2.0 COMMENTS ON DRAFT FINAL DESIGN SPECIFICATION

Item	Title	Comments
1	Introduction	
2	Equipment Specification	
2.1	Mechanical	
2.1.1	System of Units	We request the system of units is metric. The standard assemblies or minor modifications of standard assemblies are currently in metric units.
2.1.2	Factor of safety method of design	Factors of safety for specific items are identified at the internal kick off design review. Internal design procedures which form part of the ISO 9001-2000 quality system are followed
2.1.2.1	Dynamic Loading	We normally follow Lloyds rules but we can follow ABS rules if preferred.
2.1.3	Materials	
2.1.3.1	Bolts, Screws and fasteners	All our fasteners are typically metric with a grade chosen which is appropriate for the application. Our standard assemblies and variations of our standard assemblies are configured with metric fasteners. There are a few exceptions such as certain hydraulic fittings, electrical connectors etc.
2.1.4	Operating Depth	Agreed
2.1.5	Dimensions & Weight	Acceptable as a target specification. Any likely deviations and reasons will be discussed with MBARI
2.1.6	Frame	The load path in our ROV frames is typically bolted. Certain low load equipment bracketry may be welded but the design will assume the area of the weld will revert to the basic strength of aluminium and there are no plans to heat treat aluminium after welding. The welding code to be used will be discussed with MBARI during the first design review and will be what can typically be provided by our current suppliers. It is not expected we will have any welds in the load path.
2,1,6,1	Instrument Sub Frame	The instrument frame design must be provided for the overall ROV design layout and balance. MBARI must make this available so that it does not delay the project and a date for this information will be agreed at the first meeting. Obviously full testing of these instruments cannot be performed at FAT if the instruments are not provided.
2.1.7	Buoyancy	
2.1.7.1	Syntactic Foam Module	A specification is attached and the buoyancy will comply with the specification. The final payload distribution will depend on the final layout of equipment and buoyancy and it is assumed at this stage the specified payload can be

		achieved.
2.1.7.2	Variable buoyancy system	General arrangement drawings of the VB system should be provided at contract award and the equipment should be sent to SMDH as soon as it is available.
2.1.7.3	Payload	Supply and distribution of lead will be by MBARI and lead will be mounted in the tool sled. Weight distribution in the sled must be suitable to minimise pitch and roll offset from zero. Sled weight distribution and variation in C of G to be considered as part of complete ROV C of G and stability analysis. Sled dwg/data to be provided by MBARI for calculations of balance and this should be provided during ROV equipment layout design with timescale agreed at first meeting.
2.1.8	Hydraulics	General schematic is okay. Detailed hydraulic schematic will be created by SMDH during the design phase. Hydraulic compensator connection to be shown and additional tooling manifold to be added.
2.1.8.1	Vehicle power	Upgrade to 75shp is still being investigated. Umbilical cooling is not required. Voltage variation at ROV motor still being reviewed. Considering 4160v as well as standard 3000v.
2.1.8.2	Hydraulic system & components	Possible allocation of 4x2.75L comps 1. HPU and Termination box. 2. Thrusters bearing housing. 3. Rov Instrument Tx JB, main JB, lighting JB, iTCU cover and iHCU cover. 4. Aux instrument Tx JB and aux JB. Assume other accessory comps such as for Schilling manipulator will be provided by MBARI. SMDH will provide Quark dual tool manifold for spare tooling outlet and variable buoyancy pump drive. Provides routing of tooling power using valves in the iHCU to control the routing. Change to hydraulic schematic required to show a manifold block interfacing between the TCU and buoyancy pump and spare tooling port. Note 7 x HTE380BA-32 thrusters. iHCU Proportional valves are rated 8lpm at pressure drop of 43bar not 15lpm. Wandfluh NG3 type A compact 10L reservoir instead of the 15L reservoir will be considered as ROV is only 75hp rated? If a 75shp motor can be provided a 100cc/rev pump is recommended
2.1.8.3	Thruster placement & capabilities	
2.1.8.3.1	Thruster placement	Agreed
2.1.8.3.2	Thrust capabilities	The maximum horizontal thrust assumes no vertical thrust and the maximum vertical thrust assumes no horizontal thrust. Exact thrust figures are difficult to predict due to proximity of equipment to thrusters reducing efficiency. It is expected horizontal thrust of 500-600kg and vertical thrust of 400-500kg can be achieved with 50shp running at 3000psi. Additional thrust can be achieved with a 75shp power pack if the system pressure is increased accordingly.
2.2	Electrical/Optical	After review with our electrical engineers it is recommended that the 10.5kVA instrument transformer capacity is included in the umbilical termination box. This removes the ROV instrument power transformer and auxiliary instrument transformer JB's. The umbilical cable will be disconnected from the termination box if the umbilical is to be disconnected from the ROV. The gland will remain on the umbilical and a flanged can will be supplied to fit to the

