

**SOUTHAMPTON OCEANOGRAPHY CENTRE**

**CRUISE REPORT No. 47**

**RV ATLANTIS VOYAGE 7 Leg XXX  
06 MAR – 12 MAR 2003**

UK ROV *Isis* – engineering trials

*Principal Scientist*  
**C R German**

**2004**

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**SOC Cruise Report**

**RV *Atlantis* Voyage 7 Leg XXX  
March 6<sup>th</sup>- March 12<sup>th</sup> 2003  
Jacksonville, Florida – Nassau, Bahamas**

**UK ROV *ISIS* – Engineering Trials**

**Principal Scientist - C R German**



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<b>ABSTRACT</b> <p>This report describes the first engineering trials dives of the new UK 6500m-rated ROV <i>Isis</i> during Voyage 7, Leg XXX of the RV <i>Atlantis</i>, 6-13 March 2003. Mobilisation occurred in Jacksonville, Florida following a period of refit for the ship between March 2<sup>nd</sup>-5<sup>th</sup> and first FAT (factory-acceptance) testing was achieved on March 7<sup>th</sup> during transit from Florida to the Bahamas in ca. 850m of water. Upon arrival in Bahamian waters a swath bathymetric survey was conducted of the northeast Providence Channel immediately west of northernmost Eleuthra Island where a tongue of &gt;4000m-deep ocean intrudes among the shelter of the Bahamas islands. Three further dives of the ROV were conducted in this area between March 8<sup>th</sup> and 11<sup>th</sup> 2003 to depths of, respectively, &gt;2000m, &gt;4000m and &gt;1000m. The first two of these dives proved the extensive depth capability of the new ROV and provided first opportunity for the UK ROV team to work with the vehicle. The third dive in Bahamian waters allowed imaging of the local seafloor fauna and collection of sample material with the manipulator arms – important for proving the capability of the vehicle for demonstration to both the scientific community and the wider public in the UK following significant Government investment. Because of insurmountable bow-thruster problems aboard ship, however, dive operations had to be abandoned early on March 11<sup>th</sup> and could not be recommenced pending further dry-dock maintenance. To that end the cruise was ended ahead of schedule with the scientific party disembarking in Nassau, Bahamas, by pilot boat on Wednesday March 12<sup>th</sup>.</p> <p>Despite this disappointing end to the cruise three important objectives were achieved:</p> <ul style="list-style-type: none"><li>• Preliminary FAT testing demonstrated the viability of the core system for the ROV.</li><li>• Dives to &gt;2000m were achieved (max &gt; 4,300m) with up to 7 hours on the seafloor.</li><li>• Basic seafloor imaging &amp; sampling capabilities were demonstrated &amp; documented.</li></ul>	
<b>KEYWORDS</b> <i>Atlantis</i> , cruise 7 leg XXX 2003, equipment trials, <i>Isis</i> , ROV	
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## **SHIP'S PERSONNEL**

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P.Vinitzky	3rd Engineer
A.Henning	Oiler
C.Wood	Steward
M.Nossitor	Cook
L.Bartholomee	Mess Attendant

## ITINERARY

Departed:	Jacksonville, Florida, USA	06 March 2003
Arrived:	Nassau, Bahamas	12 March 2003

## OBJECTIVES

There were 3 key objectives and one ancillary objective to the cruise. The first three objectives involved trialling of the new UK 6500m-rated ROV *Isis*.

These primary *Isis*-related objectives, in order, were to:

- Complete FAT (Factory Acceptance Tests) of the ROV prior to or upon leaving port.
- Conduct first operational dives of the ROV to >1000m, >2000m, >4000m.
- To obtain video footage to illustrate the ROV's capability to the UK community/public.

In addition, an ancillary objective was to provide at-sea training with the WHOI Tow-Cam operated by Dr. Dan Fornari using time available when *Isis* was not deployed.

## NARRATIVE

**Port-Call (Jacksonville, Florida).** The Science Party for RV *Atlantis* Voyage 7 Leg XXX assembled in Jacksonville Florida on Saturday March 1<sup>st</sup> where the ship was preparing to return to sea following a period in dry-dock. Mobilisation of the new UK 6500m-rated ROV *Isis* aboard ship commenced on Sunday March 2<sup>nd</sup>. Because of the strong tides and associated currents experienced in port it was deemed impractical to conduct FAT tests prior to sailing. Instead, it was decided to conduct such testing as soon as a suitable depth of water was encountered, outside of major shipping channels, but as close as possible to Jacksonville, Florida in case of any major failure that might require a return to harbour.

