



Proceedings of
Workshop



Qualifying New Technologies for Deepwater Oil & Gas Development



October 29-30, 2002
Houston, Texas

Qualifying New Technologies for Deepwater Oil & Gas Development

Executive Summary by

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Workshop Proceedings

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Qualifying New Technology for Deepwater Oil and Gas Development

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Offshore Technology Research Center – Texas A&M

Executive Summary

Background & Objectives

Implementing new technology in a deepwater project can be difficult for regulatory agencies and operators alike. The provisions of the Minerals Management Service's DWOP state that new technology introduced into deepwater development systems must be demonstrated to be as safe as existing technology. This requirement, though simply and clearly stated, can be difficult to implement for a specific project. The regulatory agencies and the project operator need to agree on an appropriate plan to demonstrate the safety of the new technology, and then the operator must complete that plan while executing the project. Developing a mutually acceptable plan in a timely manner that can be carried out in conjunction with a specific project can be difficult. The result can create uncertainty for the project and thus inhibit the introduction of new technology.

The objectives of this Workshop were to

- Discuss requirements and processes to qualify new technologies
- Develop a rationale and methodology that can lead to a process for qualifying new technologies that is acceptable to all stakeholders (MMS, USCG, operators, contractors, and manufacturers),
- Recommend a specific course of action to develop this process.

Particular emphasis was given to the needs of emerging composite technologies, since composite components now being developed can provide significant advantages for deepwater development systems targeted for increasing water depths, and are likely to be proposed for future projects.

Workshop Summary

The Workshop was initiated and sponsored by the Minerals Management Service (MMS) and carried out by the Offshore Technology Research Center (OTRC). The Workshop was planned to bring together MMS and oil industry stakeholders and experts plus experts from other fields to

- Discuss requirements and processes to qualify new technologies,

- Develop a methodology and process that could lead to a mutually acceptable plan to qualify new technology.

The 1-1/2 day Workshop was held on October 29-30, 2002, and was well attended. The 65 participants represented a wide range of perspectives and experiences.

Day 1 The first day focused on information gathering and sharing on subjects related to introducing and qualifying new technology. Presentations on Qualifying New Technology included:

- The regulatory agency perspective (MMS)
- The oil and gas industry operator's perspective (DeepStar)
- The role of Standards and Classification Organizations in the introduction and qualification of new technology (API, ASTM, ABS, and DNV),
- The processes and experiences of agencies and industry in managing the introduction of new technologies in the aerospace and defense fields (NASA, DARPA, and Boeing).

Contributions from operators on experiences in Introducing New Technology or first-time technology applications in the oil and gas industry included presentations on:

- Titanium and composite risers (ConocoPhillips)
- Spoolable tubulars (Shell)

and a panel discussion on

- Manufacturers' experiences in bringing new technologies to market and first-time applications (Hydril, ABB, Deepwater Composites, Halliburton)

Workshop participants were formed into Discussion Groups to address issues in Introducing New Technologies and Regulatory Requirements including

- Definition of "new" technologies
- Interfaces between the project team and regulators regarding new technology
- Development of standards for new technologies
- Performance assurance of new technologies

A second session of Discussion Groups addressed issues on Manufacturing and Testing to Achieve and Assure Performance including

- Scaling up from small scale tests to full scale prototypes
- Production manufacturing to achieve required performance
- Performance testing
- Performance monitoring

The individual Discussion Groups reported out to the assembled Workshop participants.

Day 2 On the second day, Workshop participants were formed into Working Groups to simultaneously develop recommendations for a Course of Action that could lead to a specific plan for Qualifying New Technologies. The Course of Action was to specifically address

- Regulatory requirements
- Regulator's needs

- Deepwater project operator's needs
- Alternative compliance methodologies
- Agencies, organizations, and individuals that should be involved in implementing the Course of Action

Members of each Working Group were selected to provide a range of perspectives, expertise, and experience.

