Twenty-second International Research Ship Operators Meeting (ISOM)

20 – 23 January 2009

National Institute Water and Atmosphere, Wellington, New Zealand

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Australia	Capt Fred	Stein	CSIRO Marine National Facility	Director
	Russell	Worth	P & O Maritime Services Pty Ltd	
	Ron	Plaschke	CSIRO Marine National Facility	
	John	Campbell	P & O Maritime Services Pty Ltd	
	Graeme	Bridges	P & O Maritime Services Pty Ltd	
	Don	McKenzie	CSIRO Marine National Facility	Ship Operational Manager
Belgium	Andre	Pollentier	Royal Belgium Institute for Natural Sciences	
Canada	Capt Ron	Grady	Canadian Coast Guard	Manager, Fleet Operational Requirements
	Jennifer	Nield	Science sector, Fisheries & Oceans, Canada	Senior Policy Advisor
China	Fan	Wang	Institute of Oceanology, Chinese Academy of Sciences	Assistant Director
	Jianjun	Yu	Institute of Oceanology, Chinese Academy of Sciences	
Denmark	Steen	Silberg	National Institute for Aquatic Resources	Head of Department
France	Jacques	Paul	GENAVIR	Oceans Department
	Olivier	Lefort	IFREMER	Fleet Programme Manager
Germany	Klaus	von Brockel	IFM - GEOMAR	Senior Scientist
	Barbara	Tanner	Projekttrager Juleich Forschungszentrum Juelich GmbH	
	Capt Michael	Ippich	RF Forschungsschiffahrt GmbH	Managing Director
	Lothar	Meinders	Briese Schiffahrts GmbH & Co KG	
Ireland	John	Breslin	Marine Institute	Research Vessels Operations Manager
Japan	Testuya	Yokota	Nippon Marine Enterprize	Ships Operations Department
	Katsufumi	Akazawa	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Operational Group Leader
Netherlands	Marieke	Rietveld	Royal Netherlands Institute for Sea Research (NIOZ)	Executive Officer
New Zealand	Fred	Smits	NIWA Vessel Management Ltd	General Manager
	Elisabeth	Smits	NIWA Vessel Management Ltd	General Manager
	Jean	Keddy	NIWA Vessel Management Ltd	Marine Logistics
	Matt	Hickman	NIWA Vessel Management Ltd	Engineering Supervisor
	Neville	Ching	NIWA Vessel Management Ltd	Contracts Manager
	John	Hadfield	NIWA Vessel Management Ltd	Operations Manager
	Rob	Murdoch	NIWA Vessel Management Ltd	Executive Director Research
	Greg	Foothead	NIWA Vessel Management Ltd	Engineering Manager
Norway	Per	Nieuwejaar	Institute of Marine Research	
South Africa	Ian	Calvert	Marine and Coastal Management, Department of Environmental Affairs and Tourism	
Spain	Juanjo	Danobeitia	UTM - CSIC	Director
	Jose	Diaz	Instituto Espanol de Oceanografia	
United Kingdom	David	Blake	British Antarctic Survey	Head Technology & Engineering
	Geraint	West	National Oceanography Centre, Southampton, National Marine Facilities	Head, Sea Systems

Country	Representative (Title, First Name, Last Name)		Organisation	Position
USA	Daniel	Rolland	Alion Science and Technology	
	Tim	Schnoor	US Office of Naval Research	Program Officer
	Dennis	Nixon	UNOLS	
	Bauke	Houtman	National Science Foundation	
	Timothy	Gates	Mantech Systems Engineering Corp.	

A. Proceedings

A.1. Opening Session

The Opening Session was chaired by Mr Fred Smits.

A.1.1. Opening

Following a traditional Maori Karakia blessing and Mihi Whalkatau speech of greeting, Fred Smits welcomed all participants to Wellington.

A.1.2. Official Welcome

John Morgan, Chief Executive of NIWA extended a warm welcome to the 55 ISOM participants from 17 countries and stated that NIWA felt honoured to be hosting the ISOM as well as having Fred become the new chair of ISOM. In particular he felt that this went some way to paying the debt that NIWA owed to ISOM for the exchange of ideas and experience.

As the outgoing Chair, Per Nieuwejaar thanked NIWA and the organising committee for their hard work, and also welcomed the ISOM 'Fraternity of Professional Collegaues' to the meeting. In aprticalr he noted that ISOM is gaining more external recognition as highlighted by an article on ISOM in the Hydro International magazine (see: http://www.hydro-international.com/issues/articles/id978-International_Ship_Operator_Meeting_ISOM.html)

A.1.3. Introduction of NIWA – Dr. Rob Murdoch (NIWA)

NIWA is a Crown Research Institute formed in 1992 and operates as a Crown-owned company, that has to operate as a financially viable entity while still recognizing the needs to provide benefit to New Zealand and pursue excellence. The focus is on atmosphere and water (marine and freshwater) and the life within and consequently the Māori name *Taihoro Nukurangi* meaning 'Where the waters meet the sky' comes from:

- *Taihoro* - flow and movement of water
- *Nukurangi* - interface between sea and sky (atmosphere).

NIWA has over 750 employees with 36 working in Vessel Management Ltd, and a total revenue of NZ$120 M. The organisation's research and consulting activities cover a variety of areas of interest:

- Atmosphere
- Natural Hazards
- Climate
- Freshwater
- Coasts
- Oceans
- Fisheries
- Biodiversity and Biosecurity
- Aquaculture & Biotechnology
- Maori Development
- Energy

A.1.4. New Zealand in the World Ocean – A Tale of Two Hemispheres – Prof Lionel Carter (NIWA)

New Zealand is a country situated in the 'Goldilocks Zone', that is, it is not too hot and not too cold and this is a consequence of a combination of forcing influences from both the South and the North. From the South, the Antarctic Circumpolar Current, which is the largest current with transport of 130 Sv and also the longest at 24,000 km, connecting as it does the major oceans (the only one to do so), also helps to isolate Antarctica and keep it cold. From the North, convergence of subtropical and sub-polar waters.

Two case studies were presented which outlined NIWA work in a world-wide context. The first of these was a joint project with NZ-US-Italy-Germany studying NZ Antarctic & global sea level. This primarily looked at past responses of the Ross Ice Shelf to climate change and attempted to determine effects on ocean currents, sea level & marine ecosystems. The Mid Pliocene (~ 3.5 Myr ago) is of particular interest since with CO_2 at ~ 400 ppm and air temperatures 10°C warmer, it potentially offers a window into the future, particularly in respect of wasting of the W. Antarctic Ice Sheet which could result in a 5-7m sea level rise. The second study looked at swell from the Southern Ocean which has distinct energy spectra, which was used to trace swell across Pacific Ocean; however the reverse is also true with N. Pacific storms directing swell to Antarctica especially in the austral summer when sea ice low. The example of the break up of the B15 ice-berg by N. Pacific swell was outlined.

A.1.5. Climate Change and Boats and Trains and Planes – Dr David Wratt (NIWA)

The observed changes to the physical environment include a number of features including:

- Big increases in greenhouse gas concentrations since pre-industrial times;
- Warming of the climate system is now evident from observations of increases in global average temperatures, widespread melting of snow and ice, and rising global mean sea level;
- Arctic sea-ice is shrinking, while there are net losses from Greenland and Antarctic ice-sheets and mountain glaciers;
- Ocean has warmed to 3000m, having absorbed 80% of heat added to climate system since 1961;
- Ocean acidification: Decrease of 0.1 in surface pH since pre-industrial times;
- Changes in precipitation patterns, drought, more heavy precipitation events;
- More intense tropical cyclone activity in N Atlantic since 1970;
- Average Northern Hemisphere temperatures during second half of the 20th Century are very likely higher than any other 50yr period in the last 500 years, and likely the highest in at least the past 1300 years

The IPCC WG1 concluded that most of the observed increase in globally averaged temperatures since the mid-20th century is very likely to be due to the increase in greenhouse gas concentrations since the best estimate of the forcing from changes in solar irradiance since 1750 is less than 10% of the forcing from human activities. Looking forward, projections for the future include a global sea level rise of 18 - 59 cm by the end of 21st Century, as well as more extreme weather events, further ocean acidification, loss of Arctic sea ice and long-term sea level rise. Not only do these projections vary spatially, but even with a stabilization of greenhouse gases, warming and sea level rise are expected to continue for several centuries. Models also suggest that global average warming of >1.9 to 4.6°C above pre-industrial values, if sustained for millennia, would eventually lead to virtually complete elimination of the Greenland ice sheet and sea level rise of about 7m. This corresponds closely with those inferred for the last interglacial period 125,000 years ago when sea levels were 4 - 6m higher.

Observational evidence shows that many natural systems are being affected by climate changes, particularly temperature increases, with impacts on biodiversity and weather, as well as physical threats due to sea level rise.

Much of the mitigation debate centres on emissions, and in this respect it is estimated that 13.1% of global greenhouse gas emissions are attributable to transport, with various studies suggesting that 1.8% to 4.5% of the total is due to international shipping. In the absence of future regulations, CO_2 emissions from ships could increase by factor of 2.4 to 3 by 2050. Measures to reduce the impact of shipping are various; with much focus being on improvements in hull and propeller hydrodynamics and machinery technologies which could result in reductions of 5 - 30% in new ships and 4 - 20% in old ships (IMO - Marintek). However for ships in excess of >100 Gross Tonnes, 96% of the energy produced is from diesel engines with service lives ~30 years, so it would take a long time for technology improvements to have a significant effect. With this in mind it is worth looking at other measures, such as fleet optimisation, routing and speed reduction with the latter having the greatest potential. Other strategies include use of alternative fuels such as biodiesel or LNG which has a 20% CO2 reduction over diesel as well as SOx and NOx reductions, while more radical solutions such as potential for combination of solar cells and sails will become more attractive as technology matures. Some operators are also now looking at the possibility of using fuel cells for auxiliary engines and/or propulsion. Many of these changes are now being implemented partly out of policy, but also because of cost.

A.1.6. Administrative Matters

A.1.7. Introduction of Participants

A.1.8. Hand-over from former Chair to new Chair

Per Nieuwejaar offered his best wishes to the new team and made a presentation to Fred; in return Fred thanked Per for all his hard work over the past 4 meetings.

A.1.9. Adoption of Agenda and Review of the Minutes of Twenty-First Meeting

Comments on the agenda were invited, which was adopted with minor additions. The minutes of the 21st ISOM were then introduced and ISOM members thanked for the contributions made. The minutes were adopted without modifications as a true record of the ship operators meeting held at the Institute of Oceanology, Chinese Academy of Sciences. IOCAS, 17 – 19 October 2007. The final version of these minutes is available on the ISOM web site (http://www.isom-info.org).

A.2. Theme 1 Delegates Reports of Activities

The outline of information presented in delegates' reports is in Part B; only the discussions are recorded in this section.

A.2.1. Australia – Capt. Fred Stein (CSIRO, Marine Research)
See presentation for report

In response to an inquiry from Jennifer Nield, John Campbell undertook to supply her with specifics of new laboratory on Aurora Australis.

It was confirmed in discussion that CSIRO funds the New Wave programme out of existing budget and waives victualling charges for students.

A.2.2. Belgium – Andre Pollentier (Belgium Federal Science Office, Royal Belgium Institute for Natural Sciences department MUMM)
See B.2 for report.

In discussion it requested that all participants Dennis Nixon know if they experience increased insurance premiums.

It was stated that Belgium had lost 20% no claim discount per year and were now tendering with 4 companies. Clarification was also given that the breaks in between most cruises in the *Belgica's* programme are as a consequence of the *Belgica* only having one crew and not usually running at weekends. It was also confirmed that €1.85M running costs quoted included all the costs associated with the *Belgica* being Navy operated.

A.2.3. Canada - Capt. Ron Grady (Department of Fisheries and Oceans, Canadian Coast Guard)
See B.3 for report

In discussion it was stated that Canada foresaw a continuing need for icebreakers even if the Arctic ice melted, as Canada was experiencing an increasing accumulation of 1st and 2nd year ice compacting in Davis Strait and Bantry Bay. Ice breakers would still be needed if the Arctic sea route opened.