		gland to protect the cables and FO connectors when the umbilical is disconnected. The umbilical gland and connections will be at the top of the termination box so only a small quantity of oil will have to be drained from the box to disconnect the umbilical and a blanking plate will be supplied to seal the entry for the umbilical gland. The number of connectors shown for the electronic pod is greater than can be mounted on one end cap. Either some connections can be routed via the main JB or a connector manifold is provided for the pod. This should be reviewed during the design. The gyro shown as a separate instrument should be changed to a compass as the standard gyro is fitted in the electronic pod but the compass is a separate housing. This is the standard parts used on our ROV's. Either the Octans or ROV gyro/compass can be selected as the source of auto heading and heading display by the Pilot. A final cabling schematic will be provided as part of the design.
2.2.1	Electrical Assemblies	Priced options for 8026-T6 aluminium hard anodised and grade 5 titanium electronic pod can be provided. Titanium will be considerably more expensive. Instrument pods will be as supplied by the manufacturer. It is planned that all oil filled junction boxes will be 8026-T6 aluminium hard anodised with 316 st/steel fittings. SMDH would be happy to use MBARI existing GFM circuit which can detect down to 10 micro amps and we also currently use the Wago units. There is concern about the quantity of hardware required for GFM and isolation as specified and this needs to be assessed during the design. It is assumed the Vicor DC/DC supplies specified can withstand the pressure specified and no testing programme is required.
2.2.2	Sub-Sea Control Pod	A general arrangement drawing of the inner chassis of a Quantum electronic pod is provided as an example.
2.2.2.1	Connectors & cables	Agreed
2.2.2.2	Focal 903 Video/Data Mux	Agreed
2.2.3	Main Junction Box	Agreed
2.2.3.1	Ground Fault monitoring	Agreed
2.2.4	Auxiliary Interface junction Box	Agreed
2.2.4.1	Auxiliary Power requirements	Agreed. It is assumed the Vicor units are suitable for fitting in the compensated JB
2.2.4.2	Auxiliary data requirements	Agreed
2.2.4.3	Connectors & ports	Agreed
2.2.4.4	Ground fault monitoring	Agreed. I assume the MBARI GFM circuit is suitable for immersion in oil
2.2.5	Lighting Junction Box	Agreed
2.2.6	Umbilical Termination JB	Agreed except we propose the ROV instrument transformer is included in the Umbilical Termination Box.
2.2.7	ROV Instrument Power Tx	It is proposed this is included in the termination box