The Working Groups each shared their recommendations with the assembled Workshop participants. Recommendations from the Working Groups included

- Develop a process to qualify (or partially qualify) and deploy new technology that could proceed ahead of and independent from an actual project
- Any process to qualify new technology needs to complement the DWOP process
- Any process to qualify new technology should engage regulators, operators, manufacturers, and class societies; begin either prior to or early in a project cycle; and include frequent communications
- Develop a process that could engage regulators (MMS, USCG) in assessing a specific new technology prior to an actual project
- Develop a common understanding and criteria for when technology would be considered "new"
- Develop a common understanding of what is needed to demonstrate that a new technology is "as safe as" or has "equivalent" safety (the DWOP process requires operators to demonstrate that any new technology is "as safe as" existing technology)
- Investigate alternative compliance methods
- Develop a process that provides regulatory agencies with opportunities to leverage their expertise with 3rd party specialists in qualifying new technology

It was pointed out that some of these recommendations were not inconsistent with current policies and procedures.

The Working Groups recommended several Courses of Action, including

- Developing an API Guideline for Qualifying New Technology
- DeepStar project to develop a Guideline for subsequent adoption by API
- JIP led by vendors and manufacturers to develop a Guideline for subsequent adoption by API
- Expert Forum chaired by OTRC to develop a Guideline for subsequent adoption by API
- Adapt/adopt Guidelines that address new technology that now exist or are under development (e.g., DNV, ABS, API)
- DeepStar projects to address the qualification of specific new technologies
- JIP's to address the qualification of specific new technologies

The assembled Workshop participants then discussed these recommendations and concluded that developing a Guideline through an operator-sponsored API project was the most

promising way to address and facilitate the qualification of new technology. The recommended consensus Course of Action and Path Forward is described in the section below.

Recommendations

The Workshop was successful in developing the following consensus recommendations for a Course of Action and Path Forward.

Course of Action

The Workshop participants concluded that an API Recommended Practice is needed to facilitate the qualification and acceptance by regulatory agencies (MMS, USCG) of new technology proposed for use in deepwater projects. The API RP should describe a process that

- can be used to “qualify” new technology for use on deepwater production systems,
- is acceptable to regulatory authorities (MMS, USCG),
- can be executed by Class Societies or CVA’s recognized by the regulatory agencies,
- can be initiated by an operator or vendor/manufacturer of the technology prior to its planned use in a specific project.
- The qualified technology could then be included in an operator’s submittal of a DWOP for approval.

Workshop participants agreed that such an Approval Process for Qualifying New Technology would offer the following benefits:

- The technology qualification process could be completed prior to and independent of a project that sought to apply the technology.
- Basic issues regarding the new technology that are of concern to regulatory agencies would be addressed and resolved in the qualification process.
- The qualification process would be done by an organization(s) recognized by the agencies following a process approved by the agencies.
- The project approval would only need to consider the application and use of the new technology in the proposed project since the basic technology had already been qualified.
- This process should reduce the schedule, uncertainty, and costs of the project approval process and facilitate the acceptance and application of new technology

Path Forward

An operator-sponsored Task Group volunteered to prepare a proposal to API to obtain their support to develop the Recommended Practice, and forward it to the API Deepwater Subcommittee (Mark Witten, Chairman). Task Group volunteers were

Mamdouh Salama, TG Chair – ConocoPhillips
Luis Bensimon – Kerr-McGee
Peter Hill – RRS Engineering
Christian Markussan – DNV

The proposal submitted to API should:

- Be similar to MMS “White Papers” (3-5 page document)
- Identify and discuss the need for a process and an API RP or Guideline
- Demonstrate the MMS and USCG’s buy-in to participating in the development and planned use of the process in approving deepwater development plans
- Be completed by December 20, 2002
- Draw on existing relevant documents, e.g., DNV and ABS Guidelines
- Should be reviewed by MMS to (1) ensure the appropriateness and consistency with regulations, comments, and suggestions, and (2) demonstrate MMS’s involvement and commitment to participate in developing the Recommended Practice to API
- Also involve the USCG – Paul Martin (MMS) to contact.

Closure

The information contained in the Course of Action and the Path Forward Sections above was forwarded to the Task Group Chairman in early November 2002, and the Task Group completed and forwarded a draft proposal to the MMS for review later in November prior to submittal to API.

Workshop Organization

The Workshop was organized in four main Sections.