**Transit from Jacksonville.** Because of the need to coordinate sailing with tidal motions, RV *Atlantis* set sail on Voyage 7, Leg XXX at 1735z (GMT) on Thursday March 6<sup>th</sup> 2003 (Julian Day 065/03). The pilot was disembarked at 1820z and at 1840z the ship altered course on heading 133° heading toward open waters to prepare for FAT testing. At 1900z a science safety meeting was held, to follow on from an initial briefing held before sailing, followed by ship-wide fire and abandon ship drills. Once this was completed a test of the Dynamic Positioning aboard ship was conducted from 2130-2200z. From 2200-2231z a series of pre-dive procedures were conducted, in anticipation of conducting the first FAT-test dive of the ROV. Due to technical problems with the heading control settings/read-out, however, it was subsequently decided to abort any plans for a dive and, instead, passage was continued overnight toward the Bahamas with the advantage of reaching deeper open water, overnight.

**Transit contd.** Transit continued into Friday March 7<sup>th</sup> 2003 (Julian Day 066/03) as preparations were re-commenced for FAT-testing of the ROV. A brief hiatus occurred when all ship's power was lost at 1335z, continuing until ca.1415z. Power was returned to the *Isis* vehicle at 1418z and pre-dive tests were commenced at 1424z. At 1436z the ship was slowed ready to begin DP operations ready for launch of the *Isis* ROV.

***Isis* Dive #001.** The first dive of the *Isis* ROV, Dive #001, was launched at 28° 29.12'N, 078°59.02m in a water depth of 837m (Fig.1). The ROV was launched at 1458z, using "football" floats clamped to the cable to decouple the vehicle's motion from that of the ship, and lowered to a depth of 100m (1523z). A series of FAT tests were then conducted (lights, swing trays, forward trays, pan-and-tilt unit, SM2000 sidescan unit, thrusters for 360° rotation) after which it was decided that the system was performing sufficiently well to merit lowering all the way to the seabed. Descent was commenced at 1553z and *Isis* arrived at the seafloor for the first time at 1624z in a water depth of 846m on soft, rippled sand. For the next 30 minutes, a further series of FAT tests were conducted: pan & tilt camera; port manipulator, starboard manipulator, turn counter. This was followed by a series of speed runs to test the thrusters at full power to North, South, East, West, South and North once more (1656-1704z). Finally, the lateral movement achieved by the thrusters was tested, followed by vertical thrust, tested by driving down into the soft sediment (1705-1710z). Ascent of the ROV was commenced at 1715z and *Isis* returned to the sea surface at 1748z. All floats were removed by 1752z (*Isis* alongside). The ROV was lifted back in-board by 1756z at 28°29.12'N, 078°59.01'W. *Isis* Dive #001 had been successfully completed. The FAT tests required (our primary ROV objective) although not complete in their execution, had been significantly addressed – and certainly to sufficient extent to continue with the rest of the cruise. With all secure, the RV *Atlantis* set off at 1805z to complete passage to the Bahamas.

Transit continued overnight and the selected work area in the Bahamas was reached on the morning of Saturday March 8<sup>th</sup> 2003 (Julian Day 067/03). Our chosen work area was in the North-East Providence Channel, immediately to the West of northernmost Eleuthra Island (Figs. 1, 2). This area was particularly favoured because it afforded us a sheltered location, among the Bahamas Islands, with access to deep waters in excess of 4,000m to provide a thorough testing of our 6500m-rated vehicle.

**Swath Survey #1.** Before commencing any ROV dive operations, however, it was considered prudent to conduct a thorough swath bathymetric mapping of the seafloor in this area with which the subsequent ROV dives could be navigated. An initial swath bathymetry survey of the eastern work-region, 25° 23-35'N between 076° 54.0'E and 077° 09.0'E, was commenced at 1110z and completed at 1852z (Fig.2). All subsequent *Isis* Dives were conducted within this survey area.

***Isis* Dive #002.** At 1937z, RV *Atlantis* arrived on station for the start of *Isis* Dive #002 in 1985m water depth at 25° 26.12'N 076° 57.92'W. *Isis* was lifted off the gantry at 2008z and entered the water at 2011z. Again, "football" floats were used, clamped to the ROV cable to decouple ship's motion from that of the vehicle. Descent was halted briefly at 2105-2110z, with *Isis* at ca.1250-1300m, due to a "false" ship's alarm which required evacuation of the control van. Descent was

subsequently completed without further incident and *Isis* arrived on bottom at 2125z. As for Dive #001, the bottom was covered in rippled sand. Bottom-depth at point of arrival was 1932m.

