Potential Fields Pool Equipment (PFPE)

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Importance of Marine Gravimetry

- Improves scientific understanding of a variety of earth science problems
- Compared to satellites, marine gravimetry provides superior resolution, both in terms of minimum detectable spatial wavelength and the resolved gravity measurement
- Detailed studies of individual features continue to require shipboard gravity data

Existing Infrastructure

- Prior to 2007, only 3 gravimeters were permanently installed on UNOLS vessels
  - BGM-3 gravimeters on the Ewing/Langseth and the Melville
  - A LaCoste and Romberg gravimeter on the Kilo Moana
- An agreement with NavO provided access to their gravimeters.
- NavO terminated their gravimeter program in 2007 forcing UNOLS to find an alternate source.

2007 Fugro Acquisition - Background

- In 2007, Fugro offered to sell used BGM-3 gravimeters and spare parts to the UNOLS community
- WHOI, SIO, and UAF successfully submitted a proposal to acquire this equipment (NSF-OCE-0705964)
- This equipment was refurbished and delivered to UNOLS by Randy Herr

Acquired equipment included:

- 7 working gravimeters
- 4 gyros
- 8 horizontal acclerometers
- Over 20 power supplies
- Over 20 boards

BGM-3 testing in Randy Herr's "Lab"

2007 Fugro Acquisition - Results

Gravimeter	Purchaser	In Service Date	Host Vessel (Operator)
S210†	NSF	2011	*R/V Thompson* (UWash)
S213	LDEO	1984	*R/V Marcus Langseth* (LDEO)
S218	NSF	2007	*R/V Revelle* (SIO)
S219	NSF	2007	*R/V Knorr* (WHOI)
S220‡	NSF	2007	WHOI (WHOI)
S221	NSF	2007	*USCGS Healy* (UAF)
S222*	NSF	2007	*USCGS Healy* (UAF)
S223‡	NSF	2007	*CCGS Louis S. St. Laurent* (WHOI)
S224	SIO		*R/V Melville* (SIO)

† Scheduled to be installed in Spring 2011

‡ Pool gravimeter.

* Scheduled to be transferred to the Arctic Regional Research Vessel (ARRV) in 2014.

Healy (left), Revelle (center), and Knorr (right) Installations. Image Credit: R. Herr

Pool Gravimeters

- In addition to providing permanent gravimeters to 5 vessels, there are 2 pool gravimeters.
- Pool gravimeters are not permanently installed on a ship and available for use on any ship of opportunity
- Since 2007, these pool gravimeters have been used in the Red Sea, Guaymas Basin, Galapagos Spreading Center, and the Arctic.

Left, 2008 Oceanus install for the Red Sea cruise. Right, 2010 install on the CCGS Louis S. St Laurent for Law of the Sea work in the Arctic.

PFPE – Motivation

- The acquisition of these gravimeters resolved the problem of *providing* gravimeters to the UNOLS fleet.
- It did not provide for the ***long-term financial and technical support of this instrumentation***.
  - Technical support was occurring informally but there were no formal best practices.
- In 2009, Fornari and Kinsey discussed with LDEO, SIO, UAF, and WHOI the possibility of forming a gravimeter pool to share equipment and technical expertise.
- All of the operating institutions supported this initiative.
- In June 2009, the Potential Fields Pool Equipment facility was formed.
- An NSF award (NSF-OCE-0943618) for $239k was awarded in Summer 2009 to provide equipment for PFPE

PFPE – Goals

- PFPE provides the UNOLS community with:
  - A supply of spares for maintaining the at-sea BGM-3s
    - Repair or refurbish sensors as necessary
  - Technical Support including on-shore support for the at-sea gravimeters and helping establish best practices.
  - Two pool gravimeters for use of ships of opportunity or as complete emergency spares for the at-sea systems.
- PFPE does **NOT** post-process or archive marine gravity data
  - Such efforts are better suited toward other researchers or community initiatives.

PFPE – Resources

- A SeaSPY towed marine magnetometer available for community use
- Pool gravimeters
- Land Gravimeters
- Gravimeter spares and equipment
  - $55k in spares bought from Lockheed-Martin in 2009

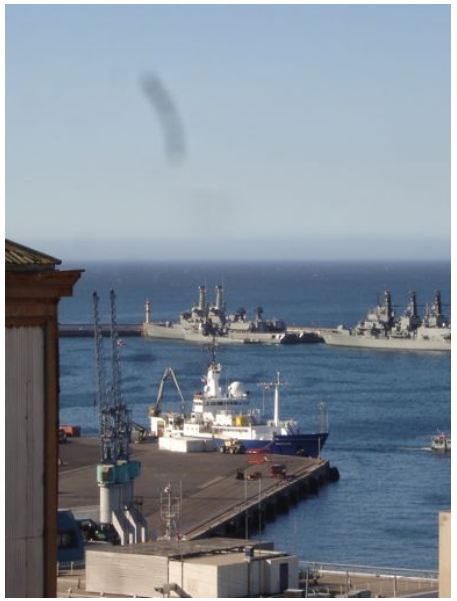
PFPE - Information

- Information on the pool gravimeters is located on the MISO website (Google ‘PFPE WHOI’)

PFPE – Technical Support

- 24/7 on-shore technical support from Kinsey and Herr and helping establish best practices.
- Visits for maintenance, cruise preparation, and emergency repair.
  - February 2010 service visit to the Melville in Valparaiso, Chile and subsequent equipment shipments.
  - April 2010 emergency shipment and installation on the Marcus Langseth in Portland, OR.

Left, emergency gravimeter shipment to the Langseth; Right, Melville in Valparaiso, Chile in February 2010.



Recently Marine Gravity Cruises

Vessel (Gravimeter)	Site	PI
R/V Oceanus (S223)	Red Sea	Bower (WHOI)
R/V Atlantis (S223)	Guaymas Basin	Lizarralde & Soule (WHOI)
R/V Atlantis (S223)	Galapagos Spreading Center	Sinton (UHawaii) & Behn (WHOI)
R/V Melville (S224)	Northern Galapagos Region	Harpp (Colgate)
R/V Revelle (S218)	Chatham Rise	Collins (WHOI)
L.S. St. Laurent (S223)	Arctic	Childs & Hutchinson (USGS)
USCGS Healy (S221)	Arctic	Childs & Hutchinson (USGS)
USCGS Healy (S222)	Arctic	Childs & Hutchinson (USGS)

PFPE – Present Status

- Working with the gyroscope manufacturer to fix refurbished gyros that failed soon after install
  - Likely cause was improper wiring at time of refurbishment
  - PFPE will be recalling some gyros early next year so they can be serviced by USD.
- Monitoring the LDEO gravimeter at WHOI and plan to return the unit to the Langseth in 2011.
- Scheduled install on the Tommy Thompson in April 2011.
  - PFPE will provide towed magnetometer and gravimeter technical support for the Tomaniga-Tivey cruise in Fall 2011.

PFPE – Future Work

- Continue existing support services
- Work with the ship technicians to ensure gravimeters are calibrated and serviced as necessary
- In collaboration with the technicians and scientists:
  - Establish and document best practices
  - Work toward standardizing data formats and establishing at sea data quality control
- Coordinate these efforts with technicians, R2R, and researchers interested in developing tools for processing marine gravity

Feedback from Yesterday's Focus Group

- Weekly Checks
  - Checks are time consuming – is there a way we can automate this?
    - Dale has some ideas. Dale and James are going to follow-up on this
  - Need a better way to transmit data to shore
    - Follow-up on better options
- Maintenance
  - Data buffer may have decadal scale issues with the memory
    - Assess situation starting with the Melville data buffers
    - Based on this assessment start rotating out data buffers for refurhishment
  - Batteries from the 2007 Fugro acquisition need replacement.
    - Add this to the to-do list for upcoming annual servicing
    - Replace the batteries on the Melville and Langseth units

Feedback from Yesterday's Focus Group

- Data Logging and Quality Control
  - Coordinate with R2R to minimize overlap
  - Feedback from technicians on possible solutions
- Gravity Ties
  - Need to regularly perform gravity ties on all ships
    - Document the best practices for gravity ties
  - Frustration with locating gravity stations in foreign ports
    - Foreign gravity station databases are a source and should be employed
    - Better communication between institutions about recent gravity stations
      - A database of UNOLS established gravity stations (but not NGA)

Feedback from Yesterday's Focus Group

- Best Practices
  - Checklists for daily, weekly, and annual maintenance
  - Standardized gravity ties
- An outline is drafted; need input from a working group on this
  - See next slide

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Action Items

- At this meeting will discuss with technical group managers:
  - Gyro swaps
  - Sharing of gravity station information
  - Establish a point of contact at each institution to assist with:
    - Best Practices Documentation
    - Coordinating between PFPE and the operating institution