Qualifying New Technologies

- MMS Perspective - presentation
- Industry Perspective - presentation
- Role of Standards, RP's, and Guidelines – panel presentations and discussion by API, ASTM, ABS, and DNV

Introduction of New Technologies

- NASA Experience – presentation
- DARPA Experience – presentation
- Introduction of New Technology and Regulatory Requirements – discussion groups
- Discussion Groups Report Out
- Industry Experience – panel presentations and discussion
- Manufacturers Experience - panel presentations and discussion

Performance Assurance

- Introductory presentation
- Manufacturing and Testing to Achieve/Assure Performance – discussion groups
- Discussion Groups Report Out

Course of Action

- Develop Recommendations – work groups
- Develop a Consensus Recommendation – general workshop session
- Path Forward (Implementation) – general workshop session

A detailed [Workshop Agenda](#) is included in Appendix A.

Workshop Documentation

The report outs by the Discussion Groups and Working Groups are presented in Appendix B and in a [separate file on the CD](#) as a series of PowerPoint slides summarizing the “flip charts” used in the report outs to Workshop participants.

[Workshop participants](#) are listed in Appendix C.

The Workshop presentations are listed below and are included as PowerPoint presentations in separate files on this CD.

- Qualifying New Technologies: MMS Perspective – [Bud Dannenberger \(MMS\)](#)
- Qualifying New Technologies: Industry Perspective – [Rick Meyer \(DeepStar\)](#)
- Qualifying New Technologies: Role of Standards, Recommended Practices, and Guidelines
 - [Mark Witten \(API\)](#)
 - [Carl Rousseau \(ASTM\)](#)
 - [James Card \(ABS\)](#)
 - [Craig Colby \(DNV\)](#)
- Introducing New Technology: NASA Experience – [Tom Gates \(NASA\)](#)
- Introducing New Technology: DOD Experience – [Ray Meilunas \(DARPA AIM\)](#)
- Introducing New Technology: Industry Experience
 - [Him Lo \(Shell\)](#)
 - [Mamdouh Salama \(ConocoPhillips\)](#)
- Introducing New Technology: Manufacturers Experience
 - [Tom Walsh \(Hydril\)](#)
 - [Karl Parfrey \(ABB\)](#)
 - David Brunt (Deepwater Composites)
 - [Mark Kalman \(Halliburton\)](#)
- Performance Assurance – [Gail Hahn \(Boeing\)](#)

Acknowledgements

This Workshop was an Offshore Technology Research Center project that was initiated and supported by the Minerals Management Service and the industry sponsors of the OTRC. Their sponsorship is gratefully acknowledged

This was a “working workshop”, and its success was due to the active engagement, participation, and collaboration of all workshop attendees in the discussions and work groups. Special thanks are due to those whose presentations and remarks sparked the discussions and set the stage for the work groups.

Participation of representatives from the aerospace and defense industries (Tom Gates, Ray Meilunas, Gail Hahn, and Carl Rousseau) provided useful perspectives, approaches, and learnings from outside the oil and gas industry. Allen Verret (OOC) was helpful in encouraging a broad participation throughout the industry.

And special thanks are due Ms. Debbie Meador for assisting with the arrangements, the workshop, and the preparation of these proceedings.

**Appendix A
Agenda
QUALIFYING NEW TECHNOLOGIES
FOR DEEPWATER OIL& GAS DEVELOPMENT**

Time	Topic	Purpose	Presenter Discussion Leader
Tuesday, October 29, 2002			
08:00 – 08:10	Objectives & Agenda	Review & consensus	Skip Ward Ozden Ochoa OTRC
08:10 – 08:40	Qualifying New Technologies: MMS Perspective	<ul style="list-style-type: none"> • Regulatory requirements • Regulations - implementation needs 	Bud Danenberger MMS
08:40– 09:10	Qualifying New Technologies: Industry Perspective	<ul style="list-style-type: none"> • New technologies for DW GOM • Regulations - implementation needs 	Rick Meyer (DeepStar/Shell)
09:10 – 10:00	Qualifying New Technologies: Role of Standards, RP's, and Guidelines – Panel Discussion	<ul style="list-style-type: none"> • Role of Standards, RP's, and Guidelines • Role Of Standards Bodies & Classification Societies 	Mark Witten (API/ChevronTexaco) Carl Rousseau (ASTM) James Card (ABS) Craig Colby (DNV)
10:00 – 10:15	Morning Refreshments		
10:15 – 10:45	Introduction of New Technologies: NASA Experience	Performance Assurance of New Materials & Components	Tom Gates NASA
10:45 – 11:00	Introduction of New Technologies: Defense Experience	DARPA's Advanced Insertion of New Materials Program	Ray Meilunas DARPA AIM
11:00 – 12:00	Introducing New Technology and Regulatory Requirements	Issues & Rationales <ul style="list-style-type: none"> • Definition of New Technologies • Interfaces Between Project & Regulators • Development of Standards for New Technologies • Performance Assurance Rationales <ul style="list-style-type: none"> ▪ Engineered Solutions ▪ Testing Analogies 	Simultaneous Discussion Groups
12:00 – 12:30	Discussion Groups - Report Out		Group Leaders
12:30 – 01:30	Lunch		

