program and ROV pilots are certified through the IKM training program.

IKM Subsea AS is a company in the IKM Group and is fully NS-EN ISO 9001:2008 certified.







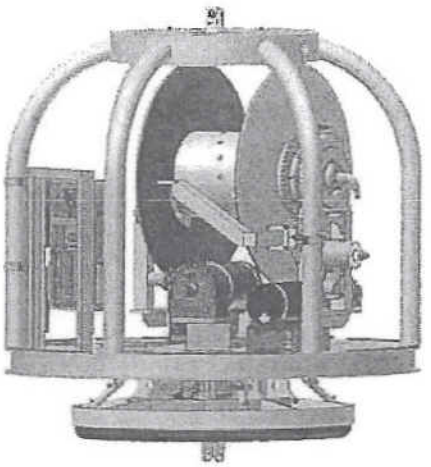


ROV Specifications:

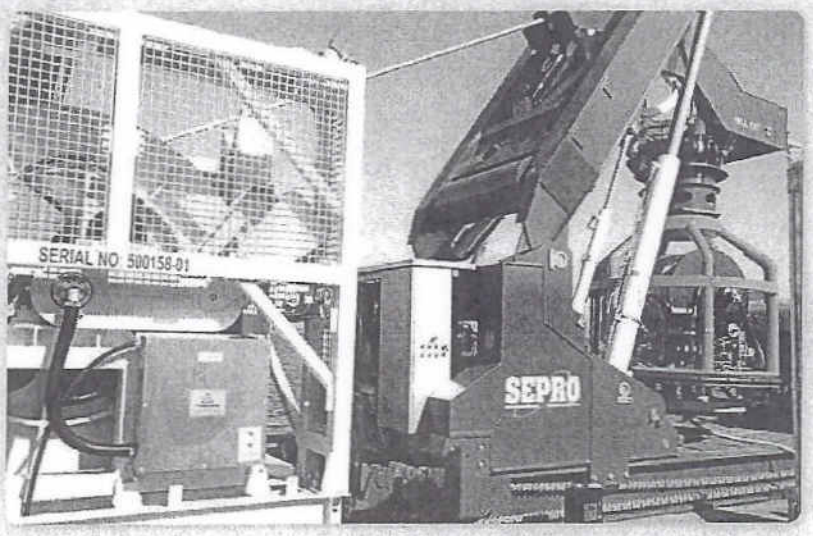
Depth rating	3000 msw
Length	2.0 m
Width	1.2 m
Height	1.1 m
Weight	Approx. 1600 kg
Manipulator	7 function Orion (or client spec.)
Manipulator	4 function Orion (or client spec.)
Thrusters	7 off Electrical 10" Each with Dual Counter Rotating Propellers
Configuration	4 off Horizontal (vectored) and 3 off Vertical (vectored)
Pulling force	5.6 kN Forward / Aft. / Lateral 4.2 kN Vertical
Auxiliary ROV HPU	1 off 8 kW Electrical Hydraulic Power Pack 20 l/min adjustable up to 250 bar
Auxiliary Tool HPU	1 off 18 kW Electrical Hydraulic Power Pack 49 l/min adjustable up to 315 bar
Valve pack	16 off proportional NG 3 valves. Sectioned for clean / dirty oil
Cameras	One color and one low light camera in front mounted on an electrical pan/tilt unit. 2 fixed color cameras mounted in front. One fixed color camera aft. One color camera for TMS docking Total number of camera slots: 8
Lights	LED lights individually dimmed
Subsea Electrical interface	Communication: RS 232, RS 422, RS 485, Ethernet, Fiber (HD) Power: 24V, 110V, 3000V
Sensors:	
Depth	Digiquartz & altimeter
Heading	Gyro - as specified by client
Pitch & Roll	+/- 20 degrees
Sonar	Obstacle avoidance sonar
Auto functions	Auto Heading / Auto Depth / Auto Altitude
Power Requierments:	
ROV	200 kVA
Control - Container	30 kW, 440 V/50-60Hz

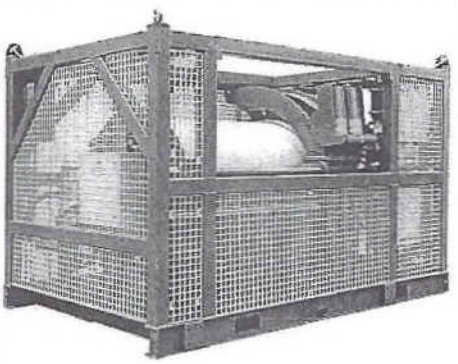
This is standard equipment for the Merlin LR120. Different options for lighting, cameras, manipulator arms, tools etc. may be selected.

Our Standard Handling Systems:



TMS:
Malm Orstad
Tophat TMS





Winch:
CETIX WAVERUNNER ™
Electrical winch

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I·K·M

IKM Subsea AS

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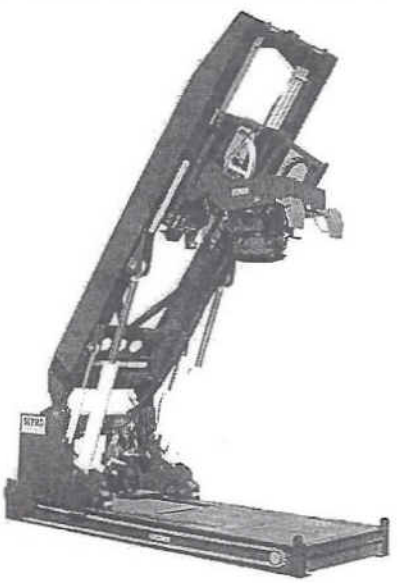
www.ikm.no/ikmsubsea



A-Frame:
SEPRO HPL
Narrow dipping A-frame

DESIGN & PRODUKSJON: DATATRYKK AS

TAB 15.A

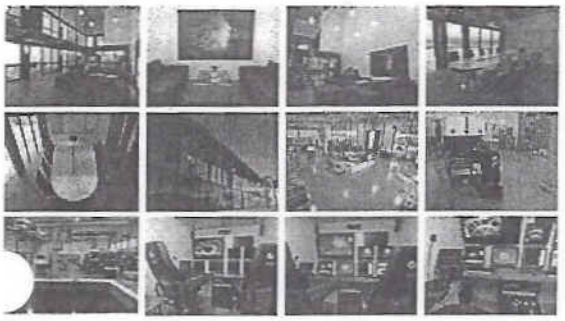
Velg språk / *choose language*

HOME SERVICES PRODUCTS REFERENCES CONTACT US ABOUT SPERRE NEWS

Our staff

Certifications
Sperre AS is now certified according to NS-EN ISO 9001:2008

Partner companies
We cooperate with other local companies here in Notodden.



About Sperre

Sperre AS is a subsea technology specialist company that manufactures and sells electrical ROV systems and subsea technology equipment.
We also wish to be a problem-solver for the subsea sector, and we are always happy to accept fresh challenges.

The company was established in 1993 and all of our professional staff have a solid background in ROVs and marine operations.

Our head office and workshops are in Notodden, centrally located in Eastern Norway. With our specially adapted vehicles and mobile ROV rig, we can reach anywhere on the coast of Norway from Cape Lindesnes to Trondheim in less than nine hours.

Our ROVs are ready for deployment 24 hours a day and are capable of serving our customers anywhere in Norway.