A.2.4. Canada - Jennifer Nield, (DFO)
Canada is a maritime nation (surrounded by three oceans, longest coastline, largest freshwater system and large offshore EEZ). The mandate and vision of Fisheries and Oceans Canada's (DFO) and how it is a science based department was given. The DFO Management Framework and the Science Sector relationship with the Canadian Coast Guard was outlined as was the At-Sea Science planning framework as well as the age, type of vessels, and number of operating days that support the At-Sea Science program. In addition, the function and composition of the Science Sector and how the At-Sea Science program plays a vital role in contributing information on the health, safety and productivity of Canada's ecosystems. The Canadian Science Sector has developed a framework for the future and DFO Science is hoping to have the capacity to support an ecosystem based management approach for the next generation of research vessels. Vessels are "not a taxi, but a tool" and DFO Science is striving to have multifunctional and multidisciplinary vessel replacements.

A.2.5. China – Dr. Fan Wang (IOCAS)

See presentation for report.

A.2.6. Denmark - Steen Silberg (DIFRES)
See B.5 for report.

In response to an inquiry regarding sales cost of the SIS system, it was stated that no thought had yet been given as to how much it might be sold for. Clarification was also given on the difference between Denmark's 2 centres:

- National marine service centre associated with one university – client of research centre.
- National ocean research centre works with all universities – coordinating centre.

A.2.7. France – Olivier Lefort (IFREMER)
See presentation for report.

In reply to an inquiry as to what mitigation measures were employed during the experiment concerning seismics and cetaceans, it was stated that soft start and visual monitoring were used, but not passive acoustic monitoring. In response to different inquiries, it was stated that the AUV is fitted with a Reson 7125 multibeam, while the penetration of the towed seismic system is 30 – 100m. Considerable discussion was centred on why IFREMER were going back to Kongsberg after having fitted Reson systems to the *Pourquoi Pas?*; During this it was made clear that although Reson were the only supplier who said they could meet the spec for the *Pourquoi Pas?*, they had not lived up to expectations and had proved to be a difficult company to work with. Nevertheless the Reson 24 kHz is an extremely efficient system with good resolution down to 4000m, while it was also confirmed that the Reson problem is not software and that IFREMER will retain the Reson system on the *Pourquoi Pas?*

A.2.8. Germany – Dr. Klaus von Broeckel (Leibniz-Institute fur Meereswissenscaften)
See B.7 for report.

In discussion it was confirmed that the cost of solving the azipod problems onboard the *Maria S. Merian* was a shipyard responsibility. There was also discussion regarding whether, now that cheaper fuel was available, would the ship's speed be increased back up to 11kts having been previously limited it to 9kts; it was stated that the limitation would remain. In response to other questions, it was confirmed that the heave compensation problems on the *Merian* have not been solved, but further trials in April/May around Canaries were planned.

A.2.9. Germany – Capt. Michael Ippich (Briese Schiffarts GmbH)
See presentation for report.

In discussion it was stated that the cost of updating the *Alkor* was not easy to calculate over a number of years, but was approximately €0.5M, while €0.2M was the cost of the *Heincke* refit.

A.2.10. Germany – Barbara Tanner (Projekttrager Juleich Forschungszentrum Juelich GmbH)
See presentation for report.

A.2.11. Ireland - John Breslin (Marine Institute)
See presentation for report.

There was considerable discussion concerning the student training programme outlined in the presentation with particular questioning over whether insurance rates had increased. It was stated that they had not since the students are signed on, within normal STCW95 trained complement. In response to further queries, it was also stated that this training is funded as dedicated days by the Irish Government and that this included pre-embarkation ENG1 and PST STCW95 training. It was further confirmed that the MI's experience with anti-fouling was good. Following an inquiry about effects of vessel noise on the EM3000, it was stated that there is some noise on the outer beams, but overall performance had been OK since new transducers were fitted.

A.2.12. Japan - Katsufumi Akazawa (JAMSTEC)
See presentation for report.

A.2.13. Netherlands - Marieke Rietveld (NIOZ)
See presentation for report.

In discussion it was stated that the EM300 had been installed onboard the *Pelagia* in 2006, while the cores that could be obtained with the NIOZ piston core system are in multiples of 6m; with the maximum usually being 18m, but 24m is theoretically achievable, although 20m is usually the practical maximum.

A.2.14. New Zealand - Greg Foothead (NIWA)
See presentation for report.

A.2.15. Norway - Per Nieuwejaar (IMR
See B.12 for report.

In discussion it was stated that the supplier of the DP system being fitted to the *Johan Hjort* is Kongsberg.

A.2.16. South Africa – Ian Calvert (Smit Marine)
See presentation for report.

In discussion it was stated that insurance for Antarctic 'ramp' operations was not a problem, but connected with commercial income, since government ship are normally self insured. It was stated that visits to yards bidding to replace the *Agulhas* would take place in February. There was some discussion concerning methods and costs of monitoring an acoustically quiet vessel monitored; in response it was stated that it currently costs $2-3k for a 2-3 day inspection by a team before each Fisheries Resource Survey cruise. It was also stated that DEAT deal with all MSR clearance requests including the clearance for working off Tanzania.

A.2.17. Spain – Prof. Juanjo Dañobeitia (UTM/CSIC)
See presentation for report.

In discussion it was made clear that the problem with the titanium window was a specific flaw in the titanium used, so the window will be replaced with an acceptable titanium window.

A.2.18. Spain – Jose Diaz (IEO)
See presentation for report.

The acquisition of the new 20' Flowcam container was noted, and it was further confirmed that a flow cytometer had also been installed in the container, but that this would not be used for profiling.

A.2.19. UK – David Blake (BAS)
See B.16 for report.

It was noted that the major refit to the *James Clark Ross* did not include any propulsion items; this was because the ship's propulsion systems were generally fine, but that the power management system had been replaced

A.2.20. UK – Geraint West (NOCS)
See B.17 for report.

In discussion it was confirmed that the *Discovery* replacement contract would be for both design and build, while it was also stated that the *Discovery* had made into port under her own power following a major motor failure.

A.2.21. USA– Bob Houtman (NSF/UNOLS)
See B.18 for report.

A.3. Theme 2 New Vessel Plans, New Builds and Modifications

A.3.1. *Southern Surveyor* Replacement – Capt. Fred Stein (CSIRO)
CSIRO have a large area of operations between the Australian continent and Antarctic and therefore have a need for an Ocean Class vessel in the 85m range. The main business driver is a growing demand for multi-disciplinary science which is researching climate extremes, while fisheries research activity has moved away from sample catches towards mainly acoustic surveys and logs from commercial fishing vessels. The acquisition is planned to be a design and build contract. With the following Guiding Principles:

- COTS
- Modularity
- Engineering for Change
- Innovation Encouraged
- Ergonomic Working Environment

A.3.2. Management/Admin challenges – Ron Plashke (CSIRO)
CSIRO had carried out some work examining what management structures work well and what doesn't using a 'bottom-up' analysis. The issue of appropriate models for technical support was specifically raised, noting the need to identify the core business and it was suggested that that ISOM considers this at subsequent meetings.

In discussion it was pointed out that one could spend weeks talking about business models and that CSIRO and IMR are the opposite ends of the spectrum. One view was that a 100% in-house operation gave control over making ones own mistakes and was therefore cheaper, while others were of the view

that infrastructure costs often make in-house operations more expensive, and that outsourced operations were competitive.

A.3.3. Discovery Replacement – Geraint West (NOCS)

The *Discovery* is now 46 years old and will be replaced with a new multi-role oceanographic vessel to be delivered in Q4 2012. NERC were currently in negotiation with the shipbuilder Astilleros Zamakona, Spain for a vessel designed by Skipsteknisk. The aim was to sign a contract prior to the end of March, but NERC were currently waiting for funding to be confirmed by the Minister (post-meeting note: the Minister blocked funding and the tender has been reissued.)

Outline requirements for the vessel are at B.17.2.

DP2 had been specified for redundancy of equipment rather than any perceived need to operate under such requirements, and although this was asked for in build, NERC would almost certainly not be looking to maintain DP2 class. It was also confirmed that the leading edge of blister is designed for bubble rejection, while the ship would be capable of operating the Isis ROV.

A.3.4. Norway's New Polar 10 Ice Class Research Vessel – Per Nieuwejaar (IMR)

The new vessel will be built to an existing design with the following outline requirements:

- Multifunctional
  (biology, oceanography, geology)
- Icebreaker (POLAR 10 ICEBREAKER)
- Helicopter carrier
- Logistics vessel
- Training and education
- Endurance
- Clean ship

The build schedule for the vessel is quite optimistic calling for a vessel to be delivered in late 2011 and ready for first science cruises in 2012, but this is not considered improbable since it is estimated that 50% of pre-existing contracts in Norway may be cancelled. The DNV Polar 10 is defined as vessels intended for ice breaking, built for another main purpose working in winter ice with multi-year ice-floes and glacial ice inclusions. i.e. ca. 1-1.5m thick. Propulsion will be through 14MW diesel-electric machinery (AC) and "Z-drive" propulsors with 2 tunnel thrusters in the bow area for DP operations. Helicopter operations will be conducted from forward, avoiding the need to stop scientific operation aft. Accommodation will be in mostly single cabins, with some doubles, although these and inside cabins will only be used if a full complement of 50 scientists are embarked. A Hugin AUV has just been acquired and it is hoped to also acquire a 600m ROV, both of which the ship will be capable of operating. An LNG generator has been specified for clean ship operations enabling the vessel to run for about 1 week with no emissions. The vessel will not be designed to completely meet "ICES 209 recommendations for radiated noise" while the use of a moon pool on a polar vessel presents significant design challenges.

In response to a question regarding reduction of energy use, it was stated that the vessel's fit of 4 diesel engines would provide flexibility. There was also considerable discussion regarding the need for helicopter operations, this being particularly pertinent to Canada's considerations for replacing the *Hudson*. It is the Norwegian Polar Institute's view that this is the easiest way to get around the ice; it

is a good platform for providing security from polar bears, as well as moving equipment. Overall it is believed that it enables maximisation of science time while also providing a local SAR capability.

A.3.5. *Aurora Borealis* Update – Dr. Klaus von Broeckel (IFM)

The build of a polar, marine science and drilling ship is intended as a European project as well as part of IODP. Consequently the European Research Icebreaker Consortium (ERICON) has been formed including various ESF partners. The following points were noted:

- €650M construction cost
- €50M pa. running costs
- 199m long
- 80m drilling rig above keel
- 120 capacity
- Ability to break 2.5 – 4m thick ice
- 2 x 7m x7m moonpool – aft for drilling rig; forwd for other science kit
- DP in drifting ice (planned power is 90 MW for icebreaking at ice drift speed); while 6 retractable transverse thrusters each with 3 propellers will be deployable deep enough to avoid ice
- Keep working decks dry to avoid ice build-up

Construction is planned to begin in 2012 and be completed 3 years later.

A.3.6. US Oceanographic Programme Update – Tim Schnoor (Research Facilities Program Manager at the US Navy's Office of Naval Research, Arlington, Virginia, USA)

The US Navy is about to embark on a program to design and construct two new Ocean Class research vessels. The Naval Sea Systems Command will manage the design and building program, to be initiated through a Request for Proposal, expected to be released by the end of February 2009. Two design contracts are expected to be awarded, leading to a single building contract awarded within the next two years. Delivery of the ships is expected in 2014. Within the year the Office of Naval Research will issue a Broad Agency Announcement for prospective operators of the ships. A selection board, assembled by the Office of Naval Research will evaluate the proposals and recommend an operating institution for each new vessel.

A.3.7. South Africa's New Ice Class Research Vessel – Ian Calvert (Smit Marine)

South Africa plans to build a replacement for the *Agulhas* and will be similar to the existing vessel, including ability to operate a helicopter, as well as extended facilities for science and a higher ice class (PC5). Rolls Royce, Skipteknisk and BMT Canada are currently competing to design the vessel which will have the following capabilities/facilities:

- Hydro-acoustic suite
- ADCPs on drop keel
- Titanium CTD
- 5000cum break bulk
- 6000L diesel
- DP1
- 125-130m length
- 45 crew with accommodation for up to 100

In response to a question why it was planned to extend the length of the vessel, it was stated that this will be to enable greater cargo capacity.