Time	Topic	Purpose	Presenter Discussion Leader
<i>Tuesday, October 29, 2002 (continued)</i>			
01:45 – 02:15	Introduction of New Technologies: Industry Experience	Titanium & Composite Risers	Mamdouh Salama (ConocoPhillips)
02:15 – 02:45	Introduction of New Technologies: Industry Experience	Spoolable Tubing	Him Lo (Shell)
02:45 – 03:30	Introduction of New Technologies: Manufacturers Experience - Panel Discussion	Manufacturers experiences in bringing new technologies to market and first-time applications	Tom Walsh (Hydriil) Karl Parfrey (ABB) David Brunt (Deepwater Composites) Mark Kalman (Halliburton)
03:30 – 03:45	Afternoon Refreshments		
03:45 – 04:00	Performance Assurance - Introduction		Gail Hahn (Boeing)
04:00 – 05:00	Simultaneous Discussion Groups - Manufacturing & Testing to Achieve/Assure Performance	Needs & Rationales <ul style="list-style-type: none"> • Small scale to full scale components • Production manufacturing to achieve required performance • Performance testing <ul style="list-style-type: none"> ▪ Static, dynamic, fatigue ▪ Material compatibility ▪ Damage tolerance ▪ Long-term performance • Performance Monitoring 	All
05:00 – 05:30	Discussion Groups Report Out (20 minutes)		Group Leaders
07:00 – 09:00	Social Hour and Dinner		

Time	Topic	Purpose	Presenter Discussion Leader
Wednesday, October 30, 2002			
08:15 – 09:00	Summarize learnings from discussion groups <ul style="list-style-type: none"> • Qualifying New Technologies • Manufacturing & Testing to Achieve/Achieve Performance 	<ul style="list-style-type: none"> • Clarify • Consensus 	Skip Ward Ozden Ochoa
09:00 – 10:30	Develop Recommendations for the Course of Action	<ul style="list-style-type: none"> • Define a Course of Action that will result in a Plan to Qualify Emerging Technologies • Course of Action to specifically addresses Composite Tendons & Risers • Course of Action to address <ul style="list-style-type: none"> ▪ Regulatory requirements ▪ Regulators' needs ▪ DW Project needs ▪ Alternative compliance methodologies ▪ Agencies/organizations/individuals to be involved in implementing Course of Action 	Work Groups
10:30 – 12:00	Adoption a Consensus Recommended Course of Action	<ul style="list-style-type: none"> • Discuss Working Groups' recommendations • Develop a consensus Course of Action 	All
12:00 – 01:00	Lunch		
01:00 – 02:30	Implementing the Recommended Course of Action	Discuss/adopt following relative to the Course of Action <ul style="list-style-type: none"> ▪ Leadership Team ▪ Roles & Responsibilities ▪ Milestones ▪ Schedule ▪ Action Items 	All Stakeholders & Interested Parties
02:30	Adjourn		

