APPENDIX A – SPECIFICATIONS OF CURRENT LiDAR HARDWARE

Table 2. 2008 LiDAR Hardware Summary Sets 1 to 5 (*Point of Beginning* website).

Manufacturer	3rdTech	FARO Technologies, Inc.	FARO Technologies, Inc.	FARO Technologies, Inc.	FARO Technologies, Inc.
Product	DeltaSphere-3000IR	Photon Laser Scanner	FARO Laser Scanner LS 840	FARO Laser Scanner LS 880	FARO Laser Scanner LS 420
Performance					
Laser Wavelength (in nm)	780	785 nm	785nm	785nm	785nm
Laser Power (in W, mW)	8mW	20 mW	10mW	20mW	20mW
FDA Laser Classification (Class)	3R	3R	3R	3R	3R
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	0.1 in. at 1 ft., 0.28 in. at 30 ft.	3.3 mm at exit, circular	3mm at exit	3mm at exit	3mm at exit
Measurement Technique	Modulated Beam TOF	Phase-shift	Phase shift	Phase shift	Phase shift
Average Data Acquisition Rate (pps)	15,000	120,000	120,000	120,000	120,000
Maximum Data Acquisition Rate (pps)	43,000	120,000	120,000	120,000	120,000
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.3 in at 40 ft	+/- 2mm at 25m	+/- 3mm at 25m	+/- 3mm at 25m	+/- 3mm at 25m
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.35 in at 40 ft		+/- 3mm at 25m	+/- 3mm at 25m	+/- 3mm at 25m
Angular Accuracy (degrees-min-sec)	0.015°		0.009°	0.009°	0.009°
Minimum Range (feet/m)	1 ft	10m	0.6m	0.6m	0.6m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	54 ft at 85% reflectance; 35 ft at 30% reflectance	80M	40m at 90% reflectivity target	76m at 90% reflectivity target	20m
Field of View (vertical angle) (degrees-min-sec)	290°	320 degrees	320°	320°	320°
Field of View (horizontal angle) (degrees-min-sec)	360°	360 degrees	360°	360°	360°
Minimum Vertical Scan Increment (degrees-min-sec)	0.075°		0.009°	0.009°	0.009°
Minimum Horizontal Scan Increment (degrees-min-sec)	0.075°		0.00076°	0.00076°	0.00076°
Surface Reflectivity Range (%)	5 - 99%	.6/11.2 mm rms@ 90%	n/a	n/a	n/a
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	Yes. Optional - for creating full color, texture-mapped, computer graphics models and 360 degree panoramic images.	Yes	optional; resolution depends on used camera	optional; resolution depends on used camera	optional; resolution depends on used camera
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes. Compatible; aligned with tribrach mount.	No	Yes; by using fixed position methods and/or survedy referenc targets	Yes; by using fixed position methods and/or survedy referenc targets	Yes; by using fixed position methods and/or survedy referenc targets
Is the scanner better for scanning topography or for as-built surveys?	As-built surveys	As-Built	both	both	both
Is software technology for processing data from scanner manufacturer?	Yes, included.	Yes	yes	yes	yes
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes/No	Yes	yes; yes	yes; yes	yes;yes
Can the user specify the field of view and scan density?	Yes - both	Yes	yes	yes	yes
Maximum sample density (mm/ft)	15 points/degree		depends on object distance	depends on object distance	depends on object distance
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Yes - range, intensity, FOV	Yes	yes	yes	yes
Does the scanner have interchangable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes	Yes	yes; fully modular set up; distance sensor, PC module, mirror module, base module; color option; WiFi option	yes; fully modular set up; distance sensor, PC module, mirror module, base module; color option; WiFi option	yes; fully modular set up; distance sensor, PC module, mirror module, base module; color option; WiFi option
Communication Method (e.g., ethernet card, firewire, wireless)	Ethernet for range data / USB for color	Wireless, internal hard drive, ethernet	Ethernet; WiFi (wireless)	Ethernet; WiFi (wireless)	Ethernet; WiFi (wireless)
Does the scanner operate when out of level? Does it have compensators?	Yes / No	Yes	yes; yes	yes; yes	yes;yes

Table 2. 2008 LiDAR Hardware Summary Sets 1 to 5 (*Point of Beginning* website).
- continued –

