Key ROV Project Project Milestones

March	**-- Acceptance testing of DSL120a sonar electronics at HMRG**
	-- Telemetry delivered
April	**-- Selection of J2 thrusters**
	-- Floatation design complete
May	**-- Final manipulator selection**
June	**-- Final test and sea trial of DSL120a**
August	**-- First deployment of DSL120a (E. Silver @ Huon Gulf)**
Nov.	**-- Decommission of Jason**
Feb. '01	**-- Ready for J2 sea trials**
May '01	**-- J2 Ready for science**

ROV Upgrade Project Progress Summary
2000

→ • Science Design Review Meeting held at June DESSC
• Detailed Specification for Jason/Medea, Argo and DSL120a Written
→ • Telemetry purchase order placed.
•Subsea 120 sonar electronics purchase order presently underway with HMRG.
• New syntactic foam floatation material identified
→ • New personnel added
→ • 3D Modeling of Jason II design
• Manipulator candidates identified
• Extensive evaluation of other science ROV systems completed.
• Documentation system established
• Power system design well underway including voltage stress testing of UNOLS E-O cable
• Various components purchased (lights, video cameras)
• Test/evaluation of RLG based attitude/heading reference
• Main umbilical tested for strength and insulation qualities
→ • Jason II and DSL120a overall layout completed
• Sensor Suite Selection
→ • Thruster candidates identified with test plan underway
• TMS specification written and RFP presently circulated
• New neutral tether cable in house

New Power Delivery System

- Designed for operation using 10km of .680" cable

- Present system delivers 8kW at 2000VAC

- New system will deliver 18kW at 2500VAC

- Power delivery increases as the square of the operating voltage

- Attempting to increase power to the vehicle by increasing conductor is much less effective and causes cable heating.

- Operating at higher voltage places stress on conductor insulation material which might affect service life of the cable

- Test plan to confirm final operating voltage

Jason II Telemetry

Signal Type	Bandwidth	Number
Video	6MHz	8
Audio	1MHz	2
Analog	16KHz	2
RS-422	10Mbit/sec	11
RS-485	10Mbit/sec	2
RS-422	19.2Kbaud	40
RS-485	19.2Kbaud	80
10 Base T		2

How Many Oxford-English Dictionaries Can Travel Through JASON II's Umbilical In ONE SECOND?

(a demonstration of data transmission efficiency)

	number	*source*
Oxford-English Dictionary (One 20-Volume Set)		
number of Entry Words described per OED	500,000	advertised
Descriptive Words per Entry Word	30	estimated average
Descriptive Words per OED	15,000,000	= 30 x 500,000
total Words per OED (Entry and Descriptive)	**15,500,000**	= 500,000 + 15,000,000
Digitizing Words (Information as Data)		
Bits per Character	2	a given
Characters per Word	6	estimated average
Bits per Word (Entry or Descriptive)	12	= 2 x 6
total Bits per OED	**186,000,000**	=15,500,000 x 12
Fiber Optic Video and Data Telemetry		
Gigabits per Second telemetered per single Optical Fiber on JASON II	3	design specification
Optical Fibers per single JASON II Umbilical	3	a given
maximum Gigabits per Second telemetered to/from JASON II	9	= 3 x 3
Bits per Gigabit (1 billion)	1,000,000,000	a given
total Bits per Second telemetered to/from JASON II	**9,000,000,000**	9 x 1,000,000,000
total number of Oxford-English Dictionarys telemetered per Second	**48**	= 9,000,000,000 / 186,000,000

M. Bowen, M. Naiman, R. Elder 03/08/00

Thruster Comparison

BRAND	DIMENSIONS IN	WEIGHT LB AIR/ SW	BOLLARD LB FWD/REV	HP	POWER V/A
TECNADYNE 2010	L16.3 OD4.2 PROP 7.51 NOZ OD 10	23.2/17.4	205/115	5	260/17
TECNADYNE 8010	L21.4 OD4.88 PROP 12 NOZ OD 13.5	48/36	470/263	10	260/33
SUBSEA SSE500 SINGLE PROP	L14.25 OD5.25 PROP 12.5 NOZ OD 14.75	24/18	250/210	5 TO 6	260/18
SUBSEA EDT500 COUNTER ROTATE DUAL	L20.5 OD4.75 PROP14.5 NOZ OD17.5	27/23	260/260	5	260/18
DSS THL-202B	L24.5 OD4.5 PROP 12 NOZ OD 15.5	68/39	303/217	5	285/13.7
MBAR	L35 NOZ OD 15	68/44***	240/225	5	280/17.1

*** MC ON THRUSTER

Criteria for Thruster Selection

- **Reliability**
- **Commercial Availability**
- **Size**
- **Weight**
- **Bollard Thrust**
- **Low speed control**
- **DC Brushless**
- **Vector Drive Integration**

Decision to Increase Operating Voltage

- **Maximum rated operating voltage of cable is 2800VDC which translates to a 3-phase line voltage of 3400VAC .**
- **Visual inspection of used section of cable by a power cable test consultant shows no sign of high-voltage damage.**
- **Oceaneering International has operated the same cable at 3200-3400VAC for more than 400 hours. They have offered us a sample of the cable for visual inspection and perhaps other testing.**
- **WHOI is approaching MBARI, Oceaneering, NAVO and Rochester to participate in the development of a full elevated voltage life test program.**

Vehicle Power Management

- Power available to the vehicle is limited by both the voltage stress capability of the cable and the amount of power that can be lost in the cable.

- Jason II will be a power limited vehicle in the sense that it will be capable of consuming much more power than it tether can safely.

- A power management system will be required to supervise and control the allocation of power at the vehicle to make optimum use of the power capacity while protecting the cable from damage.

Limitations of Existing Systems:

Jason/Medea

- Limited Payload (samples and sensor equipment)
- Limited manipulative capabilities
- Slow speed (low thrust)
- Poor range of motion from Medea
- Outdated telemetry
- Minimal auxiliary hydraulic supply
- Poor workspace design and minimal sample storage volume
- Obsolete components becoming increasingly hard to maintain
- Poor fault protection/location

Anticipated Missions

- High resolution mapping and survey (multi-frequency acoustic and image based)
- Installation/service of seafloor observatories
- Manipulation and sampling in a more “Alvin like” manner
    - multi-disciplinary hydrothermal sampling
    - large volume biological sampling
    - high demand hydraulic tools (e.g. rock drill)
    - large volume/weight geological sampling (e.g. box cores, in-place rocks)
    - deployment/retrieval of large scale instrumentation

Power Manager Requirements

- **Must prevent the vehicle from consuming more power then the system can safely deliver**
- **Must provide the ability to monitor power usage**
- **Must no distract operators**
- **Must exercise control of loads only by denying request to turn loads on not by turning loads off.**
- **Must not interfere with vehicle directional control or navigation.**
- **Should allow allocation of power capacity among major vehicle load groups (e.g. thrusters, lights, hydraulics, etc.) by a combination of preset mode buttons or manual controls.**