Appendix B

Discussion Groups: Introduction of New Technology and Regulatory Requirements

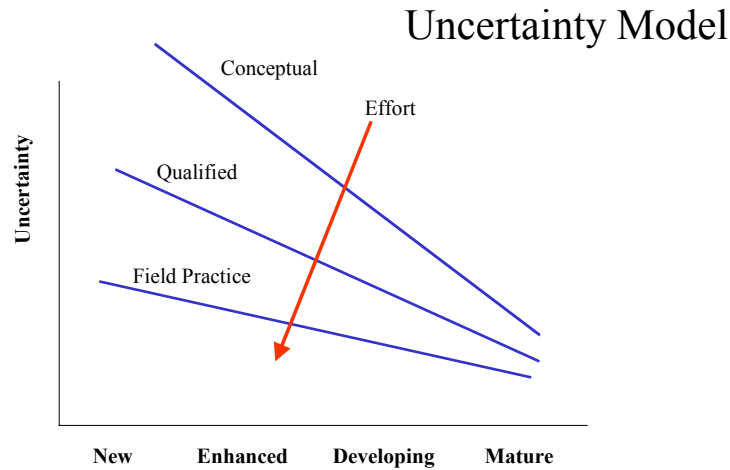
1

Definition of New Technologies

- Technology Readiness Levels
 - New (serial #1)
 - Enhanced(modified use (new location or environment))
 - Developing (beyond first application)
 - Mature (field proven)
- Risk
 - High (low maturity, basic R&D)
 - Low (high maturity)
- Assessment of Risk & Consequences

2

Definition of New Technologies



3

Development of Standards for New Technology

- Need standard methodology for product qualification
 - Components/application
 - Materials
 - Include regulatory agencies
- Regulatory Guidance (case-by-case basis)
 - Prescriptive
 - Performance-Based (ideally)
- Expertise in Composite Technology
 - MIL-HDBK 17
 - ASTM D30
 - ASM Composite Handbook

4

Development of Standards for New Technology

- Product development drives standards development
- Insertion of composites products inhibited by lack of
 - Engineering knowledge
 - Experience
 - Inspection techniques
 - Regulatory acceptance

5

Interface Between Projects & Regulators

- Regulatory Needs
 - Early dialog
 - Involvement in JIP's
 - Reliability analysis
 - MOU with Class Society
 - ID conservation issues
 - Operator experience
 - NEPA
- Uncertainty Matrix
 - Failure modes
 - Safety margins



	Limited Experience	New Technology
Known Applic.	1	3
Unknown Applic.	2	4

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Interface Between Projects & Regulators

- Schedule Needs & Identification
 - Options & awareness of critical path
 - Class Societies involvement early
 - New technology vs. new application
 - Definite process with known timeframes & milestones (e.g. DWOP, CVA)
- Information
 - Confidentiality/sharing across industry
 - Involvement Independents & Contractors

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Discussion Groups: Manufacturing & Testing to Achieve/Assure Performance

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Performance Assurance – Testing & Analogies

- Building block approach
- In-service inspection & repair
 - Monitoring
 - Intervention
 - Validate predictability
- Define functional requirements
 - Operators/manufacture's responsibility
- Define failure modes
- Demonstration of equivalency
- Few units to be built

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Technical Assurance Alternatives to In-Service Inspectability

- Plan is owner/vendor responsibility
- New technology requires increased inspection
- Successful performance can decrease inspection needs
- Equivalency document to justify alternative compliance
 - Statistical variability in composites > steel (MILHDBK)
 - lack of in-situ inspectability
 - production manufacturing specs.

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Performance Assurance - Engineered Solutions

- Is need for New Technology compelling?
- Integrity Monitoring to address lack of long-term data
- Tools exist
- Needs
 - Good material data
 - Process & organization
 - Basis for acceptance (include FMEA)
 - Experienced personnel
 - Knowledge base (industry & regulatory)
 - Cooperation with regulatory agency

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Small to Full Scale Component Testing

	Verify	Validate	Economics	Regulations	Design
Materials T.	3	1	I 1/2	2	1
Small Scale	2	2	I 2		1
Assembly T.			I		1
Prototype	1		I/C 1	1	1
Full Scale		1	C		
Field Test			C		

Verification: Are we using the correct methods?

Validation: Have we solved the right problem?

Economics: Financing, Profit

1 always

2 sometime

3 rarely/never

I- internal C-client

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Production Manufacturing

- Process to meet Performance Specs
 - New technology design drivers (weight, stiffness, cost)
- Regulators “needs”
 - Safety Equivalence of new technology
 - Safety factors
 - Contingency
 - Fail safe plan

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Production Manufacturing

- Material Selection & Design
 - Testing - test standards exist, implement for offshore service conditions, validate design methods
 - Proof test to validate design & define acceptance criteria
 - Failure tests to ID failure modes
 - Incorporate NDE
 - Repair & recycle

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Production Manufacturing

- Certified process to ensure quality needed
 - Traceability
 - Statistical specs for material & manufacturing variability
 - Protocols exist in other fields – adapt/adopt
- Certification requirements
 - Inspectability
 - Repairability
 - Service life
 - Maintenance
- Space & offshore similarity – not accessible for conventional inspection