Manufacturer	3rdTech	FARO Technologies, Inc.	FARO Technologies, Inc.	FARO Technologies, Inc.	FARO Technologies, Inc.
Product	DeltaSphere-3000IR	Photon Laser Scanner	FARO Laser Scanner LS 840	FARO Laser Scanner LS 880	FARO Laser Scanner LS 420
Resolution and range of compensators	NA		resolution 0.001°; range +/- 15°	resolution 0.001°; range +/- 15°	resolution 0.001°; range +/- 15°
Environmental					
Storage Temperature Range (degrees F/C)	32 to 113°F		0°C to 60°C	0°C to 60°C	0°C to 60°C
Operating Temperature Range (degrees F/C)	32 to 113°F	5 degrees C to 40 degrees C	5°C to 40°C	5°C to 40°C	5°C to 40°C
Humidity (%)	Non-condensing	non condensing	non condensing	non condensing	non condensing
Ambient Light	Interior lighting or shade to total darkness. Direct sunlight reduces the range.		darkness until sunlight	darkness until sunlight	darkness until sunlight
General					
Scanner Dimensions (LxWxH) (inches/cm)	14 x 14 x 4 in	15.7	400mm x 160mm x 280mm	400mm x 160mm x 280mm	400mm x 160mm x 280mm
Scanner Weight (pounds/kg)	22 lbs	35lb	14.5kg	14.5kg	14.5kg
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes - or photographic tripod	Yes	yes	yes	yes
AC Power Requirements (volts/watts)	100-240 V (40 - 65 w)		90V to 280V; 60W	90V to 280V; 60W	90V to 280V; 60W
DC Power Requirements (volts/watts)	12 V (40 - 65 w)	24V	24V DC; 60W	24V DC; 60W	24V DC; 60W
Batteries	Standard 12 V battery	Nickel Metal Hydride	available	available	available
Battery Dimensions (LxWxH) (inches/cm)	Variable		110mm x 320mm x 420mm	110mm x 320mm x 420mm	110mm x 320mm x 420mm
Battery Weight (pounds/kg)	Variable		12.0kg	12.0kg	12.0kg
Battery Life (hours)	4 - 8 typical	6 hours	8 hrs.	8 hrs.	8 hrs.
Are batteries hot-swappable? (Y/N)	No	No	N	N	N
Computer Requirements for Control (handheld option?)	Standard PC/laptop, Win XP/Vista, ethernet, USB for color option.	Ethernet, WLAN, by PC or PDA	Standard Windows PC (or PDA with WiFi)	Standard Windows PC (or PDA with WiFi)	Standard Windows PC (or PDA with WiFi)
Computer Requirements for Data Processing	Standard PC/laptop,Win XP/Vista, 512 MB memory, 3D graphics card for display performance, 3-button mouse	Pentium III, 700 MHz, 256 MB RAM	OpenGL graphics card, 1GB RAM recomended	OpenGL graphics card, 1GB RAM recomended	OpenGL graphics card, 1GB RAM recomended
Standard Accessories (list)	Wheeled shipping crate with handle, external power supply, auxiliary auto power cable, quickrelease tripod mount, cables, SceneVision-3D software, safety glasses.	Power supply, connector box, LEMO cable, Ethernet cable, 2 laser protection glasses, FaroRecord software, FaroScene software, Inclination Sensor	Power supply, connector box, LEMO cable, Ethernet cable, 2 laser protection glasses, FaroRecord software, FaroScene software	Power supply, connector box, LEMO cable, Ethernet cable, 2 laser protection glasses, FaroRecord software, FaroScene software	Power supply, connector box, LEMO cable, Ethernet cable, 2 laser protection glasses, FaroRecord software, FaroScene software
Optional Accessories (list)	Calibrated professional digital camera and lens, camera mount, additional software, tripod, laptop stand, dolly, laptop, onsite training.	carbon fiber tripod, power base, ipod touch, nikon digital camera, backpack	Tripod, color option, reference spheres, software packages and many other accessories.	Tripod, color option, reference spheres, software packages and many other accessories.	Tripod, color option, reference spheres, software packages and many other accessories.
Warranty	12 months	1 year standard, optional additional 3yr	1yr	1yr	1yr

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Table 3. 2008 LiDAR Hardware Summary Sets 6 to 10 (*Point of Beginning* website).

Manufacturer	Leica Geosystems	Leica Geosystems	Maptek I-Site 3D Laser Imaging	Maptek I-Site 3D Laser Imaging	Measurement Devices Ltd
Product	HDS6000	Leica ScanStation 2	I-Site 4400LR Laser Scanner	I-Site 4400CR Laser Scanner	QuarrymanPro / LaserAce Scanner
Performance					
Laser Wavelength (in nm)	650, 690 nm	532	905	905	905nm
Laser Power (in W, mW)	< 4.75mW	1 mW, avg.	10mW	10mW	
FDA Laser Classification (Class)	3R	3R	3R	3R	1M
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	3mm at exit; 8mm @25m; 14mm @50m	6 mm at 50 m [1]	140mm at 100m	140mm at 100m	46mm at exit, 173mm at 50m
Measurement Technique	Phase shift	Pulsed laser; TOF	Time of flight	Time of flight	Time of flight
Average Data Acquisition Rate (pps)	125,000	Dependent on scan conditions	4400	4400	250pps
Maximum Data Acquisition Rate (pps)	up to 500,000	Up to 50,000 [2]	4400	4400	250pps
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	4mm at 90% albedo up to 25m; 5mm at 18% up to 25m; 5mm at 90% up to 50m; 6mm at 18% up to 50m	4 mm at 50 m [3]	20mm at 50 m (1), 50mm at 500m	20mm a 50m (1), 50mm at 500m	5cm
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	6mm, 1m to 25m range; 10mm to 50m range	6 mm at 50 m [4]	50mm at 100m (1)	50mm at 100m (1)	67mm at 50m
Angular Accuracy (degrees-min-sec)	0.0071 degree (25 seconds)	0.0034 degree (12 seconds)	0.04	0.04	0.02degrees
Minimum Range (feet/m)	0.1m	< 1 m	5m	2m	5m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	79m @90%; 50m @18% albedo	300 m at 90%; 134 m at 18%	150m at 4%, 700m at 80%	500m at 80%	700m at 90%, 400m at 18%
Field of View (vertical angle) (degrees-min-sec)	310°	270 degree	80	80	-45 to +80 degrees
Field of View (horizontal angle) (degrees-min-sec)	360°	360 degree	360	360	0 to 360degrees
Minimum Vertical Scan Increment (degrees-min-sec)	0.009°	00-00-01 (1 arc second)	0.108 degrees	0.108 degrees	0.05degrees
Minimum Horizontal Scan Increment (degrees-min-sec)	0.009°	00-00-01 (1 arc second)	0.108 degrees	0.108 degrees	0.05degrees
Surface Reflectivity Range (%)	1%-100%	1 - 100%	1-95%	1-95%	1-100%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	Any external digital camera can be used for photo-overlay using Leica Cyclone software	Yes [5]	Integral linear, 40 megapixel (16667x2520)	Integral linear 80 megapixel (16667X4200)	No
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes, via Leica's X-Function, LandXML and ASCII.	Yes [6]	Yes (2)	Yes (2)	Yes, via software
Is the scanner better for scanning topography or for as-built surveys?	As-built	Excellent for both	Topography	Topography	Topography
Is software technology for processing data from scanner manufacturer?	Yes, Cyclone and CloudWorx Suite	Yes, Cyclone, CloudWorx, Cyclone II TOPO	Yes	Yes	Yes, ModelAce and Face3DPro
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes, Yes	Yes; yes [7]	Yes/Yes	Yes/Yes	Yes and yes
Can the user specify the field of view and scan density?	Yes	Yes [14]	Yes/Yes	Yes/Yes	Yes
Maximum sample density (mm/ft)	1.6x1.6mm @ 10m, 7.9x7.9mm @ 50m	< 1 mm at 300 m range	190mm at 100m	190mm at 100m	10mm
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Yes: range, intensity, area	Yes, range, intensity, area	Yes	Yes	Polygon, rectangle, last hit
Does the scanner have interchangable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes: battery, user interface, reflector attachment	[8]	Battery may be upgraded for extreme weather conditions, otherwise no.	Battery may be upgraded for extreme weather conditions, otherwise no.	No
Communication Method (e.g., ethernet card, firewire, wireless)	on-board controls, ethernet, and bluetooth	Ethernet or wireless	Ethernet, Memory stick	Ethernet, Memory stick	Serial