Our vision: to be a flexible partner ready to offer all our clients the best possible service and technical support.

Sperre AS - Merdeveien 2F - 3676 Notodden
Email:wh@sperre-as.com
Phone: +47 35 02 50 00 **Fax:** +47 35 02 51 20

Search pages:

TAB 15.B

SUB-fighter

ROV comparison chart
Standard delivery volume

MODEL		3000	3000	4500	7500	7500 CROV	7500 offshore	15 k offshore	30 k offshore
Type of ROV System									
Electric		yes	yes	yes	yes	yes	yes	yes	yes
Inspection		yes	yes	yes	yes	yes	yes	yes	yes
Light work		yes	yes	yes	yes	yes	yes	yes	-
Work		-	-	yes	yes	yes	yes	yes	yes
Survey		yes	yes	yes	yes	yes	yes	yes	yes
TMS		-	-	option	option	option	option	option	option
LARS		-	-	option	option	option	option	option	option
Container based		-	-	option	option	option	option	option	option
Custom build		yes	yes	yes	yes	yes	yes	yes	yes
Depth rating									
Standard	m	300	700	700	700	700	1500	700	1000
Optional	m	700	-	3000	3000	3000	3000	6000	6000
Dimensions									
Length	mm	800	970	1180	1440	1200	1500	1500	2500
Width	mm	700	670	720	820	930	820	9700	1500
Height	mm	550	640	720	810	830	870	820	1600
Weight									
ROV	kg	91	147	190	340	310	410	450	1350
Top side	kg	17	48	126	136	136	-	-	-
System Complete	kg	108	195	316	476	446	-	-	-
Payload ROV									
Weight App.	kg	5	5	20	20	20	30	30	60
Optional Payload		yes	yes	yes	yes	yes	yes	yes	yes
Tether									
Fiber / Chopper	F/C	C	F	F	F	F	F	F	F
Dimension	mm	11	12,5	15,5	15,5	15,5	16 / 20	16/20	22/27
Weight Dry / 100 m	kg	25,5	13	18	18	18	21	-	-
Weight in Salt Water	kg	+10	0	0	0	0	0	0	0
Max, Length std. Tether	m	200	1000	1000	1000	1000	500	500	500
Power Requirements									
Single Phase	VAC	230	230	230	230	230	-	-	-
3 Phase	VAC	230	230	230	230	230	440/690	440/690	440/690
AC	Hz	50-60	50-60	50-60	50-60	50-60	50-60	50-60	50-60
Power	kVA	5	5	7	10	10	10	18	40
Optional System VAC		yes	yes	yes	yes	yes	yes	yes	yes
Thrusters									
Brushless AC		yes	yes	yes	yes	yes	yes	yes	yes
Electronic Fuse Reset		yes	yes	yes	yes	yes	yes	yes	yes
Adjustable Power Settings		yes	yes	yes	yes	yes	yes	yes	yes
Oil Compensated		yes	yes	yes	yes	yes	yes	yes	yes

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MODEL		3000	3000	4500	7500	7500 CROV	7500 offshore	15 k offshore	30 k offshore
Thruster configuration									
Horizontal		2	2	2	2	2	2	4 x V	2
Vertical		1	1	1	2	3	2	2	3
Latheral		-	-	1	1	V	1	4 x V	1
Optional Thrust		-	-	yes	yes	yes	yes	yes	yes
Speed									
Forward	knot	>3	>3	2,6	2,8	2,5	2,8	3	2,1
Vertical	knot	1,5	1,5	1,1	1,9	2.6	1,2	2	1,8
Lateral	knot	-	-	1,2	1,3	-	1,3	3	0,9
Frame									
Anodized Aluminium	6082	yes	yes	yes	yes	yes	yes	yes	yes
Buoyancy									
Dyvinicell		yes	yes	yes	yes	yes	-	-	-
Syntactic Foam		-	-	option	option	option	yes	yes	yes
Auto Functions									
Depth		yes	yes	yes	yes	yes	yes	yes	yes
Heading		yes	yes	yes	yes	yes	yes	yes	yes
Altitude		option	option	option	option	option	option	option	option
Traction DP, Dynamic Positioning		-	-	-	option	option	option	option	option
Telemetry System									
Fibre		option	option	yes	yes	yes	yes	yes	yes
TWP - FSK		yes	yes	option	option	option	-	-	-
Video and Data system									
Camera Interfaces		3	3	4	4	4	4 - 5	4 - 5	4 - 7
Video Simultaneous		1	1	3	3	3	3	3	4
Switch function Channel for 3 Cameras		1	1	1	1	1	1	1	1
Survey Channel RS 232		-	3	3	3	3	3	3	16
Survey Channel RS 485		-	3	3	3	3	3	3	5
Survey Data Channels		-	option	yes	yes	yes	yes	yes	yes
Ethernet 10 –100 mBit		-	option	option	option	option	option	option	option
USB interface		-	option	option	option	option	option	option	option
HD - Camera Interface		-	option	option	option	option	option	option	option
Camera									
CCD Colour High Res.		yes	yes	yes	yes	yes	yes	yes	yes
CCD Low Light		option	option	option	option	option	yes	yes	yes
Zoom		option	option	option	option	option	option	option	option
HD-SDI		-	option	option	option	option	option	option	option
Still Camera		option	option	option	option	option	option	option	option

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MODEL		3000	3000	4500	7500	7500 CROV	7500 offshore	15 k offshore	30 k offshore
Lighting									
Lights Halogen 250W		2	2	2	2	2	2	2	2
Light Interfaces Standard		2	2	4	4	4	4	4	4
Dimmable Halogen 250W		-	-	4	4	4	4	4	4
Dimmable Channels		-	-	3	3	3	3	3	3
LED 150 W Interface		option	option	yes	yes	yes	yes	yes	yes
HMI 2 x 400W Interface		option	option	yes	yes	yes	yes	yes	yes
Camera mounting									
Pan and Tilt Cameras		yes	yes	yes	yes	yes	yes	yes	yes
Pan and Tilt Lights		yes	yes	yes	yes	yes	yes	yes	yes
Top and Rear Mounted		option	option	option	option	option	option	option	option
LARS Launch and recovery									
Pad Eye		yes	yes	yes	yes	yes	-	-	-
Latch		-	-	option	option	option	yes	yes	yes
LARS		-	-	option	option	option	yes	yes	yes
Interfaces Tools and Survey Equipment									
Manipulator Grabber 1F		yes	yes	yes	yes	yes	yes	yes	yes
Hydraulic Manipulator 5F		option	option	option	option	option	option	option	option
Hydraulic Manipulator 7F		-	-	-	-	-	-	option	option
Sonar TWP / RS 485		yes	yes	yes	yes	yes	yes	yes	yes
Cameras		yes	yes	yes	yes	yes	yes	yes	yes
HD Camera		-	-	option	option	option	option	option	option
Lighting		yes	yes	yes	yes	yes	yes	yes	yes
Transponder		yes	yes	yes	yes	yes	yes	yes	yes
Laser		yes	yes	yes	yes	yes	yes	yes	yes
3 phase Electric Tools		option	option	option	option	option	option	option	option
Multi beam		-	-	option	option	option	option	option	option
Cable Tracker		-	-	option	option	option	option	option	option
CTD Sensors		-	option	option	option	option	option	option	option
Sub Bottom		-	-	option	option	option	option	option	option
Digiquarts Depth Gauge		-	option	option	option	option	option	option	option
Hydraulic Tooling		-	.	option	option	option	option	option	option
Surface Viewing and Control System									
Portable Units		yes	yes	yes	yes	yes	build in	build in	build in
Splash proof Cabinets		yes	yes	yes	yes	yes	-	-	-
Video Monitor	>19"	yes	yes	yes	yes	yes	yes	yes	yes
PC Monitor	>19"	yes	yes	yes	yes	yes	yes	yes	yes
PC		-	-	yes	yes	yes	yes	yes	yes
Portable Remote Control		yes	yes	yes	yes	yes	yes	yes	yes
Wireless Control		option	option	option	option	option	option	option	option