During Dive #001 of the *Isis* ROV, the vehicle was piloted entirely by members of the WHOI team aboard ship to demonstrate the vehicle's compliance under FAT testing. With much of the ROV system proven during that previous dive, Dive #002 became the first opportunity for members of the UK ROV team from SOC to pilot the vehicle at the seafloor. To that end, no attempt was made to move the ROV or ship over any great distance from the initial landing point. Rather, each of the 5 members of the UK ROV team were afforded the opportunity to rotate through the roles of duty pilot and duty ROV engineer, under close WHOI supervision, over the following ~7 hours on-bottom (significantly longer than a typical Alvin dive!). At 0431z on Sunday March 9<sup>th</sup> 2003 (Julian Day 068/03) *Isis* began its ascent from the seafloor. It arrived at the surface at 0510z and was secured inboard by 0530z.

**Camera Tow #1.** Following *Isis* Dive #002 the opportunity was taken for Dr Dan Fornari to conduct a training deployment of his Tow-Camera system. The ship was relocated to just south of the Dive #002 site and the Camera deployed at 25° 26.00'N, 076° 57.92'W from where it was towed South East following gradually uphill along the top of a spur extending from the west of Eleuthra Island, from 2000m to 1800m water-depth. The WHOI Tow-Camera system was recovered inboard by 1050z with all secure by 1110z.

**Transponder Deployment.** In order to conduct navigated ROV Dives across the seafloor, the next priority was to lay a transponder net to cover the work area extending into the deepest portion of the NorthEast Providence Channel which, swath mapping revealed, extended to >4200m along its axis (Figure 2). Two transponders were deployed, at 25° 31.77'N, 077° 02.40'W and at 25° 33.00'N, 077° 00.99'W. deployment lasted 1 hour (1150z-1250z). after which course was made to the Dive #003 launch-site.

***Isis* Dive #003.** ROV *Isis* Dive #003 commenced at 25° 32.46'N, 077° 03.33'W in a water depth of 4332m. The ship arrived on station at 1851z, deployment began at 1909z and *Isis* was lowered into the water at 1914z. Almost immediately, an electrical fault was detected from the control van (1915) and *Isis* was recovered inboard (1921z). By 1934z the fault had been identified/isolated and launch was recommenced at 1939z with, as before, "football" floats being used to provide buoyancy to the cable immediately above the ROV. During this dive, the ROV *Isis* was lowered to the very axis of the NorthEast Providence Channel reaching a maximum depth of ca.4300m. Again, time was taken to provide all 5 of the UK ROV team ample opportunity to gain experience both as duty Pilot and Engineer whilst operating along the largely featureless sand-rippled seabed. *Isis* was recovered inboard at the end of Dive #003 at 0540z on Monday March 10<sup>th</sup> 2003 (Julian Day 069/03) near 25° 32.06'N, 077° 03.40'W – i.e. less than 0.5 nmile South and a little East of the initial launch point.

**Camera Tow #2.** Following recovery of the *Isis* ROV, the WHOI Tow-Cam was deployed a second and final time. Again, the tow-cam was deployed above a shallow spur extending west from Eleuthra Island, on this occasion at 25° 36.17'N, 076°

57.75'W, and towed slowly south and east, uphill, along the axis of the spur. The WHOI Tow-Cam was launched at 1028z and recovered in-board approximately 6 hours later at 1437z. The ship was then repositioned to the south and east of the Tow-Cam recovery position ready for what was to prove to be the final *Isis* Dive of RV *Atlantis* Voyage 7, Leg XXX.

**Isis Dive #004.** The purpose of *Isis* Dive #004 was to obtain images of biota on the seafloor close to the Bahamas and to conduct first sampling operations with the ROV. To this end it was decided to deploy *Isis* in closer to Eleuthra Island toward the shallowest extent of our swath bathymetric survey and adjacent to a steep cliff (Figure 2). The RV *Atlantis* arrived on station at 2058z and was launched at 2142z in 1200m water depth near 25° 31.62'N, 076° 55.45'W. Within ca. 2 hours of arriving on bottom it was reported to the control van that the ship was having trouble with its bow thrusters and that this might be problematic for holding station under Dynamic Positioning. Thus, *Isis* operations might have to be discontinued at any moment. Conscious of an inability to move the ship under such circumstances, the opportunity was taken to collect images of the local biota (see accompanying powerpoint file: *Isis* D001-D004) and to make use of its manipulators to recover a first sample from the seafloor, a manganese encrusted carbonate rill (also shown in accompanying powerpoint file). At 0350z on Tuesday March 11<sup>th</sup> (Julian Day 070/03) instruction was received from the Bridge to discontinue operations with *Isis*. Recovery commenced from a depth of 1037m and *Isis* was recovered inboard approximately 1 hour later at 0448z near 25° 31.36'N, 076° 55.67'W.

**Swath Survey #2.** To make best use of the shiptime at our disposal, a new swath bathymetry survey was conducted until daybreak commencing at 0605z at 25° 40.00'N, 077° 01.00'W (Fig.1). This survey was continued until 1307z by which time the survey had been extended as far West as 077° 11.93'W.