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Table 3. 2008 LiDAR Hardware Summary Sets 6 to 10 (*Point of Beginning* website).
- continued –

Manufacturer	Leica Geosystems	Leica Geosystems	Maptek I-Site 3D Laser Imaging	Maptek I-Site 3D Laser Imaging	Measurement Devices Ltd
Product	**HDS6000**	**Leica ScanStation 2**	**I-Site 4400LR Laser Scanner**	**I-Site 4400CR Laser Scanner**	**QuarrymanPro / LaserAce Scanner**
Does the scanner operate when out of level? Does it have compensators?	Yes. Integrated tilt sensing and read-out.	Yes; yes, survey-grade [9]	Yes/Yes	Yes/Yes	Operates out of level, manual compensation
Resolution and range of compensators	Dual-axis tilt sensor: selectable on/off; 3.6" resolution	1 second resolution; 5minutes range	20	20	
Environmental					
Storage Temperature Range (degrees F/C)	-20°C to +50°C	+65 to -25 degrees Celsius	-40C to +60C	-40C to +60C	-20 to +70C
Operating Temperature Range (degrees F/C)	0° C to +40° C	+40 to 0 degrees Celsius	-40C (3) to +50C	-40C (3) to +50C	-10 to +45C
Humidity (%)	non-condensing atmosphere	Non-condensing	100% IP65	100% IP65	IP66
Ambient Light	any light conditions	Any light conditions	Any	Any	Any light conditions
General					
Scanner Dimensions (LxWxH) (inches/cm)	7.5?D x 11.5? W x 13.8? H, 190mm D x 244mm W x 351.5mm	370mm x 265 mm x 510 mm	430x250x360 mm	430x250x360 mm	20.9 x 24.3 x 42.0 cm
Scanner Weight (pounds/kg)	14 kg, nominal (includes integrated battery)	18.8 kg with carry handle	12kg	12kg	9.7kg
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes.	Yes	Yes	Yes	Yes
AC Power Requirements (volts/watts)	90 - 260V AC	100 - 240V; < 80W avg.	N/A (battery integral)	N/A (battery integral)	100-240VAC for battery charger
DC Power Requirements (volts/watts)	24V DC	36V; < 80W avg.	24V,1.6W (battery integral)	24V,1.6W (battery integral)	12VDC
Batteries	On-board: Li-ion, External (optional): lead acid	2 lead acid with System	24V 3800 mAh NiMh rechargeable	24V 3800 mAh NiMh rechargeable	7Ah 12VDC
Battery Dimensions (LxWxH) (inches/cm)	External: 9.5? x 10? x 12? ; 240mm x 260 mm x 300mm	236 mm x 165 mm x 215 mm	Included in scanner dimensions (battery is integral)	Included in scanner dimensions (battery is integral)	18 x 13 x 8 cm
Battery Weight (pounds/kg)	Internal: 1kg External: 16 kg,	12 kg	2kg	2kg	3.2kg
Battery Life (hours)	Internal: 1.5 hours External (optional): 4 hours	> 3 hrs	3	3	3hours for continuous fast scan
Are batteries hot-swappable? (Y/N)	No	Yes	No	No	No
Computer Requirements for Control (handheld option?)	1.4GHZ Pentium M or similar, 512MB SDRAM, Ethernet Card, SXGA+, Windows XP (Pro or Home Edition), Windows 2000; Handheld Tablet PC option; handheld PDA option	[10]	Hand held supplied	Hand held supplied	Optional ruggedised PC
Computer Requirements for Data Processing	2.0 GHz Pentium 4, 512 MB SDRAM, ethernet card, SXGA+, Win XP (Pro or Home Edition), Win 2000	[11]	PC or laptop (I-Site Studio? software supplied)	PC or laptop (I-Site Studio? Software supplied)	

Table 3. 2008 LiDAR Hardware Summary Sets 6 to 10 (*Point of Beginning* website).
- continued –

Manufacturer	Leica Geosystems	Leica Geosystems	Maptek I-Site 3D Laser Imaging	Maptek I-Site 3D Laser Imaging	Measurement Devices Ltd
Product	HDS6000	Leica ScanStation 2	I-Site 4400LR Laser Scanner	I-Site 4400CR Laser Scanner	QuarrymanPro / LaserAce Scanner
Standard Accessories (list)	Scanner & accessories carrying case; additional internal battery; battery cradle for internal battery; battery charger/AC power supply; Cyclone-SCAN software; cleaning kit	[12]	Transport case, 2 Batteries, 110 VAC charger, Car charger, Tripod, Laser tribrach, Hand held computer, Remote control, Manual	Transport case, 2 Batteries, 110 VAC charger, Car charger, Tripod, Laser tribrach, Hand held computer, Remote control, Manual	Tribrach, 3x memory cards, card reader, battery, battery charger
Optional Accessories (list)	Notebook PC, tablet PC, PDA; scan targets; service agreement; extended warranty; tribrach (Leica Professional Series); tripod (Leica professional series); external battery	[13]	Underground photographic light, Cold weather jacket, Extreme environment and/or long life battery, Horizontal mount system, Low profile case.	Underground photographic light, Cold weather jacket, Extreme environment and/or long life battery, Horizontal mount system, Low profile case.	Tripod, traverse kit
Warranty	1 Year	1 year	12 months	12 months	12 month

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Table 4. 2008 LiDAR Hardware Summary Sets 11 to 15 (*Point of Beginning* website).