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MODEL		3000	3000	4500	7500	7500 CROV	7500 offshore	15 k offshore	30 k offshore
Video Overlay									
Overlay		yes	yes	yes	yes	yes	yes	yes	yes
Still Picture		-	-	yes	yes	yes	yes	yes	yes
Video Measurement		-	-	yes	yes	yes	yes	yes	yes
Video Pointer		-	-	yes	yes	yes	yes	yes	yes
Position and NMEA		-	-	yes	yes	yes	yes	yes	yes
Individual Setup		-	-	yes	yes	yes	yes	yes	yes
Video Recording									
DVD Build In PC		-	-	yes	yes	yes	yes	yes	yes
HDD Build In PC		-	-	yes	yes	yes	yes	yes	yes
External DVD HDD HD		option	option	option	option	option	option	option	option

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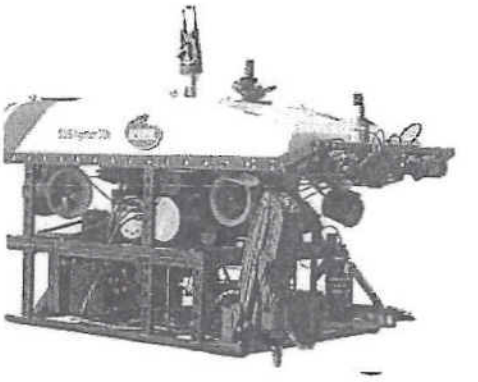
TAB 15.C

PRODUCT SPECIFICATIONS

SUB-fighter 30k

SPERRE
ROV TECHNOLOGY

- ROV designed for tough conditions
- Reliable and well proven design
- Quick and easy mobilization
- Very good stability
- Plenty of power
- Interface for standard tools
- Quality at an affordable price
- Require a minimum of maintenance
- Made in Norway



STANDARD ROV SYSTEM

Vehicle	LWH 2500 x 1500 x 1600 mm.
Frame	Aluminum, black anodized
Housigns	2 or 3 electronic pressure bottles
Weight in air	Approximately 1350 kg, std.
Payload	60 kg
Standard working depth	700 m. Other ratings available
Power input	230/400/440/690 VAC, 3 phase, 30 kW.
Thrusters	6 thrusters with 3kW, pressure compensated
Speed approx.	Horizontal 2.1 knot, Vertical 1.8 knot Lateral 0,9 knot, Turn 90 deg/sec.
Pan / Tilt	Pan angle 45 degrees, Tilt angle 90 degrees
Camera	7 camera interfaces PAL color Color camera 0.1 lux, Zoom camera, Sony HD-SDI camera, option
Lights	6 x 250W halogen light, 3 channel light dimmer Interface for, halogene, LED and HMI gas light 2 x 400W
Sensors	6 x 250W halogen lights, 4 channel light dimmer 2 x 400 W gas light HMI
Telemetry	Fiber optic CWDM system, Focal mux, model 907 4 video, synchronous, 16 RS 232 channels 5 RS 485 channels, 3 port 20 base Ethernet
Auto functions	AD, Auto depth, AH, Auto heading AT, Auto traction, option

Specifiacations are subject to change

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PRODUCT SPECIFICATIONS

SUB-fighter 30k

SPERRE
ROV TECHNOLOGY

OPTIONS ROV / ADDITIONAL EQUIPMENT

DEPTH
700 - 3000 meter depth rating

LARS AND TMS
Different models

MANIPULATORS AND HPU
Different hydraulic manipulators
7-5 function, raptor, force feedback
Standard electric grabber manipulator
Hydraulic cable cutter
HPU 5,5 kw. 18 l/min. 140 bar

VIDEO AND STILL CAMERAS
Mini color cameras
LL CCD monochrome camera
CCD zoom camera
HD-SDI camera
Stillcamera, 8 mPix. Online
Photo mosaic camera

LIGHT
Halogen lights, 250 W
HMI gas lights, 200 and 400 W

AUTO FUNCTIONS
DP, Dynamic Positioning system
AA, Auto altitude
ATC, Auto track control – closed loop control (if integrated LBL system and doppler/MRU)

POSITION AND SURVEY SYSTEM
SSBL HPR system
LBL, integrated into ROV
EIVA survey mapping and monitoring system

OTHER SENSORS AND EQUIPMENT
Scanning sonars
Multibeam
Sub bottom
Scanning sonars
Cable tracker
Side scan
Altimeter
Doppler log
MRU
Lasers
HPR LBL integrated
Transponders
1 kw. Vacuum pump
2,2 kw. Water pump
Remote controlled collecting unit

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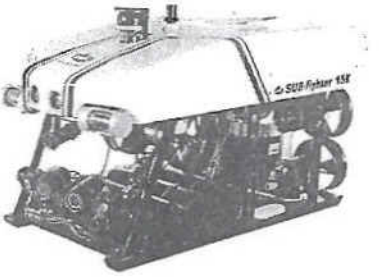
TAB 15.D

PRODUCT SPECIFICATIONS

SUB-fighter 15k survey

SPERRE
ROV TECHNOLOGY

- ROV designed for tough conditions
- Reliable and well proven design
- Quick and easy mobilization
- Very good stability
- Plenty of power
- Interface for standard tools
- Quality at an affordable price
- Require a minimum of maintenance
- Made in Norway



STANRARD ROV SYSTEM

Vehicle	LWH 196 x 82 x 92 cm
Frame	Anodized aluminium
Housigns	3 x 1 ata.
Weight in air	530 kg
Payload	20 kg approx.
Max depth	700 m. (3000 m)
Buoyancy	Solid cell structure
Power input	230 / 400 / 440 / 690 VAC, 3 phase 20 kW
Thrusters	Horizontal 4 x 2000W, Vertical 2 x 2000 W, Lateral 1 x 2000 W, Thrust 400 – 450 N Electronic resetable overcurrent protection
Speed approx.	Horizontal 3,5 knot, Vertical 1.9 knot Lateral 1,2 knot, Turn 60 deg/sec
Viewing P/T	Pan 0 – 90 degrees, Tilt 0 – 120 degrees
Cameras	5 x camera interfaces
Camera 1	Low light colour camera, PAL 520 TV lines 0,1 lux.
Camera 2 (option)	Zoom camera, Colour CCD, PAL, 580 TV lines, 1 Lux 18 x optical 4 x digital zoom
Light	4 x 250W halogen light, 3 channel light dimmer, HMI gas light 2 x 400W
Sensors	100 bar depth sensor, fluxgate compass, leakage detectors
Other	Auto depth, Auto heading, Auto traction (option) Digital control of thrusters and lights
Telemetry	Focal 907, Fibreoptic multiplexer 3 x 8bit video channels, 6 x RS 232/485 channels

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PRODUCT SPECIFICATIONS

SUB-fighter 15k survey

SPERRE
ROV TECHNOLOGY

Survey Channels on bulkhead	1 x RS 232, 24 V, 1 X RS 485, 24 V
Manipulator skid	Skid with EH5 manipulator, HPU, 140 bar, Valve pack, 7 channel, Height 21 cm, Width 80 cm, Length 150 cm. Weight dry, 60 kg, Weight in water, 20 kg.