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Performance Testing

Purpose of full scale testing

- Validate analysis
 - failure modes
 - margins of safety
- Meet functional requirements
- Demonstrate successful manufacturing
- Level of test dictated by
 - regulations
 - type of product
- Prototype vs Field Tests

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Performance Monitoring

- Develop plans for insitu
 - Observation, inspection, monitoring, & reporting programs for specific components
 - Based on predicted performance
 - Remaining life

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Other

- Qualification vs. Acceptance vs. Approval??
 - Roles/responsibilities of various stakeholders

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Work Groups: Recommendations for Course of Action

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Course of Action – WG Recommendations

1. Participate in DeepStar CTR for composite risers
 2. Participate in revision of API RP series for deepwater
 3. Work with operators for qualification & applications
 4. Prepare Conceptual DWOP & Production DWOP
 5. Obtain MMS & USCG approvals
- Issue – How to engage MMS & USCG without a specific application?

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Course of Action - WG Recommendations

- Agencies need to put forth a process to qualify new technologies
 - Process in addition to DWOP that is NOT project specific
 - MMS needs to work with vendors to qualify new technology
 - Operators need to know in advance (of project) what is ok
- Agencies need a MOA or MOU with 3rd parties to provide input/recommendations on new technology
- Expedite Standards for new Technology
 - Start with draft API Guideline
 - Work group with representation from regulators, operators, manufacturers & vendors, and class societies

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Course of Action – WG Recommendations

- Composite risers & tendons – MMS is lead agency
- Watch out for MIM (Maintenance-Induced-Maintenance) – work force not accustomed to handling composites
- Technical qualification
- DWOP
- Field Trials
- Issue – What is ‘Equivalence?’

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Course of Action – WG Recommendations

- Need a qualification process that is NOT project specific
- Develop API Guidelines
 - Criteria that new technology must meet
 - If a new item meets criteria, then could be submitted with a DWOP for MMS review
- Develop new technology needs to include
 - Application drivers
 - Trials & testing
 - Continuing research
 - Analytical tools
 - Economic viability
 - Data collection

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Course of Action – WG Recommendations

- Define a process for deploying new technology
- Need definition of “new technology” that is accepted by all parties
- Recognize system of shared responsibilities
 - MMS
 - USGG
 - EPA
 - Others
- Start early and discuss often
- Identify 3rd party broker that can leverage MMS’s experience base (similar to CVA program)
- Need manufacturer’s assistance/early interfacing with MMS “broker”
- JIP’s that address identified areas (e.g., FPSO EIS) can help reduce risk to cycle time

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Course of Action – WG Recommendations

Stakeholders

- MMS
- USCG
- EPA
- Operators
- Manufacturers
- Vendors
- Contractors
- Engineers & Scientists

Trades

- API – standards & RP's
- OOC – operating practices
- IPAA – access
- NOIA – operating practices & access
- IADC – drilling, workovers

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Course of Action – WG Recommendations

- MMS, USCG, operators, class societies, & manufacturers need to work together
- MMS explore workshop/information exchange on composite risers
- Required elements to be included in Course of Action
- Regulatory needs & requirements
 - MMS – what acceptance criteria?
 - Are failure tests required?
- Early involvement
 - By companies with expertise
 - JIP's, seminars
- Proof of due diligence

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Course of Action – WG Recommendations

- Encourage API to follow up on DNV standard
- Additional MMS expertise needed
 - In-house
 - Contract
 - CVA?
- Alternative Compliance Methods
 - Equivalence
 - Comparative Risk Analysis
 - Identify fall-back position
 - Evolution instead of revolution (small steps first)

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Path Forward

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Path Forward - Discussion

- Need to develop Guidelines for Qualifying New Technology
- Possible paths to develop Guidelines
 1. API Project
 2. DeepStar Project w/ subsequent adoption by API
 3. JIP to sponsor development by Vendors & Manufacturers
 4. Adopt/adapt Guidelines that exist or are being developed (ABS, DNV, API GL on Composite Risers)
 5. Expert Forum facilitated by OTRC
- Developing Guidelines through an operator-sponsored API Project selected as best path forward