A.3.8. Spanish IEO Fleet Modernisation Programme – Jose Diaz (IEO)

The construction of 2 regional vessels and a conceptual replacement for the *Cornide de Saavedra* was described:

The regional vessels currently under construction are due to be delivered in 2009 and 2010. Their outline characteristics are shown at B.14.2. Of particular note on these vessels is the bow design which incorporates an Icelandic bow due to bubble sweepdown consideration, while the gondola has been tilted by 1.5° to facilitate flow of bubbles, and the drop keel has been fitted with a camera in front and lights on the sides. The ships have been designed to achieve 10kts on one engine, and can be supplemented by harbour set. Two trawl winches will be installed below main deck aft of fish processing room in order to allow installation of either 2 x 20' containers longitudinally or 1 athwartships.

In discussion the fisheries lab was described as 'big!', while it was confirmed that the build cost of €18.5M includes the scientific fit.

The project to replace the *Cornide* was initiated in 2007 and a tender exercise has been started in order to get an idea of cost. The bulbous bow has been dropped from the initial design while power has been reduced from 7 to 5MW resulting in a reduction of design speed to 14kts. Particular attention is being paid to BV cleanship requirements and the fitting of solar panels and a Skysail as well as scrubber and SCR is planned. A fuel cell for harbour is under consideration because of the target to have no harbour gen-set; a containerised solution is currently planned. The operational arrangements for the CTD are planned to be similar to the *Sarmiento da Gamboa*.

There was considerable discussion concerning ICES 209 for these vessels and it was noted that the standard is defined at 11kts. In consideration of the element of the budget is associated with achieving ICES 209, it was felt that the main engines are the highest risk, but these are a Spanish manufacturer which is cheaper than Wartsila; the main cost element was considered to be design (marginal). It was however observed that while most measures such as resilient mounts are not expensive, the builder will build in contingency for penalties, so beware! It was stated that the intent was to range the ships on the Spanish Navy range in the Mediterranean, but noted that the military STANAG model breaks down at very lowest frequency so there is the risk of rejecting a perfectly good ship (the yard might also prove you wrong as well!)

A.3.9. *Haliotis* Workboat: a New Concept for Coastal Survey – Olivier Lefort (IFREMER)

The requirement was for a boat that can easily be moved around on the back of a truck with a crane as an all-in-one solution; consequently the solution had to meet road transport regulations, as well as meeting the restrictions imposed by deploying via ferry to Corsica. The facility is operated by 2 people (+1 scientist) on a 5-6 days operation and 2 days rest cycle. The motor boat needs high transit speed so has a semi-plane design for 18kts, but actually 22 achieved on trials. Weight has been reduced by aluminium and composites, while an interferomtric sonar has been installed due to much higher swath width achievable.

In discussion it was stated that the facility cost €1.3M, with half of this being scientific equipment. In response to another query it was stated that the boat is capable of coping in up to SS4, but only works up to SS2.5.

A.3.10. *Sonne* Replacement - Dr Klaus von Broeckel (IFM)

The Federal Waterways Engineering and Research Institute (Bundesanstalt für Wasserbau - BAW) recently started the preparation of a call for tender for a replacement for the *Sonne* which will be for the construction and operation of the ship for about 10 years. The objective is a highly sophisticated Deep-Sea Research Vessel which fulfills all requirements from the whole multidisciplinary marine community during the next decades. The Federal Government as well as the five German coastal states has allocated a sum of up to €110M. The ship is intended to be similar to *Maria S. Merian* with some changes:

- lengthening within bow and aft part (total 12 m)
- one additional deck for accommodation
- all social rooms on 1. deck with large windows
- one additional crane on working deck
- - free-fall lifeboats towards sides of ship to get a free working deck (if possible)
- (extension of aft working deck towards the sides: 1.5 m each)
- extension of bridge over starboard side

It is hoped to build a vessel which is quiet to 'self-evident' levels for a modern research vessel, but not 'at any price'. In combination with this a number of propulsion systems are under consideration (the bow-drive will be a pumpjet):

- PODs (similar to *Maria S. Merian*)
- 'Combi-Drive' and small rudder
- mixed system with shaft (and propeller) and azimuth-propulsion
- mixed system with shaft (and propeller) and Voith-Schneider Propeller
- two Voith-Schneider propeller with bigger dimensions
- two shafts (and propellers) with two Voith Cycloidal Rudder

Other features which are under specific consideration are stabilisation systems for both on-station and cruising, while energy-efficiency measures under consideration include the use of waste heat, SkySails and fuel-cells for use within harbours and when there is a need for very clean ship operations during specific sampling periods. However these are still very expensive and not proven.

There was considerable discussion concerning the merits of DC rather than AC and it was stated that the preference for DC was because of size, although it was also pointed out that AC is far greener. The merits of Voith-Schneider props were also broadly discussed and it was confirmed that this is a well proven technology fitted to many tugs and some offshore vessels. The specification for the deep-water multibeam was confirmed as 1° x 1°.

A.3.11. DP2 on *Tangaroa* – Fred Smits (NIWA)

Tangaroa is expected to remain in service for up to another 20 years and the decision to enhance the ship with DP was taken not only because of a range of operational needs, but also because of the dependence on commercial charter for a proportion of its work. As well as fitting new stern and bow thrusters, 2 new 1400kW Diesel Generators and the CTD winch will be fitted in part of the fish-hold.

There are time risks to the project due to supply pressures on Brunveld thrusters, while the issue of training has taken some consideration: Masters and Mates will receive basic training and DP operators will be bought in for specific contracts, which has reinforced the decision to adopt a Kongsberg standard. Nevertheless there is a shortage of yard facilities in New Zealand and it hoped to benefit from the gathering down-turn in the bigger yards such as Singapore etc.

In discussion the budget for the upgrades was confirmed as NZ$10M. It was also stated that there would be a fixed DP console plus a 'floating' portable, while BAS observed that Kongsberg don't tell you that you need a ramp-up with older thrusters; NIWA were aware of Kongsberg informational limitations.

A.4. Theme 3: Environmental and Ecological Impacts

A.4.1. Green Ships - Geraint West (NOCS)

Three ongoing initiatives were outlined:

- **RV Code of Practice**

The ISOM RV Code of Practice has now been widely recognized and is increasingly being quoted in international forums: Elements have been incorporated into the OSPAR Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Maritime Area, while it has also been quoted in the Convention on Migratory Species Draft Resolution on Adverse Anthropogenic Marine/Ocean Noise Impacts on Cetaceans and Other Biota. ISOM members were encouraged to promote the code.

- **EUROFLEETS**

As part of the Eurofleets programme, NOCS and VLIZ (Flanders Marine Institute) are taking the lead on a €0.5M work-package on 'Eco-Responsibility and Eco-Design for Existing and New Research Vessels':

- Aim to support European RV operators in managing the environmental footprint arising from their vessels, equipment and research operations at sea in accordance with national, EU and international legislation and other applicable policies.
- Provide sustainable guidance and capability to promote best practice mitigation measures to minimise the effects on the environment
- Current known environmental footprint are wide ranging and include (but not limited to):
  - Potential for pollution accidents;
  - Sustainable fuel consumption;
  - Emissions (that include greenhouse gases, sewage, grey water, ballast water);
  - Garbage;
  - Anti-fouling paint systems;
  - Anthropogenic underwater noise.
- Primary output will be a Research Vessels Environmental Management System in accordance with ISO 14001.

In discussion the issue of why ISO14001, but not ISM was quoted was raised; this is because current ship operators already work in compliance with ISM, but many have aspirations to also be ISO 14001 accredited. It was emphasized the approach would enable this, rather than it being mandated.

- **IMO MEPC Shipping Noise**

The IMO's Marine Environment Protection Committee (MEPC) have set up a Noise Correspondence Group which is tasked with identifying and addressing ways to minimize the introduction of incidental noise into the marine environment from commercial shipping to reduce the potential adverse impact on marine life, in particular develop non-mandatory technical guidelines for ship-quieting technologies as well as potential navigation and operational practices. As a result of this the idea of ISOM obtaining observer status on the MEPC has been mooted (see A.9.1)

A.4.2. Ecological Impact of Vessels: IIFREMER's CONVENAV Project - Olivier Lefort (IFREMER)

The CONVENAV project aims to deliver tools for the evaluation and optimisation of environmental impact of vessels, by adapting existing (COTS) life cycle software, both on vessels and ashore. Determination of pertinent marine eco-indicators will be based on an eco-toxicological analysis and classification of emissions from vessels during the life cycle, from building through operation to final disposal. Deliverables due by the end of 2011 are two software tools for:

- Management of the environmental impact of the vessel during operations;
- Eco-conception which can be used for the design phase by a shipyard.

During discussion it was stated that no decision has yet been made on whether the outputs will be for sale; this will very much depend on whether it is an add-on to existing software package or is new.

A.4.3. Ecosystem Approach for Canada's New Research Vessels - Jennifer Nield (DFO)

Canada's annual programme, worth ca. CA$40M pa, is planned by committee and emphasis is moving towards less invasive techniques such as electronic habitat surveys, rather than trawling. With this in mind new vessels will be multifunctional and multidisciplinary with an emphasis on reduced levels of radiated noise to ensure accurate data is being collected.

There was some discussion over whether recent world events increasing focus on oil and gas reserves would trigger a more widespread fleet renewal, however it is not clear that Canada has the resources. Nevertheless Arctic sovereignty is a big political driver, so there is some hope that money for at least a small fleet replacement will be forthcoming. The example of it being relatively straightforward to obtain funding for a polar icebreaker, but more difficult to be allocated adequate operating funds was cited.

A.4.4. Energy Savings - Geraint West (NOCS)

The UK had recently completed replacing the hull coating of the *James Cook* with Intersleek 900. This is touted as a new, unique fluoropolymer foul release coating which significantly improves upon the performance of the best silicone based systems. In particular its smoothness is quoted by International as saving 6% predicted fuel consumption and emissions over a vessel's lifetime. ISOM members were asked if any of them had experience with this product.

In discussion NIWA indicated that they had looked at the product, but had ruled it out on cost, although it was looking at some prop coatings. ***NIWA undertook to would provide details of prop coatings investigated to ISOM members.***

Smit indicated that it had used the product on several harbour vessels and these had been clear of growth on subsequent dockings, although caution about bare patches was urged. P&O was looking at the product but cost/benefit was not yet proven, although it was believed that it would be most efficient on smaller faster vessels. IEO has adopted the product for its new vessels because of speed, lower contamination (for metal free chemistry), and greater period between re-coating. It was also pointed out that growth is associated with higher noise levels.

A.4.5. Mobile Equipment on Hired Vessels (Fishing, Supply Vessels etc) - Per Nieuwejaar (IMR)

There are a number of issues with using commercial vessels, and in response IMR have built up a dedicated group of technicians using a parallel QA system similar to their own ships, which has allowed them to build up a database of experience of different operators. One specific issue highlighted was the preference to build dedicated self-contained packages in order to avoid interfacing with chartered ships' network due to significant problems with viruses.

This subject generated a lot of discussion with some ISOM members highlighting their own procedure for scientists embarked in such vessels to take their own EPIRBs and lifejackets. The main issue discussed however, was inspection procedures ranging from safety to more technical issues such as assessing deck loadings and vessel noise. In the latter case, IMR arrange for these vessels to transit via deployed equipment/hydrophones and/or a Navy noise range so that the ship's machinery configuration can be fine tuned. It was also considering whether to write this requirement into contracts. In the USA, following an incident where students lost their lives in Mexico, UNOLS now has a requirement for the nearest UNOLS superintendent to inspect a chartered vessel personally. It was pointed out that the International Marine Contractors Association (IMCA) issues a standard inspection document (www.imca-int.com/documents/divisions/marine/docs/IMCAM149.doc), and several ISOM members confirmed that they had used this.

It was agreed to further discuss the legal aspects and inspection procedures for hired vessels at the next ISOM meeting.

A.5. Theme 4: Reports on External Workgroups

A.5.1. Eurofleets - Olivier Lefort (IFREMER)

Eurofleets is a ca. €9 M (€7.2M EU contribution) programme comprising 24 marine institutes, universities, foundations and SMEs, from 16 European countries. Based on the recommendations of the ESF-Marine Board Position Paper 10 "*European Ocean Research Fleets – Towards a Common Strategy and Enhanced Use*" (March 2007), and developed in the frame of the MarinERA ERANET project (Oct. 2007), Eurofleets aims to:

- Define a common strategic vision for European research fleets and associated heavy equipment (e.g. submersible vehicles as ROVs and AUVs),
- Use more cost-efficiently the existing European ocean/global and regional fleets, develop their interoperability capacities,
- Facilitate a wider sharing of knowledge and technologies across fields and between academia and industry,
- Promote greener and sustainable research vessel operations and responsibility,
- Provide all European Researchers with a full access to high performing research fleets to conduct marine research,

- Foster the coordinated and joint development of European fleets in terms of capacity and performances.