**Transponder Recovery.** The Western swath survey (see previous paragraph) was interrupted once daylight was sufficient (1322z) to recover the two navigation transponders deployed previously. Transponder A was recovered in-board at 1558z and Transponder B ca. 80 minutes later at 1720z. With all secure, the ship proceeded back toward the swath survey area at 1742z.

**Decision to Abort.** During the course of the transponder recovery (above) and transit back to the western swath survey area (below) a series of telephone calls between the Master, Chief Engineer and Chief Scientist aboard ship together with the ships operations office at WHOI and responsible agency representatives of NSF (USA) and NERC (UK) a consensus was reached that the ship's bow-thruster was not amenable to immediate repair and that, because no further ROV operations could be conducted without any such repair, the most profitable course of action was to abort the cruise at the earliest opportunity, 24 hours ahead of schedule.

**Swath Survey #3.** To make most effective use of the time left available until a boat transfer could be effected at Nassau, the western swath survey was recommenced once more at 1827z and continued westward overnight eventually extending as far West as 077° 21.35'W where the survey was discontinued at 1238z on Wednesday March 12<sup>th</sup> 2003 (Figure 1).

**End of cruise.** The ship's scientific party was subsequently disembarked from RV *Atlantis* by Pilot Boat at Nassau, Bahamas, arriving ashore at 1610z on Wednesday 12<sup>th</sup> March (Julian Day 071/03) thereby bringing to an end Leg XXX of Voyage 7 of the RV *Atlantis* and first ever dives of the UK's new 6500m-rated ROV *Isis*.

## SUMMARY

Despite late sailing and early disembarkation of what was already a rather foreshortened initial engineering trials cruise, Voyage 7 Leg XXX of the RV *Atlantis* proved remarkably productive. During the course of 4 days the new UK 6500m ROV *Isis* was deployed on 4 occasions to depths ranging between ca.1000m (including its first ever deployment in the ocean) to a maximum in excess of 4300m. An important subset of the required Factor Acceptance Tests were conducted while we were at sea and the vehicle was able to demonstrate its capability in terms of manoeuvrability, collection of sample material from the seafloor and collection of high-quality images – important for public outreach to both the scientific community and wider public as examples of the benefits of such a significant capital investment by the UK Government.

A listing of the technical capabilities and specifications of the delivered and trialled ROV *Isis* is listed at Table 1.

## ACKNOWLEDGEMENTS

On behalf of the UK science party aboard the RV *Atlantis* I would like to express our great thanks to our friends and colleagues at WHOI and in the wider USA who made the cruise as successful as it was. Our thanks go to Capt Gary Chiljean and the Officers and Crew of the RV *Atlantis* who did their very best to make us feel at home and help when problems, as did Jon Alberts and Dolly Dieter, ashore in Woods Hole and Washington DC respectively. Thanks too, to Dr Dan Fornari, Chief Scientist for the WHOI Deep Submergence Group for taking time to participate in the cruise and provide useful insight into the ROV's capabilities for future science investigations. Most special thanks of all, however, must of course be extended to Andy Bowen and his excellent ROV team at Woods Hole. Although things may not always have been perfect, to develop and build an ROV that can dive immediately to nearly 1,000m – extended rapidly past 4,000m – at first time of asking is a remarkable achievement.

As Chief Scientist I would also like to extend my personal thanks to Pete Mason and the rest of the UK ROV team, Dave Edge, Dave Turner, Andy Cartney and Mike Bissett. My thanks too, to Paul Tyler, lead-PI for the overall ROV commissioning programme and co-chief scientist at sea and to Gwyn Griffiths, our co-PI ashore who was with us as much by e-mail as he was in spirit. Their advice was extremely helpful as a series of difficult decisions were required both at the start and end of what was, remember, really a rather short but eventful trip!

We shall look forward to renewing our highly profitable UK-US deep-submergence collaborations, taking *Isis* aboard RV Knorr to the Mid-Atlantic Ridge, Spring 2004.

**TABLE 1 – Isis ROV SPECIFICATIONS**

**1. VEHICLE FRAME**

The vehicle frame is constructed from a combination of hollow and structural section aluminum, welded together to form a rigid structure. Nylon skids and rubber fenders protect the frame from impact damage during normal operations. A light bar is provided for mounting of video camera, sonars and lights.

The following equipment is housed within the vehicle envelope.

6 electric thrusters	5 hp electro-hydraulic power unit
Servo/solenoid valve pack for auxiliary functions	Transformer housing (oil filled)
Gyro and flux gate compass housing	Two manipulator arms
Power/control/telemetry unit housing	Manipulator valve packs
Video and Still cameras and lights	Camera pan and tilt unit
Forward looking obstacle avoidance sonar	Altimeter

Provision also exists for mounting of dedicated "work package" sleds beneath *Isis*.