2.2.8	Core Instruments (MBARI supply)	Section numbers incorrect. If core instruments are available to be shipped to the UK then they can be tested prior to and included in the FAT, otherwise the integration and testing will have to be included in the commissioning in the USA. Details should be agreed between SMDH and MBARI during the manufacture stage.
2.2.8.1	Navigation Equipment	Agreed
2.2.8.2	Cameras & Viewing Equip	Agreed
2.2.8.3	Science Tool Sleds	Are all the items listed in tables 10 & 11 included in the tool sled? Please separate tools tables to clearly identify what is in the sled and what is fitted as standard to the ROV main frame. Review sections 2.1.7.3, 2.2.8.3.1 and table 11
2.3	Surface control Equipment & Power distribution	Does the Focal 903 mux not have a facility to switch to a back up fibre if the main fibre is faulty as this is not shown? Extra science touch screen PC shown. General schematic is okay and SMDH will provide a detailed interconnection diagram as part of the design.
2.3.1	Control room	I assume the SMDH panels will have to be sized to fit the existing console and MBARI will provide panel drawing details.
2.3.2	Control System	Agreed
2.3.2.1	Software	
2.3.2.1.1	GUI	Agreed
2.3.2.1.2	Joy Stick Integration	Agreed.
2.3.2.1.3	Focal Video Switcher	Agreed
2.3.2.1.4	Advanced navigation Controls	Agreed
2.3.2.1.5	Navigation Processor	Agreed
2.3.2.1.6	Video Overlay	Agreed
2.3.2.1.7	Integrated Viewing System	Agreed
2.3.2.2	Control System Hardware	
2.3.2.2.1	SMDH hardware	Agreed
2.3.2.2.2	Video Equipment	Agreed
2.3.2.2.3	MBARI Core Instruments	Agreed
2.3.3	ROV Auto Functions	Tolerances will be provided as part of the design process.
2.3.4	Power Distribution	
2.3.4.1	Western Flyer Power	The existing ROV power conditioning equipment will be used to provide a clean and stable ROV Instrument supply. A relatively clean and stable supply is also required for the ROV HPU. Either a dedicated 350kVA generator or the common vessel bus if it is suitable. Scope waveforms to be verified or removed.
2.3.4.2	High Voltage Systems & GFD Interruption	Our power distribution systems are normally built into an airconditioned container so we do not have drawings and dimensions available for a 50/75shp stand alone system. These drawings will be provided as part of the design data.

		The system is designed to be built into an air conditioned and low humidity environment. Any external cooling requirements and range of ambient temperature will be agreed as part of the design.
2.4	Deployment System	
2.4.1	Umbilical handling system (UHS)	Agreed
2.4.1.1	Slip ring	MBARI supply I assume?
2.4.2	Launch & Recovery system (LARS)	Agreed
2.4.2.1	Remote belly Pack	Do you want modification of the existing belly pack or a replacement belly pack?
2.4.2.2	Vehicle Latch	Are you requesting SMDH provide a new latch and release system for the deployment line? I assume a higher load version of the existing design would be preferred and that MBARI would provide information on the existing design.
2.4.3	Umbilical Cable	
2.4.3.1	Cable Specification	Cortland cable specification previously provided by SMDH and should be used as the specification. I am still waiting for confirmation and cost of additional testing specified so I cannot verify compliance at this stage
2.4.3.2	Testing	Awaiting information from Cortland
2.4.3.3	Termination	Agreed
3	Documentation	Agreed
4 ✓	Spares	An example of a spares list based on Quantum was previously provided. It is not practical to provide a complete list of spares until the design and parts lists for the system are complete. A budget price should be allocated and a final list of spares agreed between both parties after the design is released for manufacture.
5	Design Review and Acceptance testing	Agreed
6	Milestone and Payment Schedule	A kick off meeting should be convened within 1-2 weeks of contract signing. This could be by conference call. Design meeting dates can be suggested at that time. I believe the design phase shown is too short and I suggest the design phase will continue until end of June 07 and manufacture and test ready for FAT will be complete by mid November 07. Long lead items will be identified and released for manufacture as required prior to the end of June 07. FAT and shipment will be complete before the second week of December 07. Shipment is 16 days but with Christmas maybe 3-4 weeks should be allowed. A more detailed project plan will be created by the SMDH Project Manager after contract award. It appears delivery has been requested a month earlier than originally suggested but I expect we can achieve the requested delivery. Payment terms are as previously agreed with Mike Pinto
7	MBARI Project Team	SMDH Project personnel will be advised after contract signing