Manufacturer	Measurement Devices Ltd	Optech Incorporated	Optech Incorporated	Riegl	Riegl
Product	C-ALS Cavity Scanner	ILRIS-3D	ILRIS-3D-ER	LMS-Z210ii	LMS-Z390
Performance					
Laser Wavelength (in nm)	905nm	1550	1550	Near infared	Near infared
Laser Power (in W, mW)		<10 mW	<20 mW	1mW	1mW
FDA Laser Classification (Class)	1	Class 1	Class 1M	1	1
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	18mm at exit, 140mm at 50m	29 mm @ 100 m	29 mm @ 100 m	50 mm at 50 m	25 mm at 100 m
Measurement Technique	Time of flight	Time of Flight	Time of Flight	LIDAR	LIDAR
Average Data Acquisition Rate (pps)	200pps	2500	2500	8000	8000
Maximum Data Acquisition Rate (pps)	200pps	UP To 10 kHz	UP To 10 kHz	12000	12000
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)		7 mm @ 100 m See Note 1	7 mm @ 100 m See Note 1	15 mm at 400 m	2 mm at 50 m
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)		8 mm @ 100 m See Note 1	8 mm @ 100 m See Note 1	10 mm at 100 m	10 mm at 100 m
Angular Accuracy (degrees-min-sec)	0.2degrees	.00115° (20 microradians)	.00115° (20 microradians)	0.005	0.0005
Minimum Range (feet/m)	0.5m	3 m	3 m	4 m	1 m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	150m at 90%, 70m at 18%	1500 m @ 80%	2100 m @ 80%	650 m	300 m
Field of View (vertical angle) (degrees-min-sec)	-90 to +90degrees	180°	180°	80	80
Field of View (horizontal angle) (degrees-min-sec)	0 to 360 degrees	360°	360°	360	360
Minimum Vertical Scan Increment (degrees-min-sec)	0.1degrees	.00115° (20 microradians)	.00115° (20 microradians)	0.005	0.001
Minimum Horizontal Scan Increment (degrees-min-sec)	0.1degrees	.00115° (20 microradians)	.00115° (20 microradians)	0.005	0.002
Surface Reflectivity Range (%)	1-100%	.1- 99%	.1- 99%	5-100%	5-100%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	Yes with Red LED illumination	Yes (built-in camera)	Yes (built-in camera)	10 megapixel	10 megapixel
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes, via software	Yes, Post-Processing Software	Yes, Post-Processing Software	Yes	Yes
Is the scanner better for scanning topography or for as-built surveys?	Topography	Both	Both	Topography	As-Built
Is software technology for processing data from scanner manufacturer?	Yes, ModelAce and VoidWorks	Yes	Yes	Yes	Yes
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Integrated pitch and roll sensors plus optional compass for position determination	Yes / Yes	Yes / Yes	Yes	Yes
Can the user specify the field of view and scan density?	Yes	Yes	Yes	Yes	Yes
Maximum sample density (mm/ft)		2 mm @ 100 m	2 mm @ 100 m	3.5 mm @ 50 m	3.5 mm @ 50 m
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Rectangle, last hit	Yes	Yes	Yes	Yes
Does the scanner have interchangable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes, optional internal compass	Yes	Yes	Yes	Yes
Communication Method (e.g., ethernet card, firewire, wireless)	Serial, TCP/IP, WiFi	Ethernet / Wireless	Ethernet / Wireless	TCP/IP	TCP/IP
Does the scanner operate when out of level? Does it have compensators?	Yes, integral pitch and roll sensors	Yes / Yes	Yes / Yes	Yes	Yes
Resolution and range of compensators		See Note 2	See Note 2	Yes	Yes
Environmental					
Storage Temperature Range (degrees F/C)	-20 to +70C	-20 to 50° C	-20 to 50° C	-20 to 60	-20 to 60
Operating Temperature Range (degrees F/C)	-10 to +45C	0 to 40° C	0 to 40° C	-10 to 50	-10 to 50
Humidity (%)	IP66	Sealed 100%	Sealed 100%	100%	100%
Ambient Light	Any light conditions	Yes (not affected)	Yes (not affected)	Not Affected	Not affected
General					
Scanner Dimensions (LxWxH) (inches/cm)	200.0 x 5.0 Diameter	32 x 32 x 22 cm	32 x 32 x 22 cm	44x21	49 x 21
Scanner Weight (pounds/kg)	9.4kg including extension piece	13 kg	13 kg	13kg	13 kg

Table 4. 2008 LiDAR Hardware Summary Sets 11 to 15 (*Point of Beginning* website).
- continued –

Manufacturer	Measurement Devices Ltd	Optech Incorporated	Optech Incorporated	Riegl	Riegl
Product	C-ALS Cavity Scanner	ILRIS-3D	ILRIS-3D-ER	LMS-Z210ii	LMS-Z390
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	No. Cable or rod deployment in up, down or horizontal borehole.	Yes	Yes	Tripod or Vehicle	Tripod or Vehicle
AC Power Requirements (volts/watts)	85-264VAC	90-260 VAC/3.2 VA	90-260 VAC/3.2 VA	No	No
DC Power Requirements (volts/watts)	10-15VDC	24 VDC/75 Watts	24 VDC/75 Watts	12-28 VDC	12-28 VDC
Batteries	12V	24 VDC Nominal	24 VDC Nominal	Marine Battery	Marine Battery
Battery Dimensions (LxWxH) (inches/cm)		9 x 13 x 5 cm	9 x 13 x 5 cm	12 x 11 x 8	12 x 11 x 8
Battery Weight (pounds/kg)		1 kg	1 kg	19	19
Battery Life (hours)		4 batteries = 5 hours	4 batteries = 5 hours	14	14
Are batteries hot-swappable? (Y/N)	No	Yes	Yes	No	No
Computer Requirements for Control (handheld option?)	Ruggedised PC	Pocket PC or Laptop	Pocket PC or Laptop	1024 MB RAM	1024 MB RAM
Computer Requirements for Data Processing		1024 MB Ram	1024 MB Ram	1024 MB RAM	2000 MB RAM
Standard Accessories (list)	50m cable, 50m rods, surface control box, transit cases, ModelAce software	Carry Case / AC Power Supply	Carry Case / AC Power Supply	Inclination Sensor	Inclination Sensor
Optional Accessories (list)	Internal 3 axis magnetometer and accelerometer	Batteries/Charger, PC, Camera Kit	Batteries/Charger, PC, Camera Kit	Internal Sync Timer for GPS/INS	Internal Sync Timer for GPS/INS
Warranty	12month	1 year	1 year	12 months	12 months

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Table 5. 2008 LiDAR Hardware Summary Sets 16 to 20 (*Point of Beginning* website).