**2. BUOYANCY MODULE**

A syntactic foam buoyancy module bolts directly onto the vehicle frame. An articulated umbilical attachment is provided. The buoyancy module is finished with a tough elastomeric coating. The colour of the vehicle is predominantly red but yellow on top where high visibility is a desirable characteristic.

**3. PHYSICAL CHARACTERISTICS**

3.1 Dimensions

Length	2.7 m / 8 ft. 10 in.
Width	1.5 m / 4 ft. 11 in.
Height	2 m / 6 ft. 6 in.

3.2 Weights

Weight (incl. tool sled)	3000 kg / 6,600 lbs.
Payload (Standard buoyancy)	190 kg / 420 lbs.

3.3 Depth Rating

Maximum working depth	6500 m / 21,400 ft.
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3.4 Power Available

Electric	40 kW @ 1000 m / 18 kW @ 6000 m
User power (various voltages)	Up to 5 kW

## TABLE 1 – *ISIS* ROV SPECIFICATIONS (CONTD.)

### 4. PERFORMANCE

The vehicle is equipped with six 3.7 kW thrusters when operating in its deep configuration (6,500 meters). With the vehicle configured for operations in 1000 meters, two additional horizontal thrusters may be added if required.

#### 4.1 Thrust

Forward (6,500 meter)	2224 N / 500 lbs.
Forward (1,000 meter)	4448 N / 1000 lbs.
Vertical	2224 N / 500 lbs.
Lateral	2224 N / 500 lbs

#### 4.2 Speed

Forward (6,500 meter)	0.75 m/s (min.) / 1.5 knots (min.)
Forward (1,000 meter)	1.0 m/s (min.) / 2.0 knots (min.)
Lateral	0.75 m/s (min.) / 1.5 knots (min.)

### 5. MANIPULATORS

Two spatially coherent Kraft Tele-robotics 7 function manipulators are installed which are powered from an auxiliary hydraulic power system on the vehicle.

### 6. LIGHTS, CAMERAS & SONAR

The vehicle can operate up to 6 cameras with focus and zoom controls. Video is transmitted to the surface control van by fiber optic links ( $\geq 8$  MHz bandwidth). Capability for further expansion – e.g. for installation of HDTV camera as required.

#### 6.1 Lights

HMI (3 circuits, total 1200W)	Incandescent (5, 250W each)
Strobe (Dual 600J units)	Scale (2-beam, red laser)

#### 6.2 Cameras

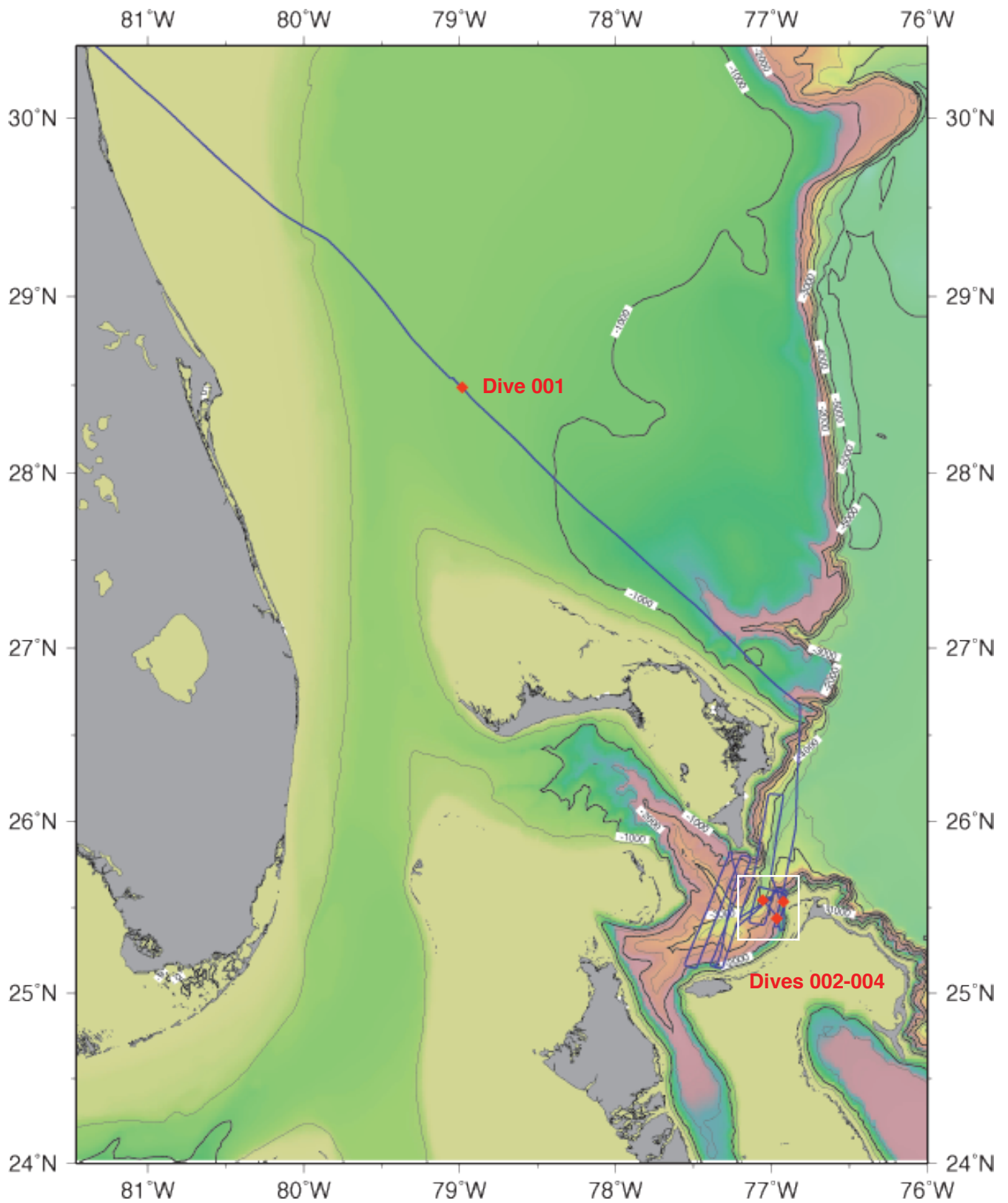
Hi-Res 3 chip 800 line colour video	Digital still camera (3.34 Mpixel)
Low light monochrome ICCD	Pan ( $\pm 165^\circ$ ) & Tilt ( $\pm 75^\circ$ ) unit
Wide dynamic range (Monochr. Pixelfly, 11-bit dynamic range)	