SURFACE EQUIPMENT

Splash proof 19` rack Consisting of: PC, Power remote control, Video matrix 8 channel, Viga Option overlay system.
Data presentations of, depth, heading, date, time, twist counter, video grabber and screen writer.
DVD and HDD video PC recorder Connections for umbilical, sonar, control console, RS 232 communication ports Digital instruments, Volts, Amps and HZ.

Height 45 cm., Width 54 cm.
Length 60 cm, Weight 42 kg.

Video and data screens, 4 x 17" HD

Height 374/424 mm, Width 1670 mm,
Length 170 mm, Weight 40 kg

POWER CONTROL AND FUSE CABINET
Steel cabinet
Power input 230V 50 HZ. 3 phase, 20kW.
Transformer 230 V / 990 V AC.
Fuses and ground fault system.
Connections for umbilical.

Height 26 cm. Width 40 cm,
Length 60 cm, Weight 19 kg.

TRANSFORMER
Transformer in steel cabinet
Height 55 cm, Width 40 cm,
Length 45 cm, Weight 146 kg.

CONTROL CONSOLE
Cabinet, glass fibre portable console.
ROV pilot control console with two XY joysticks for thrusters control.
Switches for camera, light, manipulator, remote functions on ROV, and other external functions.

Height 20 (40) cm, Width 21 cm,
Length 43 cm, Weight 4 kg.

WINCH
Winch 1, 1000 meter sinker cable
Height 105 cm, Width 82 cm,
Length 105 cm, Weight 230 kg

Winch 2, 1000 meter tether cable
Height 105 cm, Width 82 cm
Length 1700 cm, Weight 430 kg

UMBILICAL 400M (SINKER)
Kevlar armoured cable.
Length 400 meters.
Weight in air 10 kg./100 m.
Weight in seawater negative
Outer diameter 7,6 mm.
2 x single mode fibre
Break strength 10kN

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SUB-fighter 15k survey

SPERRE
ROV TECHNOLOGY

TETHER CABLE

Kevlar armoured cable.
Length 5000 meters.
Weight in air 260 kg/km.
Weight in seawater approx 0kg/km.
Outer diameter 18 mm.(approx.)
Break strength 12000 N
Foamed PE jacke

ADDITIONAL EQUIPMENT

- Lights, halogene, LED, HMI gas light
- HD camera
- Black/White super low light
- Colour zoom camera
- Laser
- Sonar
- Navigation, HPR
- Video enhancer
- Survey channels, RS 232, RS 485
- Electric manipulator/ropecutter
- Hydraulic Manipulator
- Tether storage winch

Several other equipment available.

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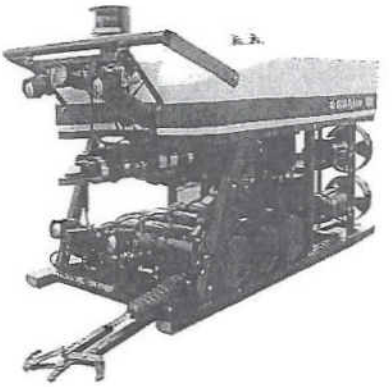
TAB 15.E

PRODUCT SPECIFICATIONS

SUB-fighter 10k

SPERRE
ROV TECHNOLOGY

- ROV designed for tough conditions
- Reliable and well proven design
- Quick and easy mobilization
- Very good stability
- Plenty of power
- Interface for standard tools
- Quality at an affordable price
- Require a minimum of maintenance
- Made in Norway



STANDARD ROV SYSTEM

Vehicle	LWH 1600 x 810 x 890 mm.
Frame	Aluminum, black anodized
Housigns	3 x electronic pressure bottles
Weight in air	410 kg (approx)
Payload	20 kg. (approx)
Standard working depth	700m. (other options available)
Buoyancy	Solid cell structure
Power input	230/400/440/690 VAC , 3 phase, 10 kW.
Thrusters	7 thrusters with 2 Hp, pressure compensated, each 400 - 450 N,
Speed, approx.	Horizontal 3,5 knot, Vertical 1.1 knot Lateral 1.3 knot, Turn 90 deg/sek
Camera	Standard camera, Low light colour camera 520 TV lines, 0.1 lux.
Lights	2 x 250W halogen light, 4 x light interfaces, 3 channel light dimmer Interface for 4 x halogene, LED and HMI gas light 2 x 400W
Pan/ Tilt	Tilt angle 90 degrees, Pan angle 45 degrees
Sensors	100 bar depth sensor, fluxgate compass, rategyro leakage detectors
Auto functions	AD, Auto depth, AH, Auto heading
Telemetry	Focal 907, Fibreoptic multiplexer, 3-5 video channels, 6 x RS 232/485 channels Optional: HD-video, Ethernet, USB link, others

Specifiacations are subject to change

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PRODUCT SPECIFICATIONS

SUB-fighter 10k

SPERRE
ROV TECHNOLOGY

SURFACE EQUIPMENT

ROV CONTROL UNIT

Splash proof 19` rack with PC and
17" monitor.
Vigra overlay system.
Data presentations with text and
graphical overlay.
Connections for umbilical, sonar, remote control,
RS 232/485 communication ports

Height 640 mm Width 540 mm
Length 600 mm. Weight 72 kg.

TRANSFORMER UNIT

Splash proof aluminum cabinet
Power input 220/400V, 50HZ, 3phase, 10kW.
Power transmission line 2500V AC.
Digital power analyzer
Fuses and ground fault system
Connections for umbilical.

Height 600 mm.Width 600 mm.
Length 600 mm.Weight 120 kg.

REMOTE CONTROL

ROV pilot control console with two XYZ
joysticks for thrusters control.
Switches for camera, light, manipulator,
remote functions on ROV, and other
external functions.
Height 200 (400) mm Width 210 mm.
Length 430 mm. Weight 4 kg.