Manufacturer	Riegl	Riegl USA, Inc	Riegl USA, Inc	Riegl USA, Inc.	Spatial Integrated Systems Inc
Product	LMS-Z420i	LMS-Z210ii	LMS-Z390i	LMS-Z420i	3 DIS - 3 Dimensional Imaging & Scanning
Performance					
Laser Wavelength (in nm)	Near infared	Near infrared	Near Infrared	Near Infrared	780NM
Laser Power (in W, mW)	1mW	1mW	1mW	1mW	20 mW
FDA Laser Classification (Class)	1	Class 1 Eyesafe Invisible Beam	Class 1 Eyesafe Invisible Beam	Class 1 Eyesafe Invisible Beam	II B
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	25 mm at 100 m	50 mm at 50 m	10 mm at 50 m	10 mm at 50 m	0.4 Inches @ 54 Ft
Measurement Technique	LIDAR	Lidar	LIDAR	Lidar	Modulated Beam TOF
Average Data Acquisition Rate (pps)	8000	8000pps	8000 pps	8000 pps	3300
Maximum Data Acquisition Rate (pps)	12000	10000pps	11000 pps	11000 pps	3300
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	5 mm at 1000 m	15 mm at 400 m	2 mm at 50 m	5 mm at 50 m	0.2 Inches @ 54 Feet
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	6 mm at 100 m	10 mm at 100 m	10 mm at 100 m	6 mm at 100 m	0.2 Inches @ 54 Feet
Angular Accuracy (degrees-min-sec)	0.0005	0.005	0.0005	0.0005	(55) Using Standard & Customized Catalogs
Minimum Range (feet/m)	2 m	4 m	1 m	2m	1 '
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	1000m	650 m	400 m	1000 m	54 '
Field of View (vertical angle) (degrees-min-sec)	80	0-80	0 - 80	0-80	320 Degrees
Field of View (horizontal angle) (degrees-min-sec)	360	0-360	0 - 360	0-360	360 Degrees
Minimum Vertical Scan Increment (degrees-min-sec)	0.002	0.005	.001	0.002	0.03 Degrees
Minimum Horizontal Scan Increment (degrees-min-sec)	0.002	0.005	.001	0.002	0.05 Degrees
Surface Reflectivity Range (%)	5-100%	5-100%	5-100%	5-100%	85%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	10 megapixel	10 Megapixels	16.7 Megapixel	16.7 Megapixels	Yes - 2 Megapixels
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes	Yes	Yes	Yes	No
Is the scanner better for scanning topography or for as-built surveys?	As-built & Topography	Topography	As Built	As built & Topography	As-Built
Is software technology for processing data from scanner manufacturer?	Yes	Yes	Yes	Yes	Yes
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes	Yes	Yes	Yes	No
Can the user specify the field of view and scan density?	Yes	Yes	Yes	Yes	Yes
Maximum sample density (mm/ft)	3.5 mm @ 50 m	3.5 mm at 50 m	3.5 mm at 50m	3.5 mm at 50 m	14.36MM @ 16.46M
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Yes	Yes	Yes	Yes	No
Does the scanner have interchangable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes	Yes	Yes	Yes	No - All Included
Communication Method (e.g., ethernet card, firewire, wireless)	TCP/IP	TCP/IP	TCP/IP	TCP/IP	Ethernet
Does the scanner operate when out of level? Does it have compensators?	Yes	Yes	Yes	Yes	Yes - Compensators Not Necssary
Resolution and range of compensators	Yes	Yes	Yes	Yes	N/A
Environmental					
Storage Temperature Range (degrees F/C)	-20 to 60	-20c to 60c	-10c to 50c	-10c to 50c	32 - 104 Degrees F
Operating Temperature Range (degrees F/C)	-10 to 50	-10c to 50c	0c to 40c	0c to 40c	32 - 104 Degrees F
Humidity (%)	100%	100%	100%	100%	Non Condensing

Table 5. 2008 LiDAR Hardware Summary Sets 11 to 15 (*Point of Beginning* website).
- continued –

Manufacturer	Riegl	Riegl USA, Inc	Riegl USA, Inc	Riegl USA, Inc.	Spatial Integrated Systems Inc
Product	LMS-Z420i	LMS-Z210ii	LMS-Z390i	LMS-Z420i	3 DIS - 3 Dimensional Imaging & Scanning
Ambient Light	Not Affected	Not Affected	Not Affected	Not Affected	Not Affected
General					
Scanner Dimensions (LxWxH) (inches/cm)	47 x 21	44 x 21	49 x 21	47 x 21	10
Scanner Weight (pounds/kg)	15 kg	13 kg	15kg	16 kg	22 Lbs - 10 Kg
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Tripod or Vehicle	Tripod or Vehicle	Tripod or Vehicle	Tripod or Vehicle	Yes
AC Power Requirements (volts/watts)	No	Yes	Yes	Yes	100-240V (50-70W)
DC Power Requirements (volts/watts)	12-28 VDC	12-28v DC	12-28v DC	12-28v DC	12V (50-70W)
Batteries	Marine Battery	NiMH	NiMH	NiMH	N/A
Battery Dimensions (LxWxH) (inches/cm)	12 x 11 x 8	14 x 4 x 4	14 x 4 x 4	14 x 4 x 4	N/a
Battery Weight (pounds/kg)	19	8 lbs	8 lbs	8 lbs	N/A
Battery Life (hours)	14	14 hours	14 hours	14 hours	N/A
Are batteries hot-swappable? (Y/N)	No	No	No	No	N/A
Computer Requirements for Control (handheld option?)	1024 MB RAM	1024 Mb Ram	1024 Mb Ram	1024 Mb Ram	Note (57)
Computer Requirements for Data Processing	2000 MB RAM	1024 Mb Ram	2000 Mb Ram	2000 Mb Ram	Note (57)
Standard Accessories (list)	Inclination Sensor	Inclination Sensor	Inclination Sensor	Inclination Sensor	Travel Case, Tripod & Computer
Optional Accessories (list)	Internal Sync Timer for GPS/INS	Internal Sync Timer for GPS/INS	Internal Sync Timer for GPS/INS	Internal Sync Timer for GPS/INS	N/A
Warranty	12 months	12 months	12 months	12 months	12 Months

Table 6. 2008 LiDAR Hardware Summary Sets 21 to 25 (*Point of Beginning* website).