#### 6.3 Sonars

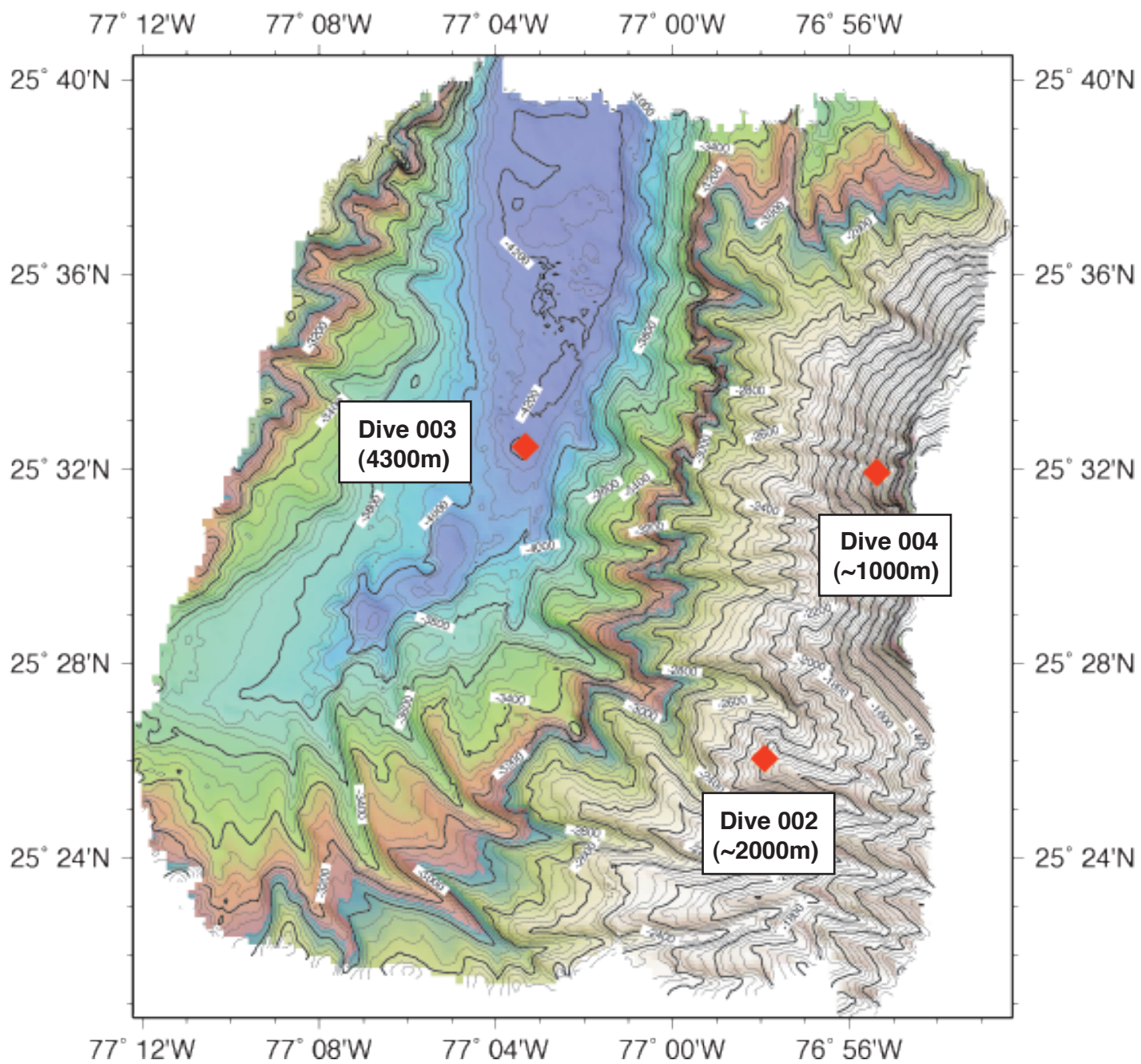
RDI Doppler Velocity Log (1200kHz; >30m range; <0.22% dist. travelled)  
SIMRAD SM2000 series forward-looking sonar (200kHz; 400m range)  
SIMRAD MS900 series profiling sonar (675kHz; 100m range)