Tether cable

Kevlar armoured cable.
Length 5000 meters.
Weight in air 260 kg/km.
Weight in seawater approx 0 kg/km.
Outer diameter 18 mm. (approx.)
Break strength 12000 N
Foamed PE jacke

ADDITIONAL EQUIPMENT

- Survey channels, RS 232, RS 485
- Lights, halogene, LED, HMI gas light
- HD camera
- Black/White super low light
- Colour zoom camera
- Video exchange
- Laser
- Sonar
- Navigation, HPR
- Electric manipulator/ropecutter
- Hydraulic Manipulator
- Tether storage winch
- Copper telemetry available
- Several other equipment available

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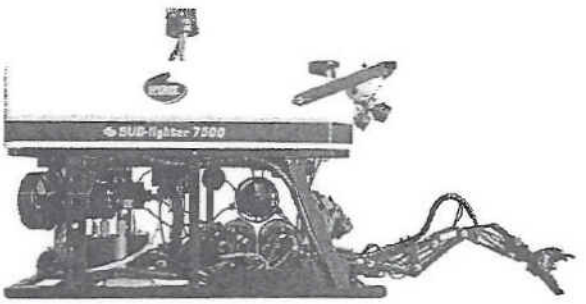
TAB 15.F

PRODUCT SPECIFICATIONS

SUB-fighter 7500 fiber

SPERRE
ROV TECHNOLOGY

- ROV designed for tough conditions
- Reliable and well proven design
- Quick and easy mobilization
- Very good stability
- Plenty of power
- Interface for standard tools
- Quality at an affordable price
- Require a minimum of maintenance



Vehicle	LWH 144 x 82 x 81 cm
Frame	Anodized aluminium
Housigns	2 x 1 ata.
Weight in air	340 kg
Payload	20 kg approx.
Max depth	700 m. (3000 m)
Buoyancy	Solid cell structure
Power input	230 / 400 / 440 / 690 VAC, 1 or 3phase 10 kW
Thrusters	Horizontal 2 x 2000W, Vertical 2 x 2000 W, Lateral 1 x 2000 W, Thrust 400 – 450 N Electronic resetable overcurrent protection
Speed approx.	Horizontal 2,8 knot, Vertical 1.9 knot Lateral 1,3 knot, Turn 60 deg/sec
Pan /Tilt	Pan 45 degrees, Tilt 90 degrees
Cameras	4 x camera interfaces, Low light colour camera, PAL 450 TV lines 0,1 lux.
Light	2 x 250W halogen light, 3 channel light dimmer Interface for, halogene, LED and HMI gas light 2 x 400W
Sensors	100 bar depth sensor fluxgate compass leakage detectors
Auto functions	Auto depth, Auto heading, Digital control of thrusters and lights
Telemetry	Focal 907, Fibreoptic multiplexer, 3-5 video channels, 6 x RS 232/485 channels Opional: HD-video, Ethernet, USB link, others

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PRODUCT SPECIFICATIONS

SUB-fighter 7500 fiber

SPERRE
ROV TECHNOLOGY

SURFACE EQUIPMENT

ROV CONTROL UNIT
Splash proof 19` rack PC and 17" monitor.
Vigra overlay system.
Data presentations with text and graphical overlay.
DVD and HDD video PC recorder Connections for umbilical, sonar, control console, RS 232 communication ports

Height 640 mm, Width 540 mm,
Length 600 mm, Weight 72 kg.

TRANSFORMER UNIT
Splash proof aluminium cabinet
Power input 230V 50 HZ. single phase, 10kW.
Transformer 230 V / 990 V AC.
Digital instruments, Volts, Amps and HZ.
Fuses and ground fault system
Connections for umbilical.

Height 340 mm, Width 370 mm,
Length 570 mm, Weight 50 kg.

REMOTE CONTROL
Glass fibre portable console.
ROV pilot control console with two XY joysticks for thrusters control.
Switches for camera, light, manipulator, remote functions on ROV, and other external functions.

Height 200 (400) mm, Width 210 mm,
Length 430 mm, Weight 4 kg.

TETHER
Kevlar armoured cable.
Length 0-1000 meters.
Weight in air, approx.230 kg/km
Weight in seawater neutral
Outer diameter approx 16-18 mm.
Power conductors
2 or 4 x single mode fibre
Break strength 800 kg

ADDITIONAL EQUIPMENT

- Video enhancer
- Survey channels, RS 232, RS 485
- Lights, halogene, LED, HMI gas light
- HD camera
- Black/White super low light
- Colour zoom camera
- Laser
- Sonar
- Navigation, HPR
- Electric manipulator/ropecutter
- Hydraulic Manipulator
- Tether storage winch
- Copper telemetry available
- Several other equipment available.

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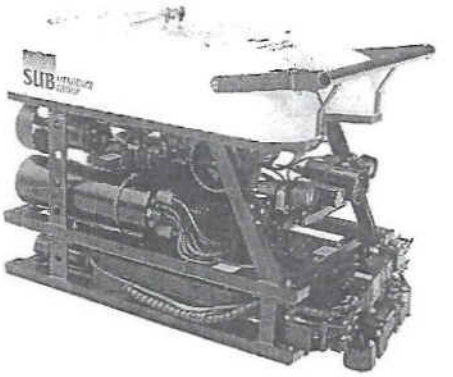
TAB 15.G

PRODUCT SPECIFICATIONS

SUB-fighter 4500

SPERRE
ROV TECHNOLOGY

- ROV designed for tough conditions
- Reliable and well proven design
- Quick and easy mobilization
- Very good stability
- Plenty of power
- Interface for standard tools
- Quality at an affordable price
- Require a minimum of maintenance
- Made in Norway



STANDARD ROV SYSTEM

Vehicle	LWH 1180 x 720 x 720 mm
Frame	Anodized aluminium
Housigns	2 x 1 ata.
Weight in air	240 kg
Payload	20 kg. approx.
Standard working depth	700 m. (3000 m.)
Buoyancy	Solid cell structure
Power input	230/400/440/690 V AC, single phase, 5-7 kW
Thrusters	Horizontal 2 x1000 W, Vertical 1 x 2000 W Lateral 1 x 1000 W, Thrust 200 - 450 N Electronic resetable overcurrent protection SUB-fighter 4500 with hydraulic manipulator skid
Speed approx.	Horizontal 2,6 knot, Vertical 1.1 knot, Lateral 1.2 knot Turn 60 deg/sek.
Camera	4 x camera interfaces, Low light colour camera 520 TV lines 0,1 lux.
Lights	2 x 250W halogen light, 3 channel light dimmer Interface for 4x halogene, LED and HMI gas light 2 x 400W
Pan / Tilt	Tilt angle: 90 degrees, Pan angle 45 degrees
Sensors	100 bar depth sensor, fluxgate compass, rategyro leakage detectors
Auto functions	Auto depth, Auto heading
Telemetry	Focal 907, Fibreoptic multiplexer, 3-5 video channels, 6 x RS 232/485 channels Opional: HD-video, Ethernet, USB link, others

Specifiacations are subject to change

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PRODUCT SPECIFICATIONS

SUB-fighter 4500

SPERRE
ROV TECHNOLOGY

SURFACE EQUIPMENT

ROV CONTROl UNIT

Splash proof 19` rack
PC and 17" monitor.
Vigra overlay system.
Data presentations with text and graphical overlay.
DVD and HDD video PC recorder
Connections for umbilical, sonar, remote control,
RS 232/485 communication ports

Height 640 mm. Width 540 mm.
Length 600 mm. Weight 72 kg.

TRANSFORMER UNIT

Splash proof aluminium cabinet
Power input 230 V 50 HZ. single phase,7 kW.
Transformer 230 V to 990 V AC.
Digital instruments, Volts, Amps and HZ.
Fuses and megacon ground fault system
Connections for umbilical.

Height 340 mm. Width 370 mm.
Length 570 mm. Weight 40 kg.

REMOTE CONTROL

ROV pilot control console with two XY
joysticks for thrusters control.
Switches for camera, light, manipulator, remote
functions on ROV, and other external functions.
Height 200 (400) mm. Width 210 mm.
Length 430 mm. Weight 4 kg.