Manufacturer	Topcon	Trimble	Trimble	Z+F	Z+F / Z+F UK
Product	GLS-1000	Trimble GX 3D Scanner	Trimble VX Spatial Station	IMAGER 5006	IMAGER 5006
Performance					
Laser Wavelength (in nm)	1535nm	532 nm	870 nm		Visible
Laser Power (in W, mW)	less than 25W	<1 mW	< 1 mW	29mW	See classification
FDA Laser Classification (Class)	1	Class 2	Distance meter class 1. Laser pointer class 2	3R	3R (ISO EN 60825-1)
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	6mm @1-40m, 16mm @ 100m	3mm@50m (fixed focus); 0.3mm@5m; 0.9mm@15m; 1.5mm@25m (with autofocus)	Horizontal 4 cm/100 m (0.13 ft/328 ft). Vertical 8 cm/100 m (0.26 ft/328 ft)	0.14 at 3.3 (3.5mm at 1m)	3 mm at 1m
Measurement Technique	Time of Flight	Time of flight	Time of flight	Phase shift AMCW	phase based
Average Data Acquisition Rate (pps)		Depends on application	5 (1)	125,000	< 250 000 pxl/sec.
Maximum Data Acquisition Rate (pps)	3000	Up to 5000 pps	15	500,000	< 500 000 pxl/sec.
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	4mm @ 150m	7mm@100m (Uc); 2.5mm@100m (Std Dev)	3 mm @ ¡Ü150 m (0.011 ft @ ¡Ü492 ft)	+/- 1mm at 50m	1mm at 25 m rms 100% white reflectivity
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)		12mm@100m (Uc)	10 mm @ ¡Ü150 m (0.032 ft @ ¡Ü492 ft)	9mm at 50m	See Angular Accuracy
Angular Accuracy (degrees-min-sec)	6	Vt - 70μrad/14.5? (Uc); 17μrad/3.5? (Std Dev): Hz - 60μrad/12.4? (Uc); 30μrad/6.2? (Std Dev)	1 second	0.007°	0.007 degrees rms
Minimum Range (feet/m)	2m	2 m	2 m (6.56 ft)	0.3m	1.0 m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	330m @ 90% reflectivity	200 m at 75% of points on 20% grey target ; up to 350 m with Overscan	Reflectorless >300 m (984 ft) to 18% reflective surface and >800+ m (2625 ft) to 90% reflective surface. Prism: 5500 m (18044 ft) (1)	79m	79 m
Field of View (vertical angle) (degrees-min-sec)	70 degrees	60 °	270 degrees	310°	310 degrees
Field of View (horizontal angle) (degrees-min-sec)	360 degrees	360 °	360 degrees	360°	360 degrees
Minimum Vertical Scan Increment (degrees-min-sec)		17 μrad (4.5?)	Minimum point spacing 10 mm (0.032 ft)	0.0018°	0.0018 degrees
Minimum Horizontal Scan Increment (degrees-min-sec)		27 μrad (5.5?)	Minimum point spacing 10 mm (0.032 ft)	0.0018°	0.0018 degrees
Surface Reflectivity Range (%)		1-99%	1-99% (1)	5-99%	upto 100%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	2.0 MP	Yes	Yes, (2048 x 1536 pixels)	yes, optional	Yes
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes, optical tribrach and coordinate based	Yes, Through Trimble Connected Site	Yes, Through the Trimble Connected Site	yes, via custom survey targets	Yes, with software
Is the scanner better for scanning topography or for as-built surveys?	Good for both	Optimized for both	Optimized for both	both (within given max. range)	As-Built Surveys
Is software technology for processing data from scanner manufacturer?	Yes, Topcon ScanMaster	Yes, RealWorks Survey	Yes. RealWorks Survey	yes	Yes, LFM Software
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes, instrument panel input	Yes ; yes (dual axis compensator, height of instrument and PPM corrections)	Yes. Supports all survey workflows	yes	Not standard work pratice
Can the user specify the field of view and scan density?	Yes	Yes	Yes	yes	Yes
Maximum sample density (mm/ft)	1mm @ 100m	140 points/sq.inch @ 100 m	Minimum point spacing 10 mm (0.032 ft)	100,000 p per 360°	See Angular resolution

Table 6. 2008 LiDAR Hardware Summary Sets 21 to 25 (*Point of Beginning* website).
- continued –