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Path Forward - Consensus

- Task Group to prepare proposal for API Project
- Task Group volunteers (Salama, Bensimon, Hill, Markussan)
- Proposal
 - “White Paper” format (3-5 pages)
 - Discuss need & proposed process
 - Involve MMS (agreement & demonstrate interest in participating and eventual use)
 - MMS to encourage USCG involvement
 - Proposal to API by end 2002

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Appendix C

Participant List

<i>Company</i>	<i>Name</i>	<i>Participant Type</i>
ABB Lummus Global	Rajiv Aggarwal	Industry Participant
ABB Lummus Global	Raymond Fales	Industry Participant
ABB Vetco Gray	Kap Parfrey	Panelist
ABS	James Card	Panelist
ABS	Jerfang Wu	Industry Participant
ABS	Ken Richardson	Industry Participant
Aker Kvaerner	Eirik Sorensen	Industry Participant
Aker Kvaerner	Henrik Hannus	Industry Participant
Aker Kvaerner	John Morrison	Industry Participant
Aker Kvaerner	Leiv Wanvik	Industry Participant
API/ChevronTexaco	Mark Witten	Panelist
ASTM	Carl Rousseau	Panelist
BHP Billiton	Kurt Albaugh	Industry Participant
Boeing	Gail Hahn	Speaker
BP	Anne-Renee Laplante	Industry Participant
BP	David Petruska	Industry Participant
BP	Fikry Botros	Industry Participant
CEAC- University of Houston	Su Su Wang	Industry Participant
ChevronTexaco	Jen-hwa Chen	Industry Participant
ChevronTexaco	Lawrence Cheung	Industry Participant
ChevronTexaco	T. M. Hsu	Industry Participant
Composites Solutions	Bill Cole	Industry Participant
ConocoPhillips	John George	Industry Participant
ConocoPhillips	Mamdouh Salama	Speaker
DARPA	Ray Meilunas	Speaker
Deepstar/Shell	Rick Meyer	Speaker
Deepwater Composites	Turid Storhaug	Panelist
DNV	Christian Markussen	Industry Participant

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<i>Company</i>	<i>Name</i>	<i>Participant Type</i>
DNV	Craig Colby	Panelist
Doris, Inc.	Oliver P. Andrieux	Industry Participant
Ecology and Environment	Gary Goeke	Industry Participant
Energy Valley	Art Schroeder	Industry Participant
ExxonMobil	Alex Selvarathinam	Industry Participant
ExxonMobil	Steve Brooks	Industry Participant
ExxonMobil	William Brown	Industry Participant
Fugro Chance, Inc.	Mark Buhrke	Industry Participant
Halliburton	Mark Kalman	Panelist
Hydril	Jennifer Hommema	Industry Participant
Hydril	Tom Walsh	Panelist
Kerr-McGee	Luis Bensimon	Industry Participant
Kvaerner	David Brunt	Panelist Paid
Kvaerner	Richard Hill	Industry Participant
MMS	Arvind Shah	Participant
MMS	Bud Danenberger	Speaker
MMS	Charles Smith	Participant
MMS	Don Howard	Participant
MMS	Glenn Shackell	Participant
MMS	James Grant	Participant
MMS	Paul Martin	Participant
MMS	Tommy Laurendine	Participant
NASA	Tom Gates	Speaker
Offshore Energy Services, Inc.	Gus Mullins	Industry Participant
Offshore Operators Committee	Allen Verret	Participant
OTRC	Debbie Meador	Liaison
OTRC	Ozden Ochoa	Coordinator
OTRC	Richard Mercier	Liaison
OTRC	Skip Ward	Coordinator
Petroleum Composites	Jerry Williams	Invited Guest

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<i>Company</i>	<i>Name</i>	<i>Participant Type</i>
RRS Engineering	Peter Hill	Industry Participant
Shell	Allan Reece	Industry Participant
Shell	Him Lo	Speaker
Shell Deepwater Services	Terry Cook	Industry Participant
Stolt Offshore, Inc.	Bill Moore	Industry Participant
Toray Carbon Fibers America, Inc.	Jeff Engbrecht	Industry Participant
Toray Carbon Fibers America, Inc.	Sam Johnson	Industry Participant
TotalFinaElf	Pierre Montaud	Industry Participant
University of Houston	Anthony Miravette	Invited Guest
Unocal	David Lush	Industry Participant
Unocal	David Saylor	Industry Participant