A.5.2. Ocean Facilities Exchange Group (OFEG) and OFEG-Tech - Marieke Rietveld (NIOZ)
OFEG is "a bottom-up approach of research fleet co-ordination & harmonisation" which facilitates the exchange of shiptime and major pieces of equipment (such as ROV *Victor*, submersible *Nautile*, *TOBI*, *SAR*, multichannel seismics, mobile compressors and laboratory containers) based on the 'bartering' principle, including joint cruises. Its 6 member agencies: NERC, BMBF, IFREMER, NIOZ, CSIC and IMR run multiple ship fleets (except NIOZ), comprising 22 of the 26 Ocean, Global Class and Regional Class ships in Europe. Exchange is based on "value points" according to scientific capacity as agreed between members. A new website www.ofeg.org has been launched and includes information on programmes, as well as a new shared roadmap of major capital items and ships.

A new initiative, OFEG-Tech has also been launched with the aims of building a network of OFEG Marine Technicians for the exchange of skills and information, and to assist the development of common equipment strategies. The second OFEG-Tech meeting took place at NIOZ, Texel and the third meeting is scheduled for Barcelona 24 – 25 November. OFEG Tech has also scheduled specialist workshops, including one on moorings and a further one concentrating on seismics is planned.

A.5.3. European RV Operators (ERVO) John Breslin (MI)
The 10th ERVO Meeting (ERVO 2008) was held 20th – 21st May in Varna, Bulgaria with 22 representatives from 18 organisations in 14 different countries. Many of the issues discussed during the ERVO are common with those of the ISOM agenda, but other items discussed were:

- New builds, facilities or equipment
- Fuel Economy
- Risk Assessments
- Bubble Sweepdown
- Scientific Diving from Research Vessels
- Review of New R.V. Constructions in the US Fleet
- Sea Survival & Medical Training Requirements
- Regional Barters and possible sharing/exchange of ROV pilots
- ERVO page in EurOcean Website
- RV Code of Conduct

The next meeting will take place at at DTU, Copenhagen 14th -15th May 2009

There was some discussion regarding the item on 'Sea Survival & Medical Training Requirements' with one ISOM member pointing out that because STCW covers all crew member required for the operation of the vessel, in their country all scientists have to undertake pre-sea training and medicals. A number of ISOM members also confirmed that they have a similar approach and require scientists to sign on.

A.5.4. INMARTECH 2008 Report and INMARTECH 2010 - Olivier Lefort (IFREMER)
INMARTECH 2008 was held at the IFREMER European Center of Underwater Technologies in Toulon, France 8 - 10 October 2008. There were 85 participants, mainly from Europe, but also from USA, Canada, Australia, New Zealand, Japan, and China. Subjects discussed included:

- AUVs
- Gliders
- Manned submersibles
- New vessels
- EOV/AUV deployment and interoperability
- Instrumentation
- Acoustic and seismic tools
- Buoys
- Moorings and observatory installations
- Data handling
- Networks and communications
- Lessons learned.

INMARTECH 2010 will be held at NIWA, New Zealand, 19 Jan 2011.

A.6. Theme 5: Insurance and Liability

A.6.1. Marine Insurance - Prof. Dennis Nixon (UNOLS)

It was suggested that we are on the cusp of a change in insurance costs with significant rises expected. Referencing the "Global Marine Insurers Report 2008," as prepared by Astrid Seltmann for the 2008 International Union of Marine Insurers (IUMI) Conference in Vancouver, it was estimated that the total of worldwide marine insurance premiums now exceeds US$20 billion and continues to rise steadily. Europe continues to dominate the market holding some 61.3% of the market share, while the UK remains the primary player in the sector. In analysing trends it was noted that 2008 was the second costliest year for losses with insured and uninsured catastrophic losses totalling US$225 billion; some US$50 billion of which was property losses resulting from primarily natural disasters such as hurricanes, storms and earthquakes. This situation has been compounded by erosion of capital by weak and turbulent stock and bond markets and constraints on borrowing which have made it difficult for reinsurers to replenish their 'investment pots' resulting in collapse of some companies while conditions have hampered the start-up of new reinsurers. Therefore according to a report by Advisen Ltd fit was forecast that while February 2009 renewals will see some increases, there is more likely to be a significant step up in insurance costs in 2010.

A.6.2. Marine Legal Issues - Prof. Dennis Nixon (UNOLS)

The following 'Top 10', illustrated with the usual range of startling and bizarre incidents, were outlined as the major legal issues affecting the marine community:

1. Alcohol - The issue of alcohol onboard ships has historically been, and continues to remain a problematic issue.
2. CCTV – There is an issue concerning to what extent this type of information can be used in disciplinary cases.
3. PPE – The JAMSTEC culture in which everyone on deck is required to wear hard-hats and lifejackets, as well as MOB alarm/homing beacon was cited as an example of good practice.
4. Insurance for students carried onboard – Already highlighted in other sessions, it was noted that while different operators have different approaches, there is an obligation for an operator to inform the insurance company of any changes which may affect terms of insurance. ISOM

members were urged to consider if they were aware of anything added to one of their vessels which the insurance company hadn't been told about.

5. Helicopter deck – It was noted that when a helicopter is embarked it is considered part of the vessel's equipment, so the Master is responsible for operations, safety and maintenance. Again, it was highlighted that the insurance company should be notified.
6. Ladders – Falling down ladders continues to be the most common source of injury onboard ships, so ISOM members were urged to consider whether stairwells are adequately lit and glow strips on step edge fitted.
7. Diversion for sue and labour clause – It was noted that if a vessel owner diverts to avoid injury, the insurance company may pay, so ASK!
8. Hull insurance – UNOLS have taken up salvage coverage risk since there is a liability of up to 50% of vessel's value in a salvage situation.
9. Contract law – This issue was raised during an earlier session, but ISOM members were encouraged to consider what inspection should occur when chartering a vessel and what insurance coverage they should require the vessel to have.
10. Environmental Law – Highlighted as a separate agenda item, but it was noted that focus on this subject was only going to continue, with the issue of noise and cetaceans being of particular concern. The impact of the RV Code of Conduct was again highlighted, while it was also noted that the impacts of ocean fertilisation needs further study before the London Dumping Convention lifts existing limitations.
11. Scientific Diving – In the USA there are significant problems resulting from the organisation being too disparate; consequently it may now come under Occupational Safety and Health Administration (OSHA).

In summary it was noted that the number of reported accidents and injuries has increased with particular factors being:

- Dramatic increase in void space fatalities;
- Safety issues and human error are direct contributors.

In addition a number of other legal issues were highlighted:

- Violations of EEZ is becoming a more serious issue;
- The new IMO Code of Safety for Special Purpose Ships would in general apply to ISOM member vessels;
- Although the issue of piracy was a separate agenda item, it does present a number of legal issues including which flag states would want prosecute if pirates are apprehended.

As usual this item generated much discussion with main emphasis being on alcohol. It was noted that UNOLS instituted its alcohol policy after a casualty overboard so that the blood alcohol level is now valid in all circumstances, while Smit highlighted a case which resulted in a fatality, so that they now check the blood alcohol of all staff arriving on the quay. Other ISOM members particularly highlighted the issue of staff coming back onboard after consuming alcohol ashore, which presented issues of whether they should remain ashore in a hotel and whether the ship delays sailing or sails without them.

Further items which generated discussion were the right of staff to reasonable expectation of privacy when film or TV crews are embarked, while several delegates raised the rising prominence of radiation

exposure from shipboard equipment including mobile telephones. It response it was noted that this was normally dealt with ashore through workman's compensation, but the need for procedures was important.

A.6.3. Personal Accident Insurance - Marieke Rietveld (NIOZ)
During operations onboard the *Polarstern* which included a number of helicopter trips to an Antarctic station employing scientists to aid with moving cargo, the aircraft crashed resulting in a number of casualties including a fatality to a NIOZ technician. On review of this incident NIOZ observed that the ship operator required embarked staff to hold own insurance, which meant that the onus fell upon what they concluded was a poor compensation system for dependents. As a consequence, NIOZ decided to institute comprehensive accident insurance for al staff (which also covers all visiting staff on premises or property) at a cost of €10k per year.

A number of delegates noted that their own organisations had responded to similar issues by founding a club of 'friends of institute' to cover insurance. There was some resultant discussion concerning resultant tax liability.

A.7. Theme 6: High Latitudes

A.7.1. IMO regulations, Arctic and Antarctic Rules Update - Fred Smits (NIWA)
It has become custom at ISOM for New Zealand to monitor the Antarctic while Finland covers the Arctic. In 2002 IMO ratified operation of ships in ice-covered waters which generated some resistance from operators since the two environments are very different. In particular there is concern regarding difficulty of responding to incidents in the Antarctic and the probable need to leave any ship wrecks in place. Consequently COMNAP (Council of Managers of National Antarctic Programmes), in collaboration with IHO, are pushing for more hydrographic data in the area, and at the October 2008 IHO Conference a Working Group was set up to establish a new GIS database. It was, however, acknowledged that it was difficult to convince countries involved in Antarctica to do more.

A.8. Theme 7: Safety and Security Issues

A.8.1. Piracy – *Pelagia* Passage through the Gulf of Aden Marieke Rietveld NIOZ)
During 2008 there was a need for *Pelagia* to undertake science in the Indian Ocean, which implied passage through the Gulf of Aden where pirate attacks have become an increasingly significant and well publicised threat. Original advice received was to transit independently as close to the Yemen coast as possible, however following intervention by IFREMER, *Pelagia* joined a 8/9kt convoy protected by French Navy. The following useful information sources were noted:

- EU-NAVFOR - Operation ATALANTA
- Co-ordinated from the Maritime Security Centre Horn of Africa (MSCHOA) **http://mschoa.org**
- ICC-CCS International Maritime Bureau – **www.ics-ccs.org**
- Lloyds List - **http://www.lloydslist.com/ll/news/index.htm**
- Joint War Committee - **http://www.lmalloyds.com/AM/Template.cfm?Section=Joint_War1&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=3&ContentID=3888**
- UNOSAT - **http://unosat.web.cern.ch/unosat/asp/prod_free.asp?id=28**

There was considerable discussion over the advisability of research vessels operating at all in areas that represented such a high risk; in particular it was noted that following the RPG attack on the *Ewing* in 2001 NSF were advised that it shouldn't be funding science in these areas, although it was noted that in this situation the science itself wasn't in a war zone, and that it was funded before piracy became a significant risk. This raised the issue of the difference between piracy and terrorism, the former requiring the operator to buy war insurance (just to make it more complicated the UK and US forms are different in their definitions.) In this respect it was noted that in the case of the *Ewing* the Molluca Straits was considered a war risk, but in the case of Somalia, the insurance might look like a good trade off against the additional cost of fuel around the Horn. The issue of scientists' attitudes to this situation were discussed, but in this case it was also noted that there were no scientists embarked, although some crew members were unhappy with going from Seychelles to Tanzania. Most ISOM delegates were firmly of the opinion that science was generally not worth weighing against the risk to staff and reputation of their organisations.

A.8.2. Piracy – Protection against piracy - Nigeria Jacques Paul (Genavir)

Pirate attacks off the coast of Nigeria have become a serious problem involving attempts to interfere with oil production, robbery and kidnapping for ransom. Generally these attacks have been by fast boats travelling at 20kts on production platforms and FPSOs within 20 miles of the coast, mainly in the Bonny River or its entrance, but more recent attacks have occurred up to 50 mile offshore. It proved too late to get protection from the Nigerian Navy for a planned research cruise onboard the *Pourquoi Pas?*, so French Navy personnel were embarked. Measures to defend against the threat included:

- Passive
  - Speed
  - Move
  - Prevent pirates from getting on board
  - Muster people in protected area
- Active
  - Local producers organization
  - Escort boats with Nigerian navy
  - Escort on board ship

A.8.3. Should ISOM publish Safety/Accident/Near Miss Data? - Geraint West (NOCS)

Most ISOM operators already collect safety statistics and in the current environment where many delegates are under pressure to benchmark their operations it was suggested that more could be done to share and compare statistics. NOCS outlined the format it uses and would like to collaborate with other ISOM members who would like to participate.