Manufacturer	Topcon	Trimble	Trimble	Z+F	Z+F / Z+F UK
Product	**GLS-1000**	**Trimble GX 3D Scanner**	**Trimble VX Spatial Station**	**IMAGER 5006**	**IMAGER 5006**
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	No	Yes, range, intensity, area of interest	Yes	yes	Yes
Does the scanner have interchangable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Tilting tribrach assembly	Yes ; all included but Trimble GX includes a standard 5/8 11 hole for accessories	No hardware upgrades. Software is upgradable.	yes	Yes
Communication Method (e.g., ethernet card, firewire, wireless)	Built-in WLAN (802.11g)	Ethernet or Wireless	USB, 2.4 GHz radio and Bluetooth to the Controller	ethernet, USB, bluetooth	ethernet, bluetooth
Does the scanner operate when out of level? Does it have compensators?	Yes, compensated On/Off	Yes / Yes (dual axis compensator)	Yes. Yes (dual-axis compensator)	yes; tilt sensor	Yes. Compensators can be overridden.
Resolution and range of compensators	1 second incremented to 6 minute max	Range: 6 min	Accuracy 0.5 seconds. Range 6 minutes	resolution: 1/1,000°; range: 2°	1/1000 degrees
Environmental					
Storage Temperature Range (degrees F/C)	-10C - +60C	-20° to 50° C	Contact Trimble for more information	-20°C - 50°C	-20C - +50C
Operating Temperature Range (degrees F/C)	0C - +40C	0° to 40° C	¨C20 ¡âC to +50 ¡âC (¨C4 ¡âF to +122 ¡âF)	0°C - 40°C	0C - +40 C
Humidity (%)	IP-52	Non-condensing	IP55. Contact Trimble for more information	non-condensing	non-condensing
Ambient Light		Any light conditions	Any light conditions (1)	all conditions from darkness to daylight	all conditions from darkness to daylight
General					
Scanner Dimensions (LxWxH) (inches/cm)	240mm x 240mm x 566mm	323 mm x 343 mm x 404 mm	352 x 209 x 196 mm (1.16 x 0.69 x 0.64 ft)	286mm x 190mm x 372mm (w x d x h)	286 X 190 X 732 mm
Scanner Weight (pounds/kg)	16kg	13.6 kg	5.25 kg (11.57 lb)	14kg	14kgs
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Standard tribrach and tripod	Yes	Yes	yes	Yes. Alternatives also available
AC Power Requirements (volts/watts)	100-240V w/Adapter	90-240 V, 50-60 Hz	100-240 V, 50-60 Hz	90 - 260V AC (power supply)	90-260 Volts
DC Power Requirements (volts/watts)	7.4VDC	24 V nominal	12 V nominal	24V DC (scanner)	24 Volts
Batteries	(4) on-board	Yes	Yes, one internal and/or three external (via battery holder)	Sealed lead acid battery + Licium Ion	Supplied with 2 off internal batteries
Battery Dimensions (LxWxH) (inches/cm)		80 mm x 80 mm x 230 mm	126 x 74 x 24 mm (0.41 x 0.24 x 0.08 ft)	acid battery: 32 x 24 x 26cm; Li-Ion: integrated in scanner	?
Battery Weight (pounds/kg)	.4 lbs	3.1 kg	0.35 kg (0.77 lb)	acid battery: 15kg; Li Ion: integrated in scanner	?
Battery Life (hours)	4 hours	3.5 hours (Average, depending on environmental conditions)	One battery approx. 5 hours, three batteries approx. 15 hours	acid battery: 4h; Li-Ion: 1,5h	2 Hours. External battery also available 4 hours
Are batteries hot-swappable? (Y/N)	Yes	No	Yes, when using external 3-battery holder	yes	No
Computer Requirements for Control (handheld option?)	PC optional	Laptop PC or Trimble TSC2 handheld controllers	Trimble TSC2 or Trimble CU Controllers	1.2GHz, 512MB RAM (Win 2000, XP)	Internal harddisk or PDA or Laptop.
Computer Requirements for Data Processing	2Ghz CPU 1GB RAM	Ask Trimble dealer; depends on application	Windows PC. Contact Trimble for more information	1024 MB RAM	Laptop

Table 6. 2008 LiDAR Hardware Summary Sets 21 to 25 (*Point of Beginning* website).
- continued –

Manufacturer	Topcon	Trimble	Trimble	Z+F	Z+F / Z+F UK
Product	GLS-1000	Trimble GX 3D Scanner	Trimble VX Spatial Station	IMAGER 5006	IMAGER 5006
Standard Accessories (list)	Case, cover,	Transportation case; compact power supply with AC cables; Trimble tribach; ethernet cable for connection of scanner to data collector; 50 adhesive flat targets; Trimble 3D Scanner Field software	Large range of accessories. Contact Trimble for more information	power supply, exchangable battery, charger	Carry cases, power supply, batteries, ethernet cable
Optional Accessories (list)	Tilting tribrach mount	Trimble TSC2 controller with PocketScape field software; Trimble 3D scanner backpack; car battery cable kit; target kits (planar, circular, traverse kit); batteries	Large range of accessories. Contact Trimble for more information	camera, dolly, tripod, laptop tray for tripod	tripod, external batteries
Warranty	12 months	1 year - extendable	Two years standard. Extendable.	Limited 1 year	12 Months. Extented warranty available

Table 7. 2008 LiDAR Hardware Summary Set 26 (*Point of Beginning* website).

Manufacturer	Zoller + Frohlich
Product	**IMAGER 5006**
Performance	
Laser Wavelength (in nm)	650 nm
Laser Power (in W, mW)	19 / 29 mW
FDA Laser Classification (Class)	3 R
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	3 mm in 1m distance
Measurement Technique	phase shift
Average Data Acquisition Rate (pps)	250.000 pps
Maximum Data Acquisition Rate (pps)	500.000 pps
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	Linearity error up to 50 m < 1mm
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	
Angular Accuracy (degrees-min-sec)	0.007°
Minimum Range (feet/m)	1.0 m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	Ambiguity interval 79 m
Field of View (vertical angle) (degrees-min-sec)	310 °
Field of View (horizontal angle) (degrees-min-sec)	360 °
Minimum Vertical Scan Increment (degrees-min-sec)	0.0018°
Minimum Horizontal Scan Increment (degrees-min-sec)	0.0018°
Surface Reflectivity Range (%)	0 - 100 %
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	no, external camera optional
Is hardware interoperable with optical total stations and GPS? If yes, how?	GPS, RS232, NMEA
Is the scanner better for scanning topography or for as-built surveys?	as-built
Is software technology for processing data from scanner manufacturer?	yes
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	mounted prism can be surveyed for the scannerposition
Can the user specify the field of view and scan density?	yes
Maximum sample density (mm/ft)	1.57 mm @ 10 m
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	yes, in postprocessing
Does the scanner have interchangable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	yes, camera
Communication Method (e.g., ethernet card, firewire, wireless)	ethernet, wireless, USB
Does the scanner operate when out of level? Does it have compensators?	yes, tilt sensor
Resolution and range of compensators	+/- 2 ° / 0.001° resolution
Environmental	
Storage Temperature Range (degrees F/C)	- 20° C - 50°C
Operating Temperature Range (degrees F/C)	0°C - 40°C
Humidity (%)	non-condensing
Ambient Light	from darkness to daylight
General	
Scanner Dimensions (LxWxH) (inches/cm)	28.6 cm x 19.0 cm x 37.2 cm
Scanner Weight (pounds/kg)	13.8 kg