**Figure 1: RV *Atlantis* Voyage 7 Leg XXX - Cruise Track**



**Figure 2: UK ROV *Isis* Dive Sites in Bahamas Waters**



Appendix: Science Operations Log

J.Day	Operation	Time (GMT)	Lat. Deg.	Long. Deg.	(W) Min.	Hdg °	WaterDpth (m)	Veh.Dpth. (m)	W/Out (m)	Alt (m)	Comments
065	Transit	1500	30	23.22	081	27.58					In Port, J'ville
065	Transit	1735	30	23.22	081	27.58					Set sail
065	Transit	1820	30	23.79	081	19.98	301				Pilot off
065	Transit	1840	30	22.08	081	17.32	133				A/c to 133°
065	Transit	1900	30		081						science safety meeting
065	Transit	2020									fire and abandon ship drills
065	Transit	2045									DP test
065	Transit	2130	30	08.71	081	00.47	0017				30min running
065	Transit	2203									ISIS power up
065	Transit	2210									Pan and Tilt not working/ Hydraulics power off. Heading Looks wrong
065	Transit	2215									Turn to starboard
065	Transit	2217									Ship at 150° . Offset due to gantry
065	Transit	2218									Turning ship to port to 140°
065	Transit	2220									Testing thrusters
065	Transit	2223									All thrusters off. Loading previous version of software
065	Transit	2227									Thrusters in reverse. Back a version too far
065	Transit	2230									Thrusters A OK
065	Transit	2231									Abort preparations because of heading problems
066	Transit	0100									Sail. Heading: 130°
066	Transit	1200	28	45.79	079	18.39					Heading 143° . Speed over ground 12 kts
066	Transit	1320	28	34.27	079	05.84					Power up
066	Transit	1335									Lost ships power, then back on
066	Transit	1342									Ship's power unstable
066	Transit	1345									Problem with ship's power. Stand by
066	Transit	1418									ISIS power up. ship heading 136°
066	Transit	1424									Start pre-dive tests. Enable thrusters
066	Transit	1427									Thrusters all OK, power + direction
066	Transit	1428									Cameras Pan & Tilt OK. Port looking OK, BUTT camera OK. No video on V9 camera (port): switch to V4
066	Transit	1431									Prism T0= 125F (130F is too hot)
066	Transit	1432									Power down while changing over
066	Transit	1436									Slow ship down to get ready to DP
066	Transit	1438									Power in back up on ISIS
066	Transit	1440									STBRD looking camera on
066	Transit	1445									Power down until ship is in position
066	Transit	1453	28	29.12	078	59.02					Ship in DP
066	Transit	1455				170°					Thrusters check OK
066	Transit	1456				169°	0837				
066	ISIS 001	1458									ISIS lifted off gantry
066	ISIS 001	1500									ISIS swung out
066	ISIS 001	1501									hauling away
066	ISIS 001	1502									in water
066	ISIS 001	1503									dumping alvin weights
066	ISIS 001	1506									one weight away
066	ISIS 001	1507									second weight away
066	ISIS 001	1508									manipulator arm in
066	ISIS 001	1509									stop driving away, fixed one float, drive out
066	ISIS 001	1510									float one on, stop driving, fix float 2
066	ISIS 001	1511									drive away, float 2 on, turn 30 deg right
066	ISIS 001	1512									stop driving fix float 3
066	ISIS 001	1513									drive away, float 3 on
066	ISIS 001	1514									fix float 4, float 4 on
066	ISIS 001	1515									going down
066	ISIS 001	1516									transfer control to control van
066	ISIS 001	1517									ISIS slightly swept towards stern
066	ISIS 001	1519									wire tending aft, control van can't see ISIS in respect to ship
066	ISIS 001	1520									50m depth
066	ISIS 001	1523									stop at 100m and wire out 110m
066	ISIS 001	1526									test pan and tilt, camera ok
066	ISIS 001	1528									starting FAT tests, starboard and port lights off
066	ISIS 001	1531									butt lights ok
066	ISIS 001	1534									port swinger tray ok
066	ISIS 001	1534									starboard swinger test ok
066	ISIS 001	1535									starboard tray speed control demo
066	ISIS 001	1538									draw out and in, ok







