Paper to Steel:
Four Things I learned on SIKULIAQ

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SEWARD, AK

Research Vessel SIKULIAQ

Departing Marinette
6 July 2014

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What is R/V SIKULIAQ?

- Ice-capable general-purpose oceanographic research ship
  - PC-5 Ice Classification
  - 261 feet 6 inches length
  - 4065 LT at design draft
  - 5,750 HP
  - 20 crew, 2 marine techs, 24 scientists
  - Tractor style Z-drives (Props forward)
  - Centerboard (Drop Keel)
- Funded and owned by NSF, built and operated by UAF
- UNOLS Global Class vessel

Arctic Region Research Vessel (ARRV)

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Research Vessel SIKULIAQ

Trials in Bay of Green Bay, Feb 2014

Marinette Marine Corporation
Hull Number 0650

Launch 13 Oct 2012

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Lesson #1

Be Careful What You Wish For

- SIKULIAQ has an extensive network wiring system.
- Served almost every space on the ship with CAT7, fiber and coax.
- Patch panels are used everywhere, so the system is very flexible and can be reconfigured.

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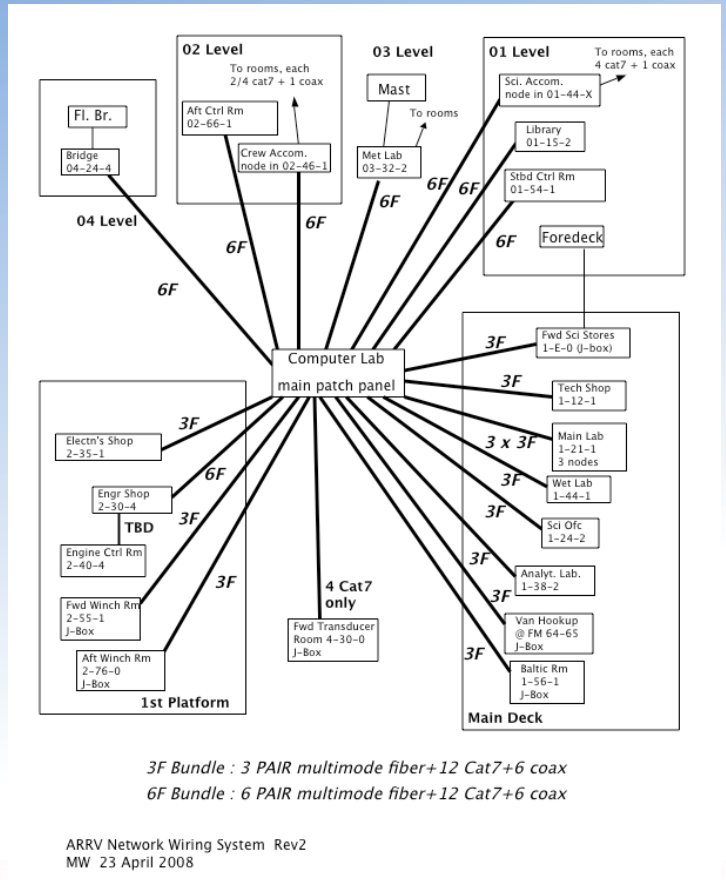
Be Careful What You Wish For



- The system uses a modified star configuration
- Subnodes serve high-density/few connection areas (staterooms)
- Which is all well and good until.....