Table 7. 2008 LiDAR Hardware Summary Set 26 (*Point of Beginning* website).
- continued –

Manufacturer	Zoller + Frohlich
Product	**IMAGER 5006**
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	yes
AC Power Requirements (volts/watts)	
DC Power Requirements (volts/watts)	
Batteries	changeable (intern) / external
Battery Dimensions (LxWxH) (inches/cm)	19.0 cm x 8.8 cm x 5.5 cm / 26.0 cm x 24.0 cm x 30.0 cm
Battery Weight (pounds/kg)	1.5 kg / 16 kg
Battery Life (hours)	2.5 h / 6 h
Are batteries hot-swappable? (Y/N)	yes
Computer Requirements for Control (handheld option?)	no computer (internal PC)
Computer Requirements for Data Processing	Windows 2000, XP; Pentium III min 1 GHz recommended Pentium IV 1.8GHz; 512 MB RAM or more; 3D Graphic card (OpenGL support)
Standard Accessories (list)	Li-Ion battery pack; Power supply KNL-24; Power cable; Li-Ion charging cradle; Power supply cable; Ethernet cable; Software Z+F LaserControl ?Advanced?; Transport box IMAGER 5006; Transport box acces
Optional Accessories (list)	Transportable rechargeable battery pack Power Pack TRAPP-15-24; Charging cable; Cross-Ethernet cable; Laptop/PDA; Tripod; Tribrach; Dolly; Mounting for Laptop; Targets; Transport box for tripod
Warranty	12 month

Table 8. 2008 LiDAR Hardware Summary Survey Notes (*Point of Beginning* website).

Survey Notes			
1	Leica Geosystems	Leica ScanStation 2	[1] There are two common methods of reporting spot size. The 'Gaussian' diameter is: 6 mm at 50 m; 4 mm at 25 m; and 6 mm at < 1m; the 'FWHM' method of reporting spot size results in values of 3 mm at 50 m; 2 mm at 25 m; 3 mm at < 1 m. [2] Maximum instantaneous data acquisition rate. [3] Accuracy for a single pulsed range measurement (not averaged). [4] Accuracy of a single pulsed position measurement; 2.0 mm target center point accuracy (based on averaging technique) [5] 1 megapixel for 24x24 degree; 64 megapixels rectified for full scan; can also be used with external camera. [6] Via Leica's X-Function, LandXML and ASCII. [7] Instrument height, backsight, traversing, resectioning and stakeout fully supported. [8] Fully integrated for highest system accuracy and minimized calibration frequency. Upgradeabililty is dependent on specific feature(s). [9] On/off dual axis compensator [10] 1.4 GHz Pentium M or similar, 512 MB SDRAM, ethernet card, SXGA+, Win XP (Pro or Home Edition), Win 2000; handheld tablet PC option. [11] 2.0 GHz Pentium 4, 512 MB SDRAM, ethernet card, SXGA+, Win XP (Pro or Home Edition), Win 2000 [12] Instrument shipping case, tribrach (Leica Professional Series), tripod, ethernet cable, two power supplies, cables, power supply charger, cleaning kit, Cyclone-SCAN software. [13] HDS scan targets and target accessories, customer care package (CCP), extended warranty, tablet PC or laptop [14] Vertical and horizontal FOV are fully independently adjustable; vert and horiz point spacings are fully independently adjustable to a minimum of < 1mm point spacing at 300m range.
2	Maptek I-Site 3D Laser Imaging	I-Site 4400LR Laser Scanner	(1) As measured on factory test range. (2) Set-up over known point using laser plummet, backsight with integral telescope and level via compensation is standard procedure. Total station measurement on same set-up may be made before or after if required. Alternatively, a GPS receiver can be fitted directly to the scanner via a standard 5/8" UNC thread, with automatic offsets to the center of the scanner made for GPS readings. Coordinates can be transferred in the field or back at the office in desktop software. (3) Extreme environment battery required.
3	Maptek I-Site 3D Laser Imaging	I-Site 4400CR Laser Scanner	(1) As measured on factory test range. (2) Set-up over known point using laser plummet, backsight with integral telescope and level via compensation is standard procedure. Total station measurement on same set-up may be made before or after if required. Alternatively, a GPS receiver can be fitted directly to the scanner via a standard 5/8" UNC thread, with automatic offsets to the center of the scanner made for GPS readings. Coordinates can be transferred in the field or back at the office in desktop software. (3) Extreme environment battery required.
4	Measurement Devices Ltd	QuarrymanPro / LaserAce Scanner	Ruggedised scanner designed for Stockpile surveys, Quarrying and face profiling. Simple onboard user interface.
5	Measurement Devices Ltd	C-ALS Cavity Scanner	Ruggedised scanner for borehole deployment to survey inaccesible natural or man-made voids either underground or surface.
6	Optech Incorporated	ILRIS-3D	Note 1: Accuracies are based on single shot measurements. No averaging of multiple shots is used to determine system performance. Note 2: Optional compensators for level, orientation, motion, direction, etc., are available, depending on the compensation required.
7	Optech Incorporated	ILRIS-3D-ER	Note 1: Accuracies are based on single shot measurements. No averaging of multiple shots is used to determine system performance. Note 2: Optional compensators for level, orientation, motion, direction, etc., are available, depending on the compensation required.
8	Trimble	Trimble VX Spatial Station	1. Performance depends on environmental conditions, range, surface texture, colour, angle etc.
9	Z+F / Z+F UK	IMAGER 5006	...the worlds fastest, and most flexible Laser Scanner. ?the first real "stand alone" scanner without any cable connection. For further information please go to our website www.zf-uk.com.