Load Handling System Workshop
(FIC Meeting – March 2005)

GOAL

" *Develop a conceptual design for the "next-generation" over-the-side load handling system for the UNOLS fleet."*

Committee Members:

Matt Hawkins, Chair

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- One year effort.
- Joint-funded by NSF and ONR.
- Focused on ship visits and field evaluations of existing systems.
- Must also address:
  - Loading Handling System design standards
  - Incorporation of “Next-generation” UNOLS wire
  - “Next-generation” science packages
  - Motion compensation
  - “Hands-free” deployment and recovery
  - Size/Weight: “Scale-able” to different vessel classes

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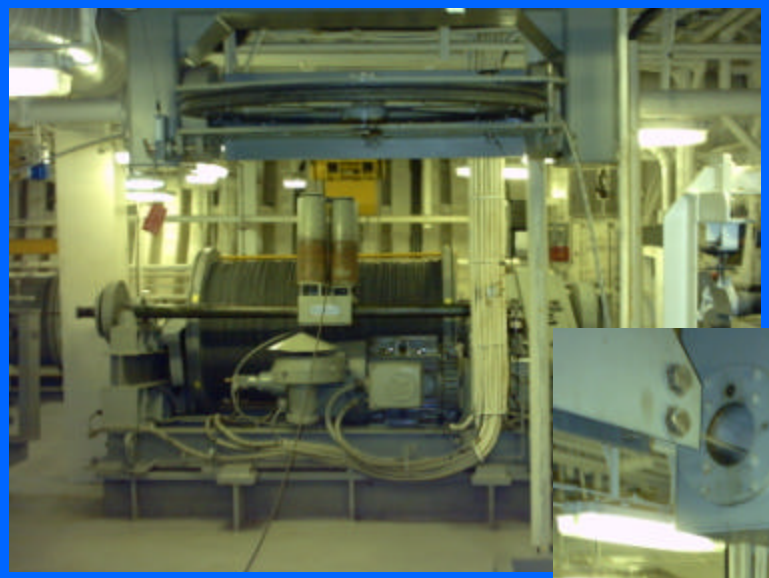
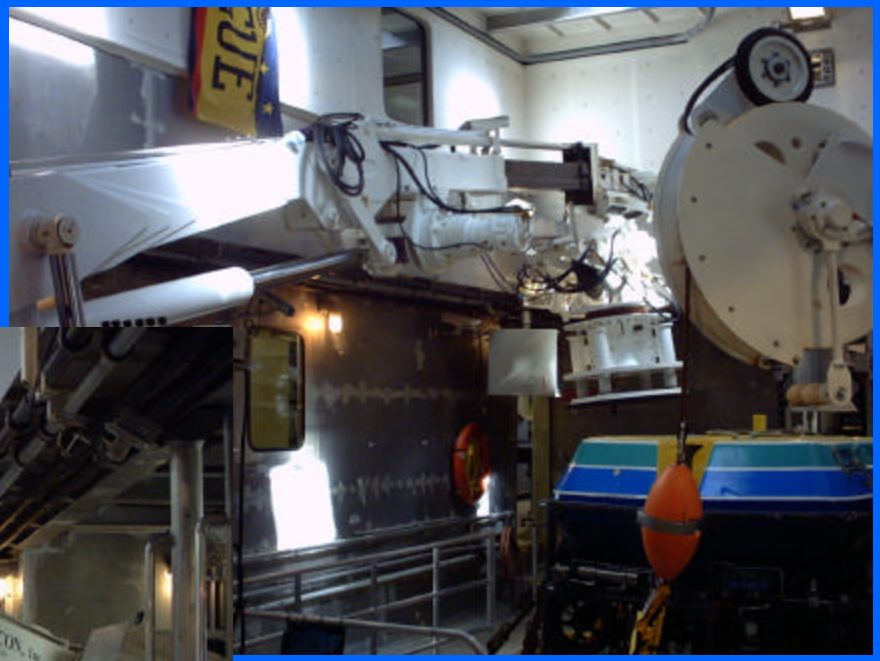
- LHS Workshop addressed handling moderately-sized, fairly common, science packages over the side and stern:
  - CTD's
  - AUV's and ROV's
  - Scanfish and Triaxis
  - Mocness
- Does not address, or attempt to replace, the stern A-frame.
- Does not address, or attempt to investigate, highly specialized or large handling systems like long-coring.

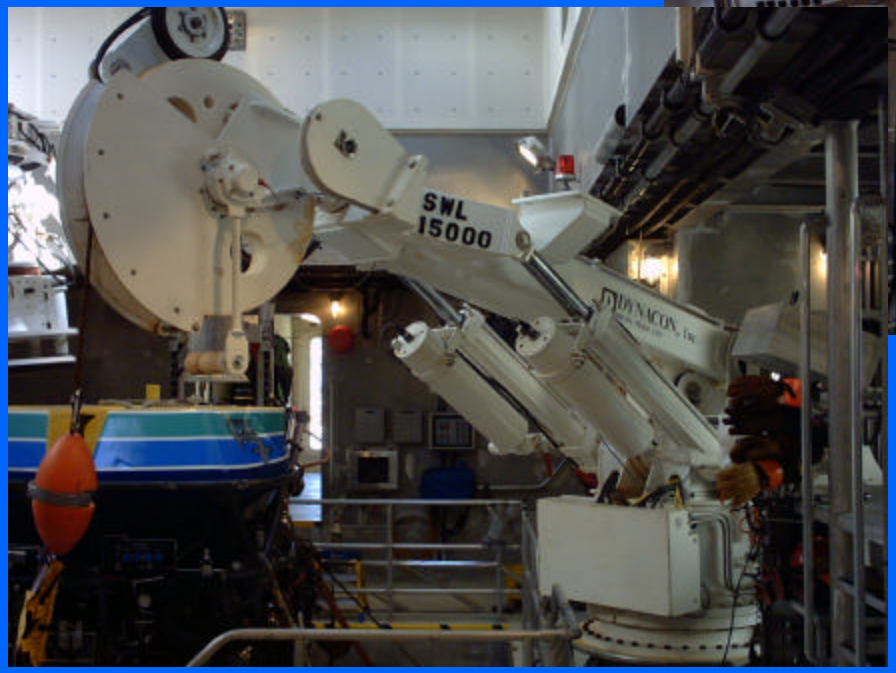
RRS *DISCOVERY* (CALEY)