Discussion centred on the variety of formats which different ISOM members use while several delegates pointed out that they also use a system anonymous 'observations' which are light on paperwork, but also generate a more honest and open safety environment. A number of ISOM members were positively inclined to participate in this exercise and ***NOCS undertook to circulate copies of its own safety data format to other interested members.***

A.8.4. Man over Board – Safety Training at JAMSTEC - Tetsuya Yokota (JAMSTEC)

An incident was outlined in which a crew member went overboard at night and spent 3hrs in 16°C water by which time he was suffering hypothermia. The circumstances included failure to employ the buddy system while the individual concerned didn't think about using his whistle until it was too late.

Although it was noted that radar signal floats and life-jacket lights are not mandatory in Japan, a JAMSTEC report recommended fitting LEDs to all PFD, as well equipping staff with personal MOB alarms, while acquisition of radar signal floats is being considered.

In discussion it was noted that existing regulations make it the prerogative of the ship operator to decide on requirements; and consequently ***it was suggested that ISOM consider developing a code of practice for safety training***. The radar reflector float shown was also particularly commented upon and several ISOM members requested more information (*This is one site I've been able to find:* http://en.item.rakuten.com/jic/629379/.) There was considerable discussion over use of personal locator beacons and one delegate pointed out that these are mandatory for Australian offshore racing. It was agreed that this incident was something that all ISOM members could all learn from.

A.9. Theme 8: Diplomatic Clearance

A.9.1. Should ISOM Apply for IMO Observer Status? – Geraint West (NOCS)

In further consideration of the issues outlined at A.4.1 regarding the involvement of ISOM in IMO activities such as the MEPC, it was suggested that ISOM consider applying for Observer Status. The UK had already made preliminary inquiries which suggested that such a request would be positively regarded, although the lack of legal status (and therefore registered office) might prove a stumbling block.

In discussion there was general support, although it was recognised that the legal status issue might be a problem while ISOM members would also have to consider the views of agencies higher up their own 'food chain'. During this discussion a query was also raised that several member had heard that the MSR application process was being reviewed. This was confirmed although few details were known and ***it was agreed that NOCS would investigate and provide more information on the review of MSR application process to members.*** *(post-meeting note: the UK attended a working group on behalf of ISOM and a report has subsequently been submitted to members.* ***It was also agreed that the Chair and Vice-Chair would prepare a paper on IMO observer status for consideration at the next meeting.***

A.10. Theme 9: Data Handling, Databases, Web Portals and Public Outreach

A.10.1. EurOcean Web Portal - Per Nieuwejaar (President, EurOcean)

EurOcean was created in 2002 as the result of a joint French-Portuguese initiative. It now has 12 full Member Organisations from 9 European Member States and 3 Cooperating Member Organisations. It has an office in Lisbon and receives financial and technical support from its Member Organisations and Cooperating Organisations. Its objectives are:

- To facilitate access to, and compile relevant information on, marine science and technology at national and European levels.
- To encourage communication and cooperation between the European organisations with activities within marine research.
- To initiate the preparation of analyses, reports and other products.

The Executive Director Laurent d'Ozouville retired and was replaced with Telmo Carvallo on 1 January 2009, while the President and "Founding Father" of EurOcean, Professor Mario Ruivo was replaced by Per Nieuwejaar on 2 November 2008.

A.10.2. Google Ocean and Classroom@Sea - Geraint West (NOCS)

Google Ocean is a new extension to Google Earth and was only just being rolled out at the time of the meeting. The extension incorporates the new GEBCO_08 global bathymetry model, which has a spatial resolution of 30 arc-seconds as well as contributions from a range of global oceanographic organisations.

Classroom@Sea (www.classroomatsea.net) is a NOCS website dedicated to public outreach from research cruises. The website is specifically designed to support schoolchildren and NOCS cruises now regularly take schoolteachers to sea so that content is more targeted.

In discussion, it was clear that a number of ISOM members support similar activities including blogs and daily logs. It was stated that Classroom@Sea is directly funded by NOCS/NERC.

A.10.3. POGO – International Research Cruise Database - Marieke Rietveld (NIOZ)

The Partnership for Observation of the Global Oceans (POGO) is a forum of directors and leaders of major oceanographic institutions around the world and representatives of international and regional programs and organisations, to promote global oceanography with particular emphasis on the implementation of an international and integrated global ocean observing system. At the 6th meeting of POGO in 2005, members recognised the need to improve information sharing on pre-planned, planned, current and past cruises to enhance awareness of opportunities, and to improve the cost-effectiveness of cruises. A working group was therefore established to review the need for an International Cruise Information Database and related website from the perspective of international programmes and initiatives. The perceived benefits of the database are:

- Help scientists from different countries coordinate future funded research through information about research vessels of opportunity;
- Aid in retrospective ability to find data in regions of interest;
- Facilitate projects to conduct joint work and to fill empty berths;
- Create capacity-building and training opportunities;
- Aid in tracking and distributing data;
- Information to evaluate the benefit of ship observations as part of GOOS;
- Facilitate scientists and operational users from other projects to get instruments deployed and/or samples taken in hard-to-reach areas of the ocean (e.g. drifters, profiling floats, moored buoy servicing);
- Enable cost sharing among institutions, projects, and nations;
- Enable inter-comparisons, inter-calibrations, validation among different data types (eg. CTD vs. Argo, in situ vs. remote sensing.)

ISOM members were encouraged to visit the website (**www.pogo-oceancruises.org)** and to respond to requests for data from British Oceanographic Data Centre (BODC) for cruise information.

In discussion the website was generally recognised as a very useful tool, although one delegate remarked that it was not helpful for BODC to email their Chief Executive asking why data has not been submitted!

A.11. Theme 10: Research Vessel and Equipment Performance

A.11.1. Ocean Class AGOR Trade Studies - Dan Rolland (Alion)

Two notional designs have been produced to test ideas of threshold (i.e. minimum requirements) versus objective (i.e. optimum). A sonar performance study has focussed on trade offs between performance and draft and fuel economy as a function of hull form and flush-mounted sonars. Separately a Propulsor/DP trade study has examined cost and DP performance where the threshold is SS4 and the objective is SS5. Z-drives have been discounted due to high maintenance cost (assessed at probably equating to a few hundred $ per day), and heavily influenced by the need to keep a set of gear spares due to having had failures on every UNOLS ship fitted with Z-drives. Innovative approaches include incorporation of a centralised freshwater cooling exchanger system which results in cheaper piping and less maintenance, while there is a strong emphasis on CBM health-monitoring, particularly of vibration in order to assess when components needs replacing. As far as analysis of AC versus DC options go; AC has become predominant on modern vessels since its generally lighter and cheaper to maintain, although DC has not been totally discounted if quietness is deemed to be critical.

In discussion, it was stated that the intended manning will be about 22 or 23 (compares to the US Coastguard minimum manning of ca. 18 for a vessel of this size.)

A.11.2. Multi-beam / Bubble Sweep-Down - Tim Gates (Mantech)

Bubble sweep-down and hydrodynamic effects on multibeam performance is a critical concern among all research vessel operators who are involved in new-builds. Experience indicates that gondolas give the best performance, but there are significant penalties to pay in terms of drag and resultant fuel costs, while there is also some evidence to suggest that gondola-induced wakes can induce noise in props resulting in adverse impacts on URN (n.b. ICES 209). Other strategies include installation of transducers forward of the bubble inception point, but this is often limited by keel area, and while bulbous bows are generally detrimental to performance, a bulged shape to push bubbles up and aft can be beneficial.

This subject promoted a significant amount of discussion including consideration of flat-bottomed ships; and in this case the US TAGS 51 class ships were quoted, which have quite flat bottoms, but only suffer limited impact since bubbles remain above the bottom (although if they do, they tend to stay there and spread out.) Some operators reported that they had not noticed an increase in fuel consumption with a gondola, but it was generally recognised was that a gondola must increase drag with a consequent impact. In the case of the *Pourquoi Pas?* with a 9m wide 10m long gondola, drag was noted to be ca. 5-10%, but sharing information was encouraged so that mistakes are not repeated. The point regarding a bulged bow was noted, but ISOM delegates were curious to know how pronounced this could be before it had a detrimental effect. In respect of the US AGOR trade study (see A.11.1) it was noted that performance was still a trade off, with modelling suggesting anywhere between a 3-5% increase in drag (best case) compared to 7-8% in drag (worst case); in both cases it wasn't a sufficiently beneficial trade-off to make a viable case for fitting of a 1° x 1° array. A final point of discussion was difficulty in modelling bubble sweepdown and it was noted that while CFD can model flow, it can't model bubbles, although some success with using dye was reported.

A.12. Theme 11: AUVs and ROVs

A.12.1. IFREMER submarines Update: *Victor 6000* and *Sysif* - Olivier Lefort (IFREMER)
IFREMER philosophy is that it must have a 6000m capable vehicle available at all times, and as a consequence it has decided to embark on a €3.5M modernization of the *Victor* ROV (see B.6.3 for details) which is intended to keep the vehicle in service for another 10 years. One specific issue is replacement of tethers (of which 3 have been lost in the past 6 years); and although these are only 300m long, they cost €70k apiece, and as a consequence 2 options are being considered: either qualification of a second supplier or development of a new tether with a central spare cable.

Also outlined was the *Sysif* compact high resolution seismic system which is a 2.5T vehicle towed from the *Victor* umbilical winch using a *Victor* 20mm cable. The vehicle comprises a 250 – 2000Hz transducer with an integrated 100m 2 channel streamer.

Discussion centred around the *Sysif* system and it was made clear during this that a multibeam survey is a prerequisite since the vehicle is towed close to the seabed and the winch operator has to be aware of seabed topography. Nevertheless it was felt that it could be an attractive option in ice-cover areas.

A.13. Theme 12: Manning

A.13.1. Manning Standards - Geraint West (NOCS)
The manning questionnaire has been updated by some ISOM members and will be reissued prior to the next meeting. In addition NSF has agreed to participate and it is hoped to receive completed questionnaires from UNOLS operators prior to the next ISOM.

A.13.2. Medical Requirements - Geraint West (NOCS)
There is currently considerable variety in the medical standards applied to personnel in ISOM vessels. This is partly due to variation in national legislation, but in the UK, there is growing concern that the mandatory merchant seamen's medical is just a bare minimum and insufficiently stringent to provide assurance for vessels working in very remote areas. ISOM members were encouraged to share information on their respective standards, particularly if these had been enhanced beyond the minimum legal requirements for their respective marine administration.

A number of ISOM members recognised this issue and it was reported that NIWA have an enhanced medical standard under review, while both the Canadian Coastguard and NOAA use a screening questionnaire, particularly to monitor changes since the individual's last medical.

A.14. Theme 13: Show and tell

A.14.1. ICES209 Revision and Cost of Implementation - Per Nieuwejaar (IMR)
The ICES CRR 209 was put forward by a Study Group in 1995 with a later Guidance Note and while the levels set are now generally accepted, there remains uncertainty over the frequency range from 1–20 Hz since fish hearing threshold and avoidance reactions at these frequencies are still poorly understood.

A number of measures have been implemented in ship design with the requirements of ICES 209 in mind; these include:

- Diesel-electric (DC) propulsion system

- Large, slow rotating 5-blade fixed pitch propeller(s)
- Motion damping of engines, pumps etc
- Wide bends on all pipes to avoid turbulense and pipe ”shivering”
- Avoid ”standing waves” in exhaust pipes

It was suggested that most measures taken to lower radiated vessel noise benefit other hydroacoustic systems and fisheries acoustics due to an improved signal-to-noise ratio, and so are appropriate for most research vessels rather than just fisheries research. Other benefits inlcude lower vibration levels which improves the living conditions for crew, as well for the use of microscopes and other ”fine tuned” working operations. Nevertheless, not all RVs are able to impelment all the measures described above and the relative contribution of each is poorly unserstood. Consequently it was suggested that while ICES 209 is predominantly the province of fisheries resaerchers, there are geological and/or oceanographic researchers who might be interested in establishing a ”common yard stick” for RVs. It was suggested that RV operators in general should take more of an interst in this issue, perhaps studying it in conjunction with other hydroacoustic perfomance issues such as bubble sweepdown.