Appendix: Science Operations Log

J.Day	Operation	Time (GMT)	Lat. Deg.	(Nth) Min.	Long. Deg.	(W) Min.	Hdg ° (m)	WaterDepth (m)	Veh.Dpth. (m)	W/Out (m)	Alt (m)	Comments
068	ISIS 002	0406					110					ship move 40m
068	ISIS 002	0413										helo - purple
068	ISIS 002	0420										gorgonian
068	ISIS 002	0425						1892			007	ROV ascending to surface
068	ISIS 002	0431						1887				swing arm out
068	ISIS 002	0437										dv on, colour chart
068	ISIS 002	0444										dv off
068	ISIS 002	0445										fish
068	ISIS 002	0453							1241			all decks timed out
068	ISIS 002	0459										
068	ISIS 002	0522										
068	TowCam1	0623	25	26.00	076	57.92						Camera in water
068	TowCam1	0900	25	25.84	076	57.41						
068	TowCam1	1000	25	25.76	076	57.16						Camera on deck
068	TowCam1	1047										Camera secured
068	TowCam1	1050										
068	TowCam1	1112										
068	Transpors	1112										Underway to TxB
068	Transpors	1150										Serial #34830
068	Transpors	1200										Turning to drop Tx B
068	Transpors	1209										Start streaming TxB
068	Transpors	1213	25	31.77	077	02.40						Anchors Away!
068	Transpors	1239										Turning to drop TxA
068	Transpors	1241										Start streaming TxA
068	Transpors	1247	25	33.00	077	00.99						Anchors away!
068	Transpors	1250										Wait for transponders to sink
068	ISIS 003	1851	25	32.46	077	03.33	288	4332				pre dive tests
068	ISIS 003	1909										pre dive checks complete, up gantry
068	ISIS 003	1912										waiting to lower
068	ISIS 003	1914										splash down ISIS
068	ISIS 003	1915										ground fault on computers displ 2 camera
068	ISIS 003	1917										abort dive to check camera
068	ISIS 003	1921										back up to a frame
068	ISIS 003	1922										port dv cam problems with signal arriving but ok on dvd drive
068	ISIS 003	1929										surface current strong move ship 30 deg
068	ISIS 003	1934										good to go again
068	ISIS 003	1935										lift off gantry, going over
068	ISIS 003	1939										launching
068	ISIS 003	1940										splash down, adjusting for floats
068	ISIS 003	1940										on way up
069	ISIS 003	0500	25	32.06	077	03.40						ISIS on deck, all secure.
069	ISIS 003	0540										
069	TowCam2	0915	25	36.17	076	57.75						DP on preparing to deploy Dan's camera
069	TowCam2	1028										Camera in water
069	TowCam2	1143										On bottom, camera firing
069	TowCam2	1332										Camera off-bottom
069	TowCam2	1400										
069	TowCam2	1437										DanCam in-board
069	ISIS 004	2015	25	32.00	076	55.40		1200				Target for launch
069	ISIS 004	2058	25	32.02	076	55.40	270	1322				At launch site
069	ISIS 004	2142	25	31.62	076	55.45		1200				In Water
069	ISIS 004	2349							1037			Problem with starboard manipulator's wrist/claw
070	ISIS 004	0350										ISIS Off-bottom
070	ISIS 004	0441										ISIS On deck
070	ISIS 004	0448	25	31.36	076	55.67						End of dive 004
070	SWATH2	0605	25	40.00	077	01.00						?Sol 1 (WP1)
070	SWATH2	0800	25	59.15	076	57.19						Eol1 (@WP2)
070	SWATH2	0851	26	09.09	076	55.70						
070	SWATH2	0915	26	09.38	077	00.76						