TETHER

Kevlar armoured cable.
Length 0-1000 meters.
Weight in air, approx. 200 kg./km.
Weight in seawater neutral
Outer diameter 12 -15,2 mm.
2 or 4 x single mode fiber
Break strength 800 kg

ADDITIONAL EQUIPMENT

- Survey channels, RS 232, RS 485
- Lights, halogene, LED, HMI gas light
- HD camera
- Black/White super low light
- Colour zoom camera
- Video exchange
- Laser
- Sonar
- Navigation, HPR
- Electric manipulator/ropecutter
- Hydraulic Manipulator
- Tether storage winch
- Copper telemetry available

Several other equipment available.

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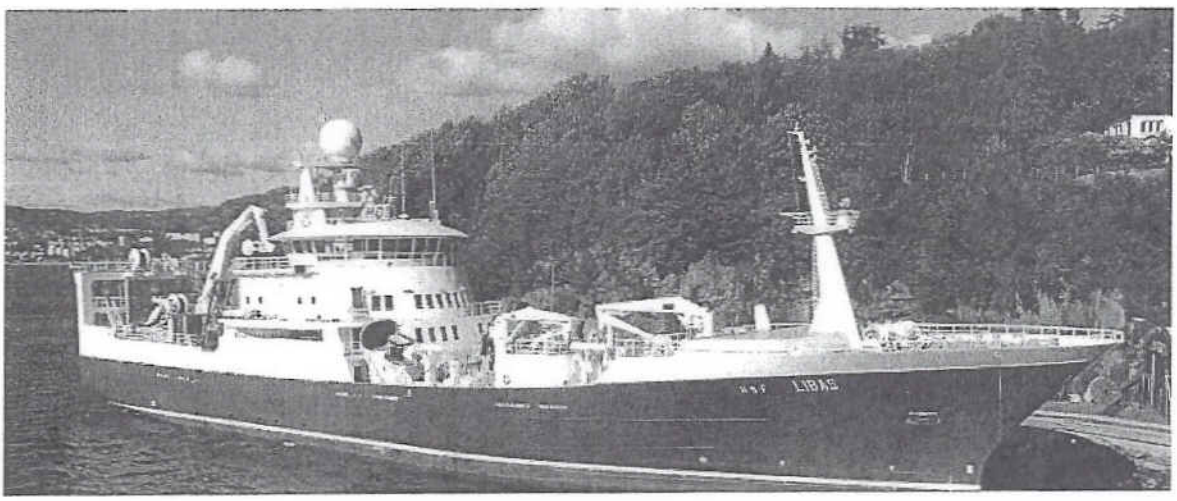
TAB 16.A



Picture taken from office showing chartered MV Libas mobilizing at Argus Base deep water quay. Argus additionally access modem offices and a spacious workshop on the quay.

Contact

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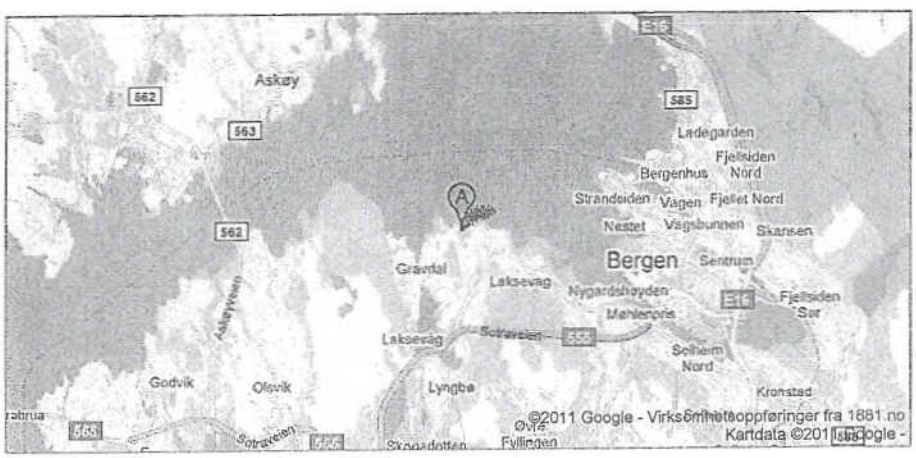

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TAB 16.B

Company Structure
Comprehensive subsea services

Argus Remote Systems was established in 1991 and currently has 30 employees and 3 consultants. Mohn Drilling, an offshore air- and saturation diving contractor, is the main shareholder of the companies owning 71% of shares in Argus Remote Systems; as well as the ROVs. From January 2009 the survey department has been operated as a separate company: Argus Survey. Argus Remote Systems owns 100% of Argus Survey.

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News

Company structure

Remote Systems

Survey

Staff

R & D

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TAB 16.C

HORIZON

SGS

Hidden depths

30/04/2007 | Channel: Drilling, Subsea, Support Services

Established in 1985 by Stein Mohn, originally as a ship-owner and operator, Mohn Drilling has extensive experience in the offshore industry and a reputation for excellent service.

Based in Norway, the business offers a range of air and saturation diving services, and through its two subsidiary companies, Argus Remote Systems, and Artec Subsea, provides ROV (remotely operated vehicle) and survey services to customers around the world.

Stein Christian Mohn, a partner in Mohn Drilling elaborates: "Mohn Drilling provides air and saturation diving services. In addition to diving, the company has two subsidiaries, Argus Remote Systems and Artec Subsea, which focus on ROVs and associated tooling systems, and subsea survey operations, respectively."

Mohn Drilling offers air and saturation diving services to customers with demanding requirements around the world, including a current major operation in Argentina: "We are presently operating on a ten year collaboration with DOF, off the coast of Argentina," Stein explains. "We initially won the contract for diving and ROV services in 1999, and the newly built diving support vessel (DSV) Skandi Patagonia, started operations in December 2000.

"It is a year-round contract, in which we always have a minimum of five diving personnel on board," he continues. "We have carried out saturation diving at the Aries and Carina field development, where McDermot have installed new platforms. We completed the diving work related to this field, including tie-ins, free span correction and as-built surveys."

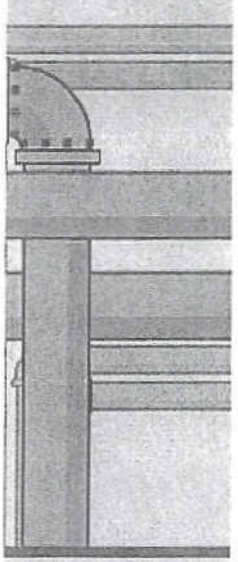
Through its subsidiary company, Argus Remote Services, Mohn Drilling provides a range of high-quality, electric ROVs to customers, for rent, hire, and sales: "Mohn Drilling is the major shareholder of Argus Remote Systems, which is a business that specialises in subsea tele-robotics, and the development, design, manufacturing and operation of ultra-deep ROVs," says Stein.

"Argus Remote Systems has 20 years of experience in the development of control systems for robots on land and in water, interface, power electronics, programming, and multiplexing hardware for signal transmission," he continues. "All of the ROVs are manufactured in-house, using the Argus key components, which means that they are highly reliable, and that we are not dependant on external know-how for IRM or implementing improvements and customised changes."

The company's ROVs are used for a number of roles by a broad range of clients: "Argus rents and sells ROV services," says Stein. Our clients include Nexans, EMGS, and many of the major oil companies. Additionally we work closely with the University of Bergen in a number of research roles, where we have completed subsea studies, including work in the mid-Atlantic mountain ridge.

nOF energy

DHL CAN MAKE A TOUGH BUSINESS EASIER



RSS FEEDS

RSS Feeds

"Our business concept is to use the clients' vessels as a platform for our ROV operations, thereby lowering the operational costs," he continues. "Our ROVs are capable of a broad range of roles, including construction, drill support, touchdown monitoring when cable laying, ROV survey with high-quality video, seismic vessel support, survey of cable routes, and survey with multi-beam, sidescan sonar and sub bottom profiler. We also do cable lays, not only power and fiberoptic cables, but also seismic ocean bottom cables."