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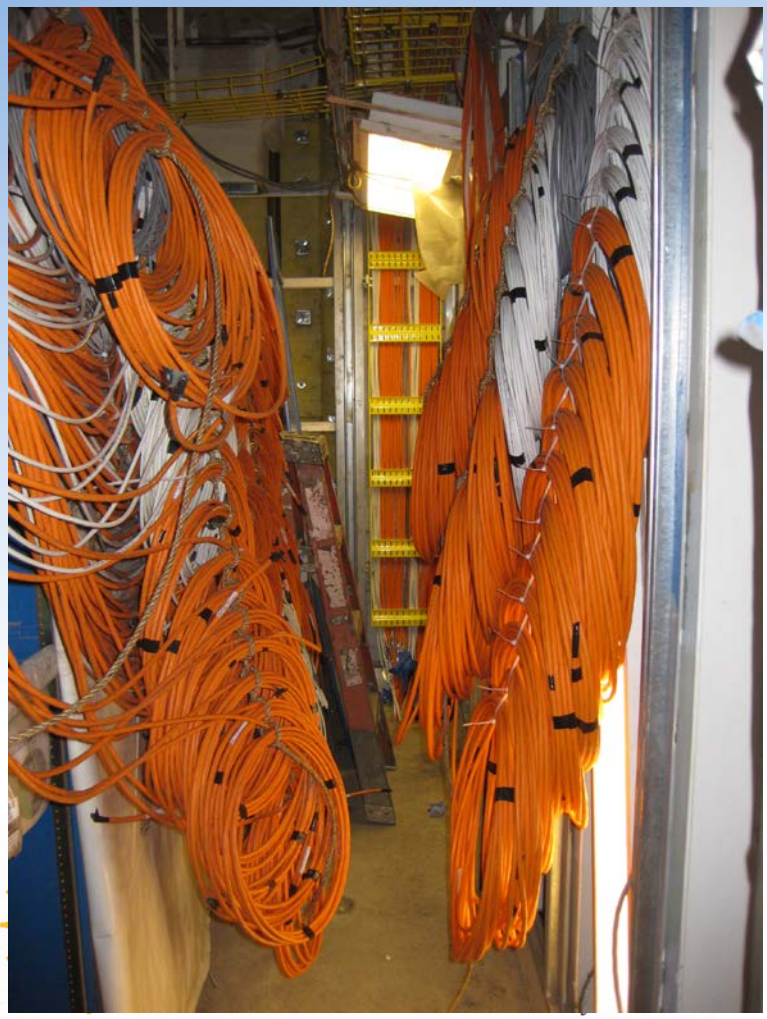
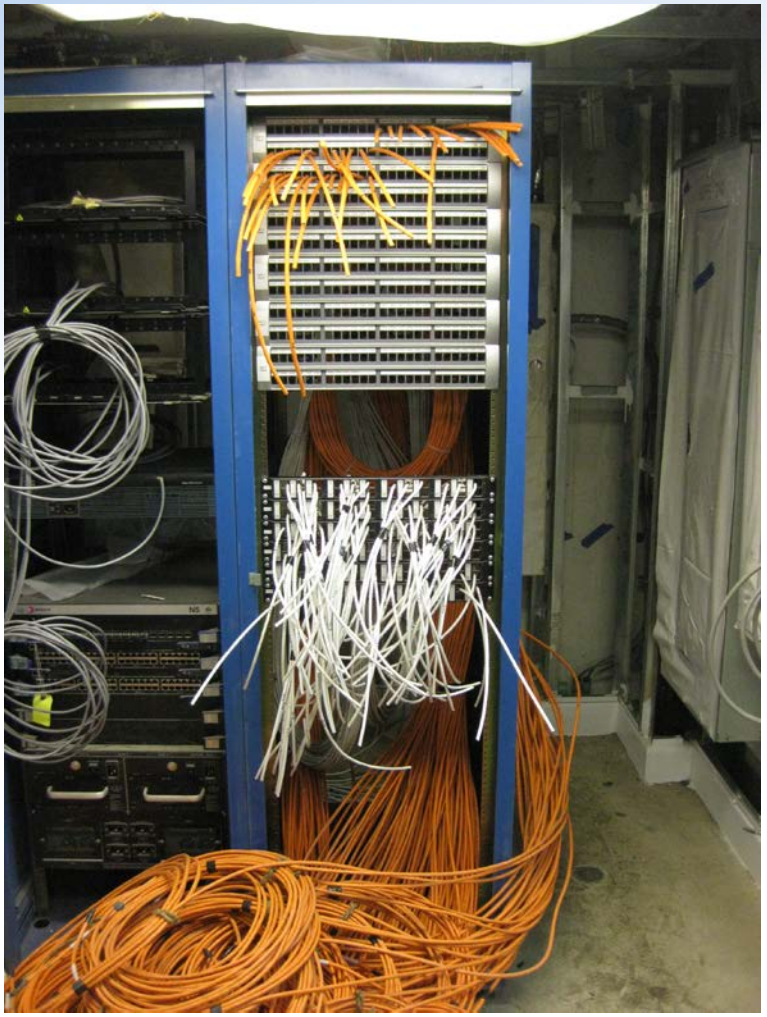
It All Comes Home (in the Computer Lab)

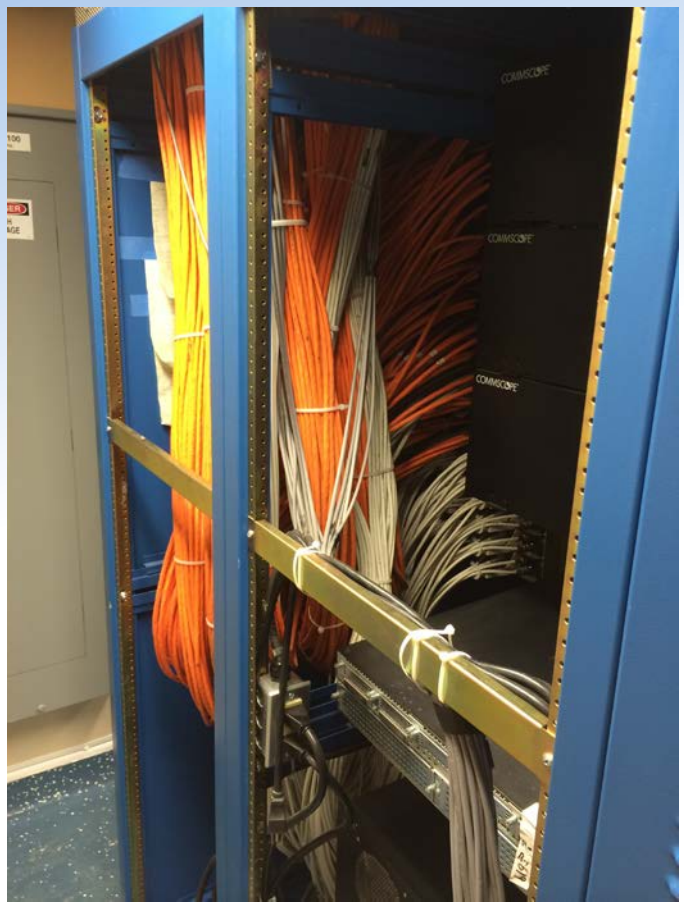
Each one needs cableway space...and...
Each one has to be tested...and witnessed!





But They Did It

(with some “encouragement”)



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Be Careful What You Wish For

- Go for the best you can get – within reason
- Design for the future
- Take time to understand what you're really asking for – and the impacts
- Expect to compromise

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Lesson #2

Be Wary Of New Tech, But Don't Be Afraid

- SIKULIAQ has one of the most advanced overside handling systems in the UNOLS fleet
- The suite consists of a telescoping, articulating side boom, and motion-compensated, constant tension, auto-haul winches.
- Boom head can accept a custom docking head.
- I was skeptical, but it is awesomely cool.

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