This issue generated a significant amount of discussion with a number of operators highlighting their own experience with achieving ICES 209, and the best practice of both initially measuring compliance and then monitoring through the life of the ship. In this respect the Canadian Coastguard particularly noted the use of inter-comparison between vessels and the implementation of a noise and vibration control policy and plan on their vessels, while IFREMER echoed this, pointing to the need for QA and monitoring activities. The difference between sonar self noise and radiated noise was also discussed, but not all shipyards have an adequate understanding of this issue which can be problematic, with most having to resort to engaging a noise consultant. ***It was suggested that RV organisation and groups like ISOM, ERVO and Eurofleets should take a lead in defining best practice.***

A.14.2. Wiki Technical Knowledge Base on BAS Vessels - David Blake (BAS)

BAS have established an engineering and ICT Wiki on their ships in order to overcome difficulties with ensuring that science data is recorded in an agreed and consistent format with the correct metadata. This has partly arisen because of the issues with setup of instrumentation and ICT systems being transferred between cruises in an ad-hoc manner. Consequently, a Wiki is now used to record hardware and software configurations, underway data formats, sensor details and problems, faults, maintenance, as well as providing a reference source to avoid setup problems.

The management and technical strategy for VSAT communications onboard BAS ships was also outlined, while the system in use would be made available as shareware.

Discussion mainly centred on BAS’ management of VSAT bandwidth and issues were raised by other ISOM delegates concerning routine software updates potentially clogging bandwidth when the ship is part of the base network. Nevertheless it was stated that implementation of VSAT in BAS had reduced communications costs by 50%.

A.14.3. Engine Alignment Problems *Celtic Explorer* - John Breslin (MI)

While carrying out a starboard generating engine scheduled 20,000 hour overhaul and Class Survey what appeared to be a small area of de-lamination was discovered in the main journal/thrust. Further examination of the crankshaft in the workshop found the journal not to be delaminated but layered with white metal in one area near the oil hole. Following re-assembly, the engine could not be aligned with the alternator. Further investigation found that the transportation plates had not been removed from the engine movement limiters at the time of new building. Inspection of the port and centre engines also

revealed that the transportation plates were still fitted. Following exhaustive investigation and in light of findings MI alleged that damage sustained in way of the port and starboard generating engine crankshafts and the ensuing abnormal conditions found in way of all three generating engines is as a result of shipbuilders and/or engine manufacturers negligence by way of not removing the transportation plates from the engine limiters prior to installation and commissioning in 2001. The case has now gone to arbitration; however MI has decided not continue its involvement in the arbitration and so the engine damage claim is now being pursued by the underwriters.

During discussion, one of the most startling aspects of this incident to be noted was that the ship still achieved ICES 209 even in this condition, and it was confirmed that the ship had indeed been ranged on delivery, while vibration had been measured across the fleximounts. In this latter respect BAS noted that the fleximounts on the *James Clark Ross* had been replaced after 25,000hrs, but no apparent deterioration had been noted. The majority of the discussion, however, centred on the legal aspects and it was pointed out that contrary to the senior council advice given in Ireland to MI, consequential damages are not available for this sort of situation in the USA. Nevertheless, Interruption of Business insurance is commercially available and usually relatively affordable, although MI did state that this had been investigated but not taken up as it was not that cheap. NIWA noted that the do hold insurance for business continuity due to the risk of natural hazards such as earthquakes.

A.15. Closing of 22nd ISOM

A.15.1. Suggestions and Topics for ISOM 2009 - Fred Smits (NIWA)

The following subjects for discussion were either raised during this session or previously during the meeting:

- Multibeam installation issues - It was agreed that a day's workshop immediately prior to the next ISOM meeting would be organised. IFM-GEOMAR undertook to host this and Tim Gates, Olivier Lefort and Geraint West will coordinate the agenda.
- Underwater Radiated Noise and ICES 209 – Fred Stein undertook to arrange for a visiting speaker.
- A new 'holistic' theme on health, environment, people and training was suggested.
- Legal aspects and inspection procedures for hired vessels.
- Code of practice for safety training.
- IMO observer status for consideration at the next meeting: Chair and Vice-Chair will present a paper.

A.15.2. Date, Place and Venue for 23rd ISOM (2010) - Dr Klaus von Broeckel (IFM)

ISOM members were presented with an overview of Kiel as the venue for the 23rd ISOM and shown a short introductory video. All ISOM members were warmly invited to participate in the 23rd ISOM which will be organised by Leibniz Institute of Marine Sciences at the Christian-Albrechts University of Kiel IFM-GEOMAR in Kiel 17 – 19 March 2010

A.15.3. Date, Place and Venue for 24th ISOM (2011)

The USA agreed in principle to host the 24th ISOM and since the meeting, the University of Washington has offered to host in Seattle, provisionally in late April or May 2011.

A.16. Adjourn

Fred Smits expressed the honour that he and NIWA felt in having had the opportunity to host 55 ISOM members from 17 different countries for the 22nd ISOM meeting, after which the meeting was adjourned.

A.17. Undertakings

1. A.2.1 ***In response to an inquiry from Jennifer Nield, John Campbell undertook to supply her with specifics of new laboratory on Aurora Australis.***

2. A.2.2 ***In discussion it requested that all participants Dennis Nixon know if they experience increased insurance premiums.***

3. A.4.4 ***NIWA undertook to provide details of prop coatings investigated to other ISOM members.***

4. A.4.5 ***It was agreed to further discuss the legal aspects and inspection procedures for hired vessels at the next ISOM meeting.***

5. A.8.3 ***NOCS undertook to circulate copies of its own safety data format to other interested members.***

6. A.8.4 ***It was suggested that ISOM consider developing a code of practice for safety training***.

7. A.9.1 ***It was agreed that NOCS would investigate and provide more information on the review of MSR application process to members.***

8. A.9.1 ***It was also agreed that the Chair and Vice-Chair would prepare a paper on IMO observer status for consideration at the next meeting.***

9. A.14.1 ***It was suggested that RV organisation and groups like ISOM, ERVO and Eurofleets should take a lead in defining best practice.***

B. Country Reports

B.1. Australia - Captain Fred Stein (CSIRO, Marine Research)

B.1.1. Overview

B.1.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Southern Surveyor		Ocean	66	1972 (converted 1994)		Australia, Papua New Guinea, Fiji	Operated by P&O Maritime Services on behalf of the MNF.	*See A.3.1 above*
Aurora Australis						Antarctica	Has provided Antarctic support, resupply and marine science services under charter from P&O Maritime Services to Australian Government Antarctic Division since 1990. This extended in 2007 to 2012. Since the 06/07 Antarctic season has been the subject of a significant upgrade package that included ▪ Accommodation ▪ A new laboratory ▪ Existing laboratory refurbishment	
Solander			36	2007			Australian Institute of Marine Science	
Cape Fergusson			22	2000				

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Negerin							South Australian Research and Development Institute	
Naturaliste							Western Australian Department of Fisheries	

B.1.3. Equipment

B.1.4. Cooperation

B.2. Belgium – Andre Pollentier (Belgium Federal Science Office, Royal Belgium Institute for Natural Sciences department MUMM)

B.2.1. Overview

B.2.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations	Notes	Plans for Replacement
Belgica		Regional	51	1984	180	Mainly Southern Bight North Sea & regional area beyond (English Channel, Irish Sea, and eastern Atlantic continental margin)	Belgica is operated by the Belgian Navy on behalf/expense of MUMM which manages the vessel. Manned by only one fixed crew Operating cost: 1.850 M€/y An additional shallow water multibeam system (EM3002D) has been installed during the summer of 2008 and also the single beam scientific echo sounder has been replaced by a Kongsberg EA 400 system while a 38 kHz transducer has been added allowing surveys in water depths until 2000 meter. Three incidents involving, not yet settled, CASCO insurance have been reported: in 2006 the Belgica ran into an illegal gill net in Irish waters causing considerable damage (estimated at EUR 250.000) to the propeller. Early 2007 an incident with the port main generator occurred as well as a high tension on the ship's electric system while powered by a harbour generator during a maintenance period.	In January 2009 a modest feasibility study has been granted concerning the replacement or mid life conversion of the Belgica.
Zeeleeuw		Regional (Refitted Pilot tender)	55	1977	150	Coastal Zone	Operated by VLIZ & Department Fleet (Flanders Min. Science & Public Works) incident which occurred early 2008; the ship was rammed by a ferry while berthed.	In 2008 an agreement between the Ministry of Science & Public Works has been signed to substantiate the research facilities of the Flanders Marine Institute task through the funding for a new built coastal research vessel (length about 35 meters) & land based facilities.
NEW		*Coastal*	*ca. 35*			*Near coastal area Belgian Continental Shelf*	Flanders Marine Institute • Project started in 2005 • Complementarity with Belgica	

						Hull - Le Havre - Bremerhaven	• End 2006 : concept • Aug 2007 : allocation of 1.1 mil €/yr (ship scientific equipment + land based facilities) • (Early) 2009 budget available • 12.5m € (incl vat & scientific equip) • Tender (early) 2009	

B.2.3. Equipment

B.2.4. Cooperation

B.3. Canada - Captain Ron Grady (Department of Fisheries and Oceans, Canadian Coast Guard)

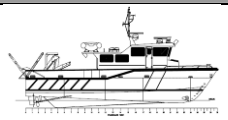
B.3.1. Overview

The Canadian Coast Guard recently presented a proposal to government for a systematic approach to replacing their ageing fleet of ships and aircraft. The "Fleet Renewal Plan", has since been adopted as the blue print for replacing all of the vessels within the civilian government fleet over the next 25 years.

The main component of the initiative is the cost saving measures of not only reducing the number of vessels, but standardizing the number of classes. Presently there exist 52 configurations of ships in the Coast Guard Fleet within 30 different classes. Of these, 19 are focussed on scientific research nearly full time, while the remaining vessels conduct research to varying degrees.

The plan as presented is to standardise the Fleet at 114 ships within 15 different classes. The idea is to realise savings through a smaller yet more efficient and capable group of vessels respecting life cycle maintenance efficiencies inherent in the various classes.

B.3.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Near-shore Science Research Vessels							Two 'subclasses': • Semi-planing hull (for larger areas of research requiring a higher speed) • Full displacement hull for ocean research. With respect to the current status of the build program, the first of two 18 M semi-displacement Near Shore Fisheries Research Vessels (NSFRV) was nearing the completion of construction with delivery in February 09. The second is scheduled for delivery in October.09. Given their higher speed of 16 knots and range in excess 400 nm, these vessels are designed to cover vast amounts of territory for shallow water research in a relatively short period of time. One will be assigned to the Great Lakes area, while the other will be assigned to the Bay of Fundy on Canada's East Coast. Three full displacement NSFRVs are planned to be constructed over the next two years. These vessels will be in the 20 to 25 M range.	

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Mamilossa		Hovercraft					This is nearing completion and scheduled for delivery in the Quebec region of Canada for SAR and icebreaking.	
Offshore Fisheries Research Vessel							Hit with market volatility coupled with devaluation in the currency with respect to the US dollar and euro, Canada is undergoing a review of these planned vessels and will determine what is the most appropriate plan of action later in the year. It is hoped that a more favourable update can be put forward at the next meeting.	
Offshore Oceanographic Vessel								
40 M Patrol Vessels							A Request for Proposal will be issued by June. These vessels are intended for the Great Lakes and the East and West coasts.	
New Polar Icebreaker							The office for the development of the Statement of Operational Requirements is currently in the process of being set up at 200 Elgin Street in Ottawa. Canada plans on prolonging its yearly 'active presence' in the region by constructing a far more capable ship with better icebreaking capability, range, hotel endurance, and onboard capability for scientific research. More detailed analysis will be available at the next meeting.	

B.3.3. Equipment

B.3.4. Cooperation

B.4. China - Dr Fan Wang (IOCAS)

B.4.1. Overview

B.4.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
R/V Shiyan 1				2008			Displacement: 2500 ton SWATH	
R/V Haiyang 6				2008			Displacement: 4500 ton	
"KeXue" (Science)				*New Build*			*Multi-purpose Oceanographic Research Vessel (MORV)*	

B.4.3. Equipment

B.4.4. Cooperation

B.5. Denmark – Steen Silberg (DIFRES)

B.5.1. Overview

The organisations in Denmark that are dealing with ocean research are being restructured into national centres. However the vessels are owned by the universities. The two national centres will be the national ocean research centre and the marine service centre. The national ocean research centre will coordinate the national funds for ocean research and allocate research time on the various vessels including international charter. This means it will recommend and fund new vessels, equipment and awareness campaigns. The national marine service centre will operate the vessels and the equipment. It will do so by using its workshop and storage facilities. The link between these two centres is that the ocean research centre will have a secretary and a technical forum where the national marine service centre will be represented.

B.5.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Dana		Global	81				Technical University of Denmark	
Gunnar Thorson		Local	81				Royal Danish Navy Oil spill	
Pamiut		Regional	71				Greenland Institute of Nature Deep sea fishing	
Alfred Jensen		Local	67				Greenland Institute of Nature	

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Havfisken		Local	63				Technical University of Denmark	
Ophelia		Local	59				Copenhagen University Education	
Genetica II		Local	61				Aarhus University Education	
Havkatten		Local	70				Technical University of Denmark	
New vessel strategy		Global multidiscipline	65				Greenland, the North Atlantic and outer Danish waters	
"		regional	35				New multipurpose research vessel to replace all smaller vessels in the North Sea, internal Danish waters and the Baltic Sea. fish stock monitoring and education of fishermen	
"		"	"				"	

B.5.3. Equipment

Equipment news was that a new line of very low cost equipment was developed including: underwater Video equipment, buoys and towed acoustic equipment. A number of systems were upgraded including bottom video sledge, vessel information systems, fish registration systems, and ROV and container laboratories. A container terminal was also established with support for hot/cold water, salt water, waste water, electric power supply and data-network.

Steen then presented the strategy behind the low cost towed acoustic equipment and the vessel information systems that including a release of the free ship information system that was based on free Google Earth modules.

At the end Steen informed that by redundant and robust equipment the institute has be able to relocate technical support from monitoring cruises to scientific cruises and work ashore. Finally Steen informed about the coming ERVO meeting in May in Copenhagen.

B.5.4. Cooperation

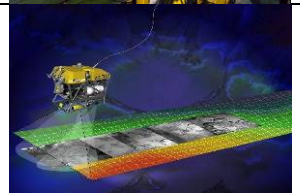
B.6. France – Olivier Lefort (IFREMER)

B.6.1. Overview

B.6.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Pourquoi Pas?		Global	108	2005		N. Atlantic, S. Atlantic, W. Mediterranean		
L'Atalante		Global	85	1990		N. Atlantic, S. Atlantic, W. Mediterranean	Modernisation : vessel has entered the Shipyard in November 2008. To be redelivered in may 2009 : Change of all scientific equipments including one EM 122 and one EM 710 multibeam echo sounders, rebuild of laboratories and scientific spaces, mid-life maintenance	
Thalassa						N. Atlantic and North Sea	Installation of a VSAT band Ku.	
Le Suroit			56	1975		N. Atlantic & W. Mediterranean		
Haliotis		*work boat*		*2008*			Entered service in for shallow waters mapping (<10m)	

B.6.3. Equipment

Name		Type	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Nautile							
Victor		ROV	1996			Undergoing modernization including: • New power supply • New real time hardware and software : o Choice of compact industrial hardware (PCI) o New software delivered from ICE (also supplier of Ifremer AUVs real time software) • Implementation of 3 new work stations in a Gbit network • Adaptation of up to date software : o Techsas o Caraibes o Mimosa • New video HD camera for direct and vertical vision • Repacement of DVDs with hard disks for data storage: 8 hard disks of 750 GO for a campaign of 15 dives of 20 hours, instead of 300 DVDs! • New digital camera (APN 2) • Upgrade of navigation • New interface for ADCP	

B.6.4. Cooperation

B.7. Germany - Dr Klaus von Broeckel (Leibniz-Institute fur Meereswissenschaften)

B.7.1. Overview

Different federal as well as state ministries run about 23 vessels of different sizes. In general ages are increasing and the fleet aging. Several replacements are under way (Sonne) and planned within the next few years (Poseidon, Polarstern and some smaller regional ones). For the oceanographic science community the important RVs belong to the Ministry of Education and Research (BMBF).

B.7.2. Vessels

Name		Type	LOA	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Meteor		Global	98	1986	320	East and west coast of middle and southern Africa.	100% ownership by the Federal German Government run by shipping company Laeisz. 'Flagship' is now fulfilling its 77 expedition off the South American coast. Gained relative good experience with new retractable bow thruster and DP during station keeping.	
Polarstern		Global (Polar)	118	1982	320	30 expeditions in Arctic (Mai – September) and Antarctic waters (November – March) circumnavigated North Pole	Alfred-Wegener-Institut in Bremerhaven: 100% ownership by the Federal GermanGovernment run by shipping company Laeisz. In March 2008 severe helicopter accident occurred, when commuting between ship and station being built in Antarctic, resulting in 2 dead and 3 injured persons. Due to high fuel costs cruising speed had to be reduced to about 9 kn. This means less working days for science in 2009.	Board of trustees decided to prepare study for replacement.
Maria S. Merian		Ocean	95	2006		Baltic and Labrador Sea down to waters surrounding Cape Verde Island and the coast of Namibia.	100% ownership by the federal state of Mecklenburg Vorpommern run by shipping company Briese Newest and most modern RV of fleet. She is slowly getting out of her teething problems. She shows excellent manoeuvrability and station keeping with pods, pump jet and DP Another unscheduled docking in December 2008 was necessary due to sealing problems between one pod and hull.	

Name		Type	LOA	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Sonne		Global	98	1969 (rebuilt 1977)	250	mainly Pacific and Indian Ocean.	100% ownership by RF Forschungsschiffahrt GmbH Project Management organization Juelich has a charter agreement over 250 days/ year with the owner. The only privately owned ship in German fleet. She is chartered by Federal Ministry of Education and Research for per year. She was chartered by India and Australia in 2008.	Will be replaced by government owned multidisciplinary RV in 2013 (See A.3.10) general data - about 106 m in lengths - cruising speed 12 kt (max. 15 kt) - cruising range 7500 sm - endurance 50 days - no ice-class - engines (diesel-electric) - low noise level - stabilisation during cruising and on station - dynamic positioning - hydro-acoustic system - 560 m2 labs and scientific rooms - 600 m2 working deck - winches 6000 to 12000 m cables/wires - 32 crew - 40 scientists
Poseidon		Ocean	61	1976		Baltic Sea, North Atlantic, Mediterranean and Black Sea.	The 'old lady' of the Leibniz Institute of Ocean Sciences (IFM-GEOMAR) In 2008 some winch and general pipe troubles due to high age. Since 1976 has made nearly 380 expeditions in the	The ship will be replaced within the next 5 years with first planning discussions starting summer 2009.
Alkor *Heincke*		Regional	55	1990		mainly working within the Baltic and the North Sea.	regional vessels for science and education Both vessels are in the process of getting major refit including new engines for ALKOR:	

B.7.3. Equipment

B.7.4. Cooperation

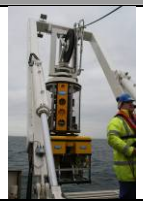
B.8. Ireland - John Breslin (Marine Institute)

B.8.1. Overview

B.8.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Celtic Explorer:		Ocean	65.5	2002	253	Irish continental shelf and N. Atlantic, including Mid-Atlantic Ridge		
Celtic Voyager		Regional	31.5	1997	267	Irish coasts		

B.8.3. Equipment

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
SMD Quasar		work class ROV		Delivered in August 2008	55 days work planned for 2009		3000m operating depth 100hp, Hydraulic Self contained portable launch and recovery system, workshop and control containers FOAT January 2009 First Mission April 2009	

B.8.4. Cooperation

B.9. Japan Mr Katsufumi Akazawa (JAMSTEC)

B.9.1. Overview

B.9.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
NATSUSHIMA			67	1981	274		Operated by NME	
YOKOSUKA			105	1990	247		"	
KAIYOU			62	1985	234		"	
KAIREI			105	1997	286		"	
MIRAI		Global	129	1997	253			
TANSEI MARU		Regional	51	1982	160		Transferred From Tokyo University's Ocean Research Institute	

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
HAKUHOU MARU		Ocean	100	1989	268		"	

B.9.3. Equipment

B.9.4. Cooperation

B.10. Netherlands- Ms Marieke Rietveld (NIOZ)

B.10.1. Overview

B.10.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Pelagia		Ocean	66	1991	323	North Sea, North Atlantic Ocean: North East Atlantic – Equatorial North Atlantic (Brasil), Mediterranean Sea, Indian Ocean (Arabian Sea)	Kongsberg EM 300 upgraded to EM 302 and SATest successful 2009/2010: MID-LIFE REFIT including New data acquisition and data logging system New TITAN Ultra Clean CTD system with Large Volume Samplers	
Navicula			24	1981				
Stern			*15*					

B.10.3. Equipment

Name		Type	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
MOVE		*Mobile Lander*			*Galicia bank*		

B.10.4. Cooperation

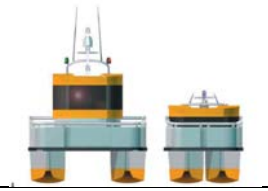
Barter cruise Indian Ocean Mozambique Channel: NIOZ team on board RV METEOR 18 January – 5 February 2008.

Barter cruise Gulf of Cadiz: MARUM Bremen team on board RV PELAGIA 9 February – 17 March 2008.
IPY cruise RV POLARSTERN - ANTARCTIC 6 February – 17 April 2008: NIOZ team on board with all titanium Ultra Clean CTD sampling system (TITAN) with Ultra Clean Container (UCC) and Deep Sea Winch with Kevlar cable for metal detection.
Combined barter cruise RV DISCOVERY: 4 d intervention NIOZ team Irminger Sea between 20 August - 25 September 2008.
Barter cruise Arabian Sea: University of Aberdeen/NOCS team on board RV PELAGIA 10 December 2008 – 7 January 2009.

B.11. New Zealand Mr Greg Foothead (NIWA)

B.11.1. Overview

B.11.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Tangaroa			70	1991			Will be upgraded to DP2 during 2009/10 (See A.3.11) • Replace aging EM300 transducers • Enhance scientific sounder array • Upgrade winch control system • Upgrade ADCP	
Kaharoa			28	1981				
Coastal Research Vessel			13.9					
CONCAT							Containerized Catamaran	

B.11.3. Equipment

B.11.4. Cooperation

B.12. Norway - Per Nieuwejaar (IMR)

B.12.1. Overview

The Norwegian Institute of Marine Research (IMR) owns four vessels, operates two for other owners and rents another two vessels.

B.12.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
G.O.Sars			77.5	2003			6 months cruise with “G.O. Sars” to South America, Antarctica and South Africa between November 2007 and May 2008	
Johan Hjort			64.4	1990			Johan Hjort will have a DP system installed at the beginning of 2009	
Håkon Mosby			47	1980				
G.M.Dannevig			28	1979				

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Dr Fridtjof Nansen			57	1993		Change in area of operation from Angola, Namibia and South Africa to Mozambique and Madagascar	Owner: NORAD In 2009 the "Dr. Fridtjof Nansen" will work even further north on the East-African coast and in the Indian Ocean. More details, unfortunately only in Norwegian, can be found on www.imr.no or http://rederi.imr.no	
Hans Brattström			24.3	1992			Owner: University of Bergen	
Fangst			15	2000	200		Rented	
Jan Mayen			63,8	1988	75		Rented.	To be replaced by new Polar Icebreaker
NEW Polar 10 Icebreaker			100				See A.3.4 • Multifunctional (biology, oceanography, geology) • Icebreaker (DNV Polar 10) • Helicopter carrier • Logistics vessel • Training and education • Endurance • Clean ship	

For more information about the vessels, please visit our website www.imr.no
Some cruise information for the oceangoing vessels can also be found on www.pogo-oceancruises.org

B.12.3. Equipment

B.12.4. Cooperation

With other agencies

The Norwegian Parliament allocated funding for concept definition for an icegoing research vessel on 5 October 2007, and the IMR/RV department is the lead agency for the project. It is a joint project involving five different ministries and eight different research institutes and

universities in Norway. The IMR/RV department are negotiating with the National Hydrographic Service about taking over the technical management and manning of their vessel "Hydrograf" and their smaller survey boats.

International cooperation

IMR became a full member of the Ocean Facilities Exchange Group (OFEG) in November 2006. IMR is a coordinating agency for "Networking activities" in the EUROFLEET project and has currently the presidency in the EurOcean, the European information centre for marine science and technology. IMR/RV department is represented in a working group for the "Aurora Borealis" project and also participated in the final design review for the ARRV-project in USA in October 2008.

B.13. South Africa – Ian Calvert (Smit Marine)

B.13.1. Overview

B.13.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
SA Agulhas						Antarctica, Marion, Gough, Tristan da Cunha	Directorate: Antarctica & Islands Blue Water Research/Antarctic & Island Supply	See A.3.7
FRS Africana		Inshore Research					Fisheries Research	
FRS Algoa		Offshore Research					Fisheries Research	
FRS Ellen Khuzwayo		Inshore Research					Fisheries Research Replaced FRS Sardinops	

B.13.3. Equipment

B.13.4. Cooperation

B.14. Spain - Prof Juanjo Dañobeitia (UTM/CSIC)

B.14.1. Overview

B.14.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Sarmiento de Gamboa			70,5	2007	115		DP Class 1 ROV scenario certification. Deployment of Ifremer's Victor 6000 Found origin of beam forming problem on EM120 at faulty Titanium ice window. Manufacturer is implementing a correction algorithm and a window replacement will be done in next dry docking	
Hesperides			82,5	1991	240	Antarctica, Spain & Portugal, Atlantic for Argentina Mediterranean	ICE-Class 1C • VSAT High speed Satcomm (Internet, VoIP): Operator Hisdesat. X Band • Piston corer (10 m)	
Garcia del Cid			37	1977	142		Multibeam echosounder ELAC SeaBeam 1050D dual 50 kHz (3000 m) -180 kHz (600 m). Octopus F-180 Inertial positioning and Attitude sensor (pitch, roll heading, heave)	
Las Palmas			*41,2*	*1978*			*Supplier*	

B.14.3. Equipment

New Equipment:

- Lacoste & Romberg Air- Sea II Gravitymeter
- VSAT High speed Satcomm (Internet, VoIP, VPN Implementation)
- Cytometer sorter
- PCO_2 (testing)

- SeaSoar
- Seismic equipment
- MCS Compressors: Containerized LMF 25/138-207-E50 (MCS Digital streamer to be installed during 2009)
- 18 OBS MOU between SCRIPPS and UTM
- New piston corer: Join venture between OSU (USA) & UTM

B.14.4. Cooperation

B.15. Spain – Mr Jose Diaz (IEO)

B.15.1. Overview

B.15.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Cornide Saavedra			66,7	1972			New equipment: • Biol. Echosounder EK60 o 18, 38, 70, 120, 200 kHz • ADCP 75 kHz • ISO 20' Radio-isotope lab. • ISO 20' Flow-cam lab. • MDM 400	2012 (See A.3.8) • Global vessel • Length 90 m, • Diesel-electric: • ICES 209 • DP II • VSAT • Conceptual project ready
F.P. Navarro			30.5	1987				2009 & 2010 (See A.3.8) • Length 46,8 m • 18,5 M€ each (incl. VAT) • Multipurpose oceanography & fishery research • 330 days/yr. • 8 - 10 scientist • Diesel-electric • Atlantic & Mediterranean waters • DP1: Dynapos AM/AT
Odón de Buen			24.0	1973				
José Rioja			15.8	1984				2015
J.M. Navaz			15.8	1984				2015
Lura			14.3	1981				2012
Thalassa			73,65	1996				2025
NEW		Ocean	50-60					
NEW		Ocean	60				SWATH	

B.15.3. Equipment

B.15.4. Cooperation

B.16. UK - Mr David Blake (BAS)

B.16.1. Overview

Future work includes an investigation into keeping both ships in southern oceans to avoid the North/South passage each year.

B.16.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
James Clark Ross		Global Icebreaker	99	1991		Undertook 22 science cruises for BAS, NERC sponsored science, commercial customers and barter work. The science work was delivered in the Antarctic and Arctic and whilst the ship was on passage between the UK and Antarctica.	Purpose of undertaking multi-disciplinary research and survey in the polar-regions. The vessel also has the capability to undertake logistics work in support of Antarctic programmes. There were many refit items in 2008 including grounding repairs, the installation of new windows and an upgrade of the scientific winches. Future years will bring a greater refit requirement with attention to the galley, corrosion issues and primary mechanical systems needed.	
Ernest Shackleton		Global logistics	80	1995			Primarily used for logistics work but does mount several smaller science cruises in the Weddell Sea. On a long lease bare boat charter from Rieber Ship Management, the vessel is also used for 120 days per year in the North Sea.	

B.16.3. Equipment

B.16.4. Cooperation

B.17. UK - Mr Geraint West (NOCS)

B.17.1. Overview

Sea Systems which operates the 2 multidisciplinary global research vessels and National Marine Equipment Pool is part of the National Marine Facilities Division at NOCS. This is quite separate from NERC's other ship operation at BAS (see B.16), but NERC initiated a Ship Management Review in August 2008 to examine whether changes to the arrangements for ship management are necessary.

B.17.2. Vessels

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
James Cook		Global	90	2006	300	E. Pacific, N. Atlantic, S. Atlantic, Indian Ocean, Antarctic.	First full year of operations with a very full programme.	

Discovery		Global	90	1962 (rebuilt 1982)	300	N. Atlantic	Suffered a major motor failure soon after delayed finish to a refit. The ship then went back on science in the North Atlantic but major issues with winches severely curtailed operations. The ship then entered yard for major planned steel-work at the end of 2008. Overall the ship spent 5 months in dockyard hands over the year.	Replacement vessel, also to be named *'Discovery'*, planned to be delivered 2012 (See A.3.3):
								• 50 days endurance (L 99.5m, B 17.5m, D 6.5m)
								• Scientific Transit Speed – 12 knots maximum
								• 23 Officers & Crew
								• 28 Scientists & Technicians
								• DP Capable (DP2) SS6/7
								• Multidisciplinary
								• Seismic capability – limited to high resolution studies
								• Multibeam(s) & Sub Bottom profiler
								• Minimal Ice Class – for hull life (Lloyds 1D)
								• Overside/overstern lifting - 20tonnes
								• Drop Keels
								• Low URN but NOT ICES 209
								• Propulsion
								  • 2 x Azimuthing Units Aft
								  • Azimuthing Thruster Fwd
								  • Manoeuvring Thruster Fwd

B.17.3. Equipment

Name		Type	Built	Op. Days	Main area of operations during year	Notes	Plans for Replacement
Isis		ROV	2002	90	E. Pacific (Hess Deep) and Mid-Atlantic Ridge	6500m depth capability – derivative of WHOI Jason II vehicle	
Autosub3		AUV	2005	60	Antarctic	1700m depth capability.	Autosub6000 with a depth capability of 6000m is currently in development and successfully completed first sea trials during 2008.

B.17.4. Cooperation

The major highlight of 2008 was a 'super barter' with Germany: This comprised a cruise onboard the *James Cook* for Germany in the Eastern Pacific, while the *Sonne* undertook two cruises for NERC off Sumatra with another two planned for 2009. A total of 190 days were exchanged in 2008.

B.18. USA – Bob Houtman (NSF/UNOLS)

B.18.1. Overview

During 2008, the fleet conducted approximately 4400 operational days at sea with cruises all around the world. The federal funding agencies and ship operators were challenged with unexpectedly sharp increases in fuel costs during the second half of the year which required additional funding support to ensure the scheduled science cruises could be conducted.

The US Navy fleet of oceanographic research platforms participate in the University National Oceanographic Laboratory System (UNOLS) consortium, which serves to support and coordinate the scheduling, usage, maintenance, repair and outfitting of the member research facilities.

In planning for the 2009 schedules, the effects of several years of level budgets with increasing fuel and personnel costs became very apparent. Initial projections were for a $13 Million NSF deficit when compared to the planned budget. Through the efforts of the UNOLS Scheduling Committee and NSF Ship Operations Program Director, the expected deficit has been reduced to about $7 Million. This was achieved through a combination of deferring cruises to 2010, moving cruises to smaller ships, instituting partial layups of several ships and finding additional academic research funded work from sources outside of the standard federal agencies.

Finally, at the request of the Office of Naval Research and NSF, the National Research Council has appointed a Committee to review the scientific and technological issues that may impact the evolution of the National Oceanographic Research Fleet over the next 25 years. The Committee will look at such factors as how technological advancements will affect the demand for ships; what are the important factors in research vessel design; what is the impact of evolving modelling and remote sensing technologies on the balance of research operations; and how the increasing costs of ship time will impact the types of science done aboard ships. The project is expected to be completed in about 18 months.

B.18.2. Vessels

The US fleet consists of 22 ships with six Global Class, six Ocean/Intermediate Class, six Regional Class and the four Local Class ships; only a subset are shown below.

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Melville		Global	85	1969			operated by the Scripps Institution of Oceanography	
Roger Revelle		Global	83	1996				
Knorr		Global	85	1970			operated by the Woods Hole Oceanographic Institution	
Atlantis		Global						
Thomas G Thompson		Global	84	1991			operated by the University of Washington	
Kilo Moana		Ocean	57	2002			operated by the University of Hawaii	

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
Flip		Research Platform (R/P)					operated by the Marine Physics Laboratory of Scripps	
Joides Resolution		scientific ocean drilling vessel	143	1978			Has been in refit status for the past several years, but has finally been completed and will be leaving the Jurong shipyard in Singapore on 25 January 2009 to conduct drilling equipment testing. The first science drilling cruise is planned for March 2009.	
Marcus G. Langseth			72	1991 (rebuilt 2007)			Completed its refit to 3D seismic capability and been designated a UNOLS vessel. It has completed a highly successful initial 3D seismic cruise and the scientific community has strongly endorsed the addition of this new capability into the fleet. The challenge to NSF will now be to balance the high operating costs ($75,000/day for 3D seismic) of the vessel versus the cost of the science teams.	
Alaska Region Research Vessel (ARRV)							Successfully completed its Preliminary and Final Design Reviews. This NSF Major Research Equipment and Facilities Construction (MREFC) project was briefed to the National Science Board in December 2008 as an information item. The project package is being refined in preparation for the May 2009 NSB briefing as an action item to request construction funding in the FY2010 federal budget.	
Regional Class Research Vessel (RCRV)							The project completed two preliminary design packages, which revealed the original Rough Order of Magnitude (ROM) construction cost estimates of $20-30 Million have increased to $60-70 Million. This cost growth is more than the	

Name		Type	LOA (m)	Built	Op. Days	Main area of operations during year	Notes	*Plans for Replacement*
							NSF Ocean Science Division budget can afford at this time and program options are being explored.	

B.18.3. Equipment

Name		Type	Built	Op. Days	Main area of Operations during year	Notes	Plans for Replacement
Alvin		Deep Submergence Vessel (DSV)				operated by Woods Hole	The Replacement Human Occupied Vehicle (RHOV) project has an objective of replacing the DSV ALVIN with a 6500 meter capable vessel by FY2011. This project has seen significantly increased construction cost estimates, which have forced NSF to consider alternative approaches. The original total project cost estimate of $22 Million has grown to $50 Million. NSF is proceeding as planned with the 6500 meter personnel sphere construction and a significant percentage of the risk associated with this portion of the project has been retired with the successful forging of the two hemispheres in 2008. The hemispheres will be electron beam welded in the spring of 2009, followed by making the cutouts and welding in the view port inserts. NSF is considering taking a phased approach with the overall project due to the increased costs. During Phase 1 the new personnel sphere would be integrated into the current ALVIN vehicle to deliver a 4500 meter capable vehicle by mid FY2011 and the upgrade to a fully capable 6500 meter vehicle would be an optional Phase 2, dependent on available funding levels.
Hybrid Remotely Operated Vehicle		HROV				Project, which will provide a new vehicle capable of operating either as an ROV or and AUV with 11,000 meter depth rating, has successfully completed its shallow water dive trials and is planned for deep water sea trials in the summer of 2009	
Sentry		*AUV*				*New development project with a 5000m depth capability and which is planned to replace the Autonomous Benthic Explorer (ABE) in the Deep Submergence Facility inventory. It has successfully completed its first science cruise by mapping the sea floor in the Axial Volcano and Hydrate Ridge areas off the coast of Washington and Oregon*	

Name		Type	Built	Op. Days	Main area of Operations during year	Notes	Plans for Replacement
						in support of the planned Ocean Observatories Initiative project.	