Included in the business' catalogue of ROVs is its highly reliable Bathysaurus: "The Bathysaurus is an extremely reliable, ultra-deep rated, electrical work-class ROV," says Stein. "It is depth rated to 6000msw, and since 2004 has proved very reliable at great depths. The machine operates regularly at depths between 1000 and 2500msw, without difficulties. It can still go much deeper."

Stein is confident that electrical ROVs will continue to become more popular in the future: "We feel that electrical power, for continuous work, is the future of subsea operations. Electrical ROVs are extremely reliable, and due to the cold temperatures of seawater there is optimal cooling of the electrical engines and components. Additionally, electrical ROVs are lighter, and the dimensions make them more suitable for greater depths. Electric propulsion, as opposed to hydraulic, is also completely environmentally clean."

Stein explains that the nature of the company's diving operations ensures that safety is the primary consideration: "It is the key factor in all of our operations, we always think 'safety first'. The health and safety of our divers is our number one priority, and together with our own company doctor, we have a contract with a diving medical specialist that is available 24 hours per day. We must also consider the environment that we are operating in. For example, Argentina is one of the most hostile environments in the world to dive in, due to low temperatures, strong tidal currents and the poor visibility."

Looking to the future, Stein is confident that the company can continue to be highly successful: "I believe that the future looks very good for Mohn Drilling, and that the general demand for subsea and offshore services will continue to increase. The trend is towards exploring and operating deeper, and as our ROVs are depth rated to 6000 metres we are very confident that depth will not be an issue for us. We currently have three ultra-deep ROV spreads under construction, and will continue to expand in the future. In terms of diving, although we are a small organisation we are very efficient, and well equipped for the future. I believe that we can continue to grow at a very good rate for the coming years," he concludes.

Mohn Drilling AS
www.argus-rs.no

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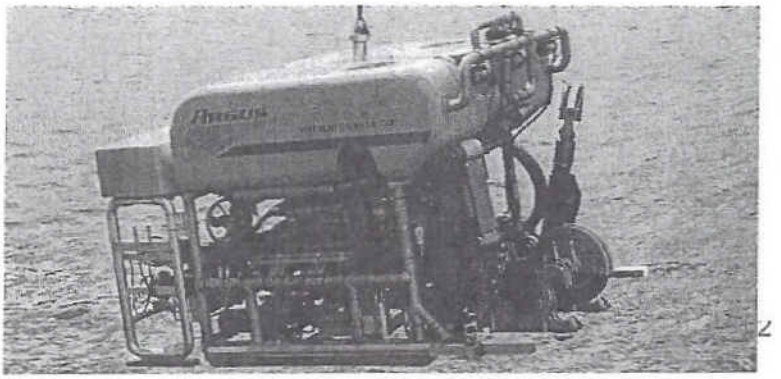
TAB 16.D

Electrical ROVs
Proven Electrical Technology



Since 1991 Argus has been engaged in advanced robotics. Electrical ROVs have a number of advantages in comparison to traditional hydraulic systems. Without reducing performance electrical ROVs are smaller in size, lighter in weight and more adaptable to new situations than their hydraulic peers. Separate power & control systems to the thrusters increase redundancy. Hydraulic oil spill is reduced to a minimum, which is better for the environment and gives the operators a safer working area. A separate hydraulic powerpack drives the tooling.

Argus has a full spectrum of ROV systems ranging from the hand-carried Argus Mini to the large work class Argus Worker.

When the entire system is developed and manufactured by the same developer the system gains seamlessness. This is reflected in Argus' outstanding track record for durability and reliability. It also makes tailoring and custom fitting of the various units efficient. Interfacing is never a problem when the components have been planned for interfacing right from the beginning. As the Argus crews take part in the product development the integrated systems are constantly being developed and improved to enhance achievements.

Products

Electrical ROVs

Argus Worker

Argus Bathysaurus XL

Argus Bathysaurus

Argus Rover MKII

Argus Rover

Argus Mini

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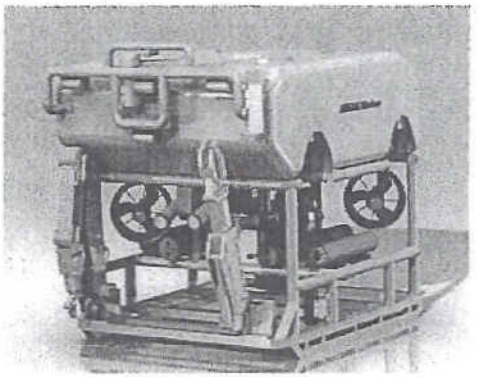
TAB 16.E

Argus Worker
Large Work Class ROV



Max operating depth: 4000msw
Fibre optic video transmission
6 simultaneous video channels
Additional HD SDI Video system
Auto heading/depth, altitude
Focus/Zoom camera facility
"Options" Video Overlay
Dual channel Halogen lights
-4 x 150W HID gas lights

Fibre optic Gyro
DC brushless 13kW Tecnadyne thrusters
Schilling T4 and 5F Rigmaster Manips
18kW Hydraulic power pack
Tooling/Tooling skid options
Survey sensor interface
Size: L=2200 x W=1600 x H=1750
Weight approx. 2100kg
195kg payload

Products
Electrical ROVs

- Argus Worker
- Argus Bathysaurus XL
- Argus Bathysaurus
- Argus Rover MKII
- Argus Rover
- Argus Mini

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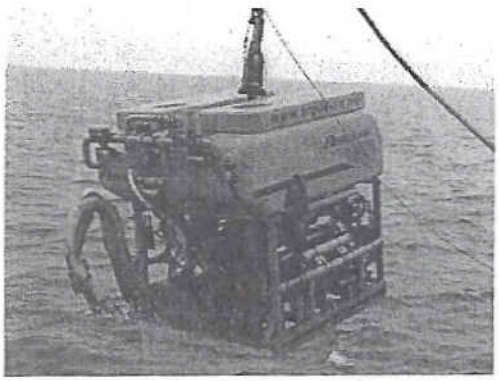
TAB 16.F

Argus Bathysaurus XL
Work class ROV



Max operating depth: 4000msw
Fibre optic video transmission
6 simultaneous video channels
Additional HD SDI Video system
Auto heading/depth, altitude
Focus/Zoom camera facility
"Options" Video Overlay
Dual channel Halogen lights
4 x 150W HID gas lights

Fibre optic Gyro
DC brushless 5,5kW Tecnadyne thrusters
Schilling T4 and 5F Rigmaster Manips
5,5kW HPU for manipulators
Tooling/Tooling skid options with aux HPU
Survey sensor interface
Size: L=2000 x W=1600 x H=1700
Weight approx. 1700kg
195kg payload

Products
Electrical ROVs

- Argus Worker
- Argus Bathysaurus XL
- Argus Bathysaurus
- Argus Rover MKII
- Argus Rover
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TAB 17.A

About Subsea Technology & Operations

Elsub I

Operations

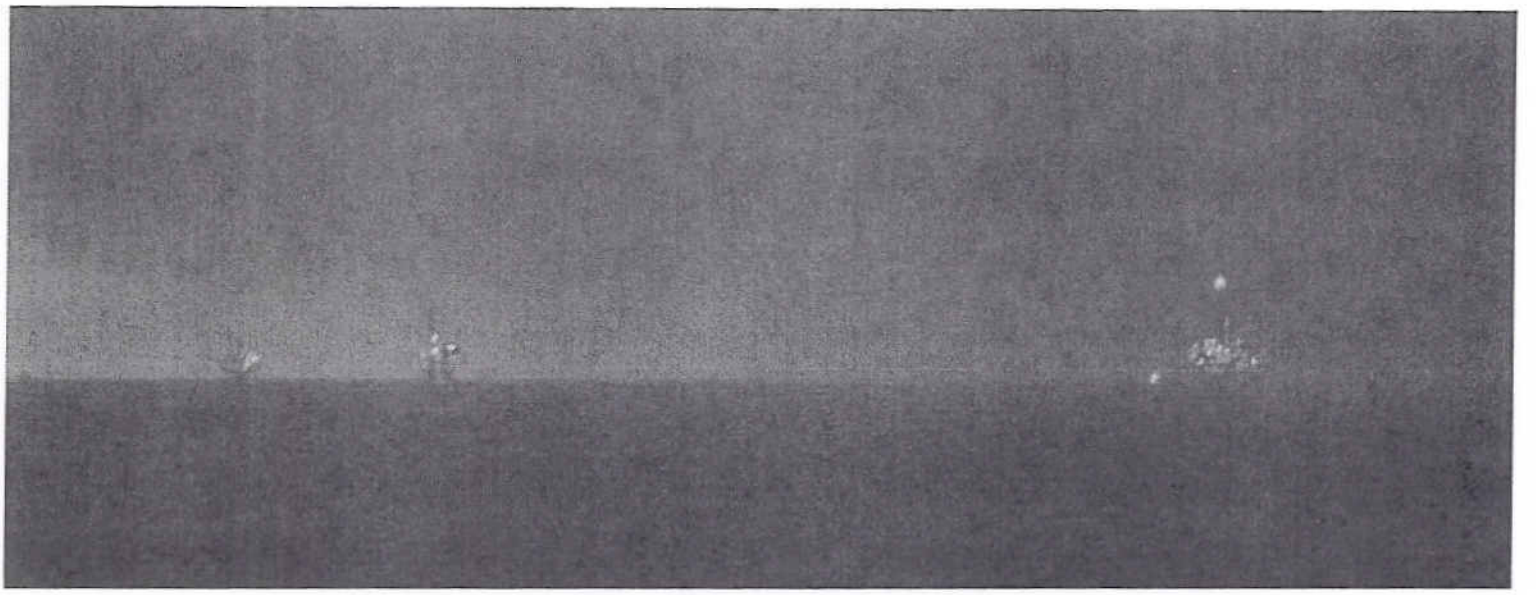
The way forward

About Subsea Technology & Operations

AAK Subsea AS is a specialist provider of ROV services utilising its proprietary electric work class ROV, the "Elsub". Designed, developed and produced in Stavanger Norway by AAK Subsea, the Elsub is believed to be the first electric ROV of this class and design to have entered into commercial service.

Based upon the success of the first generation ROV, AAK Subsea has embarked upon the expansion of its fleet with the next generation, environmentally-friendly work class ROV, the Elsub II.

TAB 17.B



About AAK Group

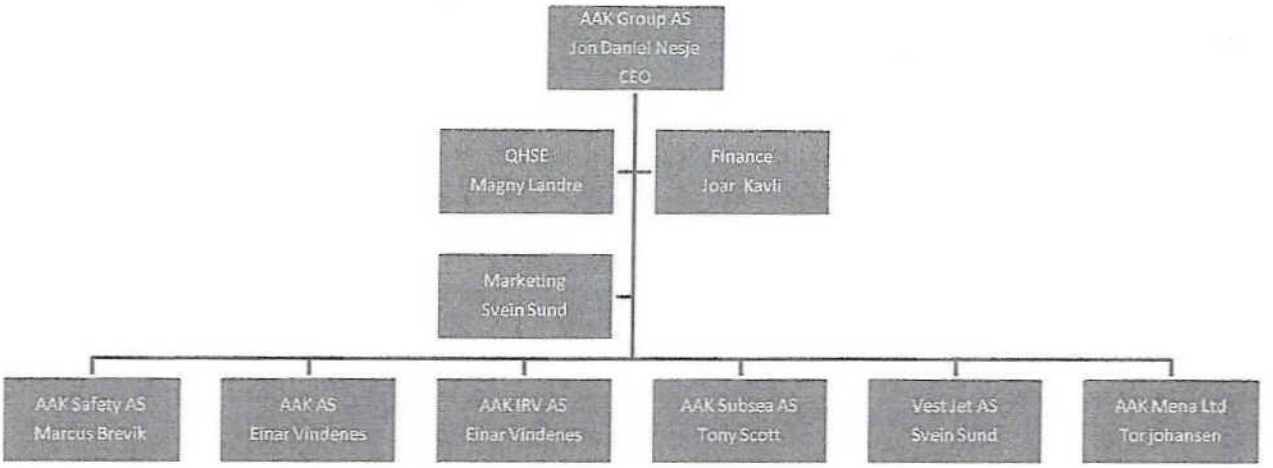
AAK Group is a cluster of companies delivering solutions to the oil & gas industry and energy sector. We are specializing in work at places hard to access: from deep below to high above, we can reach it and make it happen - whether it be inspection, installation, repair, modification, decommissioning or safety systems.

We have our origin from the west coast of Norway, from one of the most hostile environments in the world. Succeeding in this environment has learned us to be focused on delivering high value services and technology through 100% dedication and performance in all phases on every project.

For the last 20 years AAK Group has been developed into a fully integrated service and technology provider for the leading companies in the petroleum industry. Working closely with our international clients we have developed a unique way of working - offering optimized and integrated teams customed designed for each project aiming for maximum efficiency and customer profability.

We currently have 230 highly multidicipline, experienced and educated employees.

Organisation



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TAB 17.C

About Subsea Technology & Operations

Elsub I

Operations

The way forward

Operations

The Elsub has been in continous commercial operation since December 2009 providing drill support services under a long term rental contract offshore Venezuela. The work scope is very varied and the operating conditions very challenging with periodically strong sea currents and a congested work zone. In the first 6 months of operation, more than 110 dives of varying have been accomplished and over 600 hours logged subsea with only negligible downtime due to equipment failure.

TAB 17.D

About Subsea Technology & Operations

Elsub I

Operations

The way forward

Elsub I

Based upon the concept of independent electric thruster power and control systems located topside instead of on the ROV. the Elsub has demonstrated its capability to deliver on its primary design goals:

High Reliability coupled with ease of maintenance resulting in very low downtime

Environmentally friendly with minimal hydraulic oil content and low topside power demand

Versatile, multi-task capability coupled with power, manouverability and stability

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TAB 17.E

About Subsea Technology & Operations

Elsub I

Operations

The way forward

The way forward

The second generation ROV, the Elsub II, is now ready for production and will incorporate further environmental enhancements together with state of the art electric powered LARS and TMS components.

AAK Subsea has also commenced concept design work on a range of electric tooling and accessories for a wide range of applications to complement the ROV.