USCG *HEALY* (InterOcean)



R/V *WESTERN FLYER* (Dynacon)





ODIM-Spectrum

R/V *ZEPHYR* (Brooke-Ocean)

JAMSTEC
(MIRAI and SHOYU MARU - Dynacon)

G.O. SARS
(TTS? MacArtney?)

R/V CELTIC EXPLORER
(Triplex/Rapp-Hydema)

Load Handling System Workshop
FINDINGS

- KILO MOANA “issues” are not unique – but represent the broader issues seen on all UNOLS vessels. KILO MOANO was simply a timely and illustrative example of the problems!
- Recommended solution for KILO MAONA illustrates the broader solution for the fleet.
- The potential solution is (as suspected) a COMBINATION of design features and capabilities from many vessels and manufacturers.
- The broad survey, combined with KILO MOANA as a case study was essential.
- Though the proposed system has many advanced and automated functions - it is essentially MANUALLY operated. **Judgment of the operator still employed.**

Load Handling System Workshop
The Handling Apparatus

- Generally speaking, an articulated crane
- Three different arrangements – but CONCEPTUALLY the same:

  -"Aft Deck" – much like Dynacon system

  -"Side" – much like CTD handling system on CELTIC EXPLORER. No slewing capability (simpler).

  - "Overhead" – NEW. Modified squirt boom.
- Able to reach VERY NEAR the water surface – boom geometry and extensions.
- Incorporates an interchangeable docking head with bolting flange for Owner-supplied "bumper". Science packages secured by cable tension (universal).
- Tow-capable by use of a forward stay.

Load Handling System Workshop
The Winch

- May be electric or hydraulic depending on vessel - as long as capable of meeting “Functional Requirements”
- May be direct pull or traction depending on vessel and use – as long as capable of meeting “Functional Requirements”
- Should be co-located with handling apparatus if at all possible to simplify cable path. If winch is “below decks” it should be directly below - NOT multiple decks below or separated by multiple compartments.
- All advanced capabilities are done by the winch itself – no other external system components other than handling apparatus.

“SMART WINCH”

Load Handling System Workshop
"SMART Winch" Capabilities

- **"Auto Tension"** – Used only for deployment and recovery. Holds science package in docking head by cable tension. *(Done by ODIM. Similar by Dynacon on Western Flyer for ROV at surface – but not in docking head)*
- **"Motion Compensation"** – All motion compensation done by winch pay-in/pay-out and a Motion Reference Unit (MRU) on the boom. "Active System" - Not reliant on cable tension which is not always representative of vessel motions. No additional system components (less weight). *(Done by CALEY on DISCOVERY).*
- **"Slip Mode"** – Allows payout of winch under tension when either SWL of winch or apparatus is exceeded (precisely calibrated). Cable breaking strength is no longer the "weak link" in the system. *(Done by CALEY on DISCOVERY. Done by both fishing and towing industries)*

Load Handling System Workshop
A bit on Design Standards
(The Crux of it All!)

- We tend to focus solely on 46 CFR, Sub-Part 189.35-9(c)(1) – “Wet Weight Handling Gear” which makes the wire or cable the “weak link” in the system. **The cable parts first**. Minimum FS on yield = 1.5
- Developed in 1970’s before we had synthetics and cables designed with high breaking strengths solely due to band width requirements.
- Can drive size, weight , and cost of the winch and handling system.
- Why do we want cables to part at all? (dangerous, loss of science package)
- Still suitable for some “heavy” systems – i.e. long coring?

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Design Standards

- Fortunately, the authors of Sub-chapter U were somewhat forward thinking – believe it or not!!
- Alternate standards **ARE** allowed by Sub-Chapter U itself:

  - Subpart 189.35-1(b) - Systems placed under ABS rules for cargo handling "assumed to have meet the intent of this sub-part". *Problem is that these rules deal mostly with cable jib booms, etc.*

  - Subpart 189.35-3(a) - "Intent": In recognition of the special nature of R/V's, maximum flexibility given to the owner/operator in complying with safety requirements.

  - Subpart 189.35-13 – "Special Cases": If above safety standards defeat the purpose of any piece of weight handling gear, relaxation of the standard will be considered.

- **UP TO US (AS A COMMUNITY) TO DECIDE.**
- Discussed during working group at 2004 RVOC.

  - Winch "slip" (as long as adequately calibrated and built in redundancy) was deemed as one acceptable means of strain relief by most operators.

Load Handling System Workshop

- Classification Society Standards (ABS, DNV, Lloyds) all tend to use “maximum anticipated operating load” as the design loading, an assign differing factors of safety depending on type of loading.
- By focusing of Sub-part 189.35-9(c)(1), we have simply defined the “maximum anticipated operating load” as always being the cable breaking strength!
- Do we really want to do that for ALL systems?
- Doubtful – as long as we can ensure safety in another way through sound engineering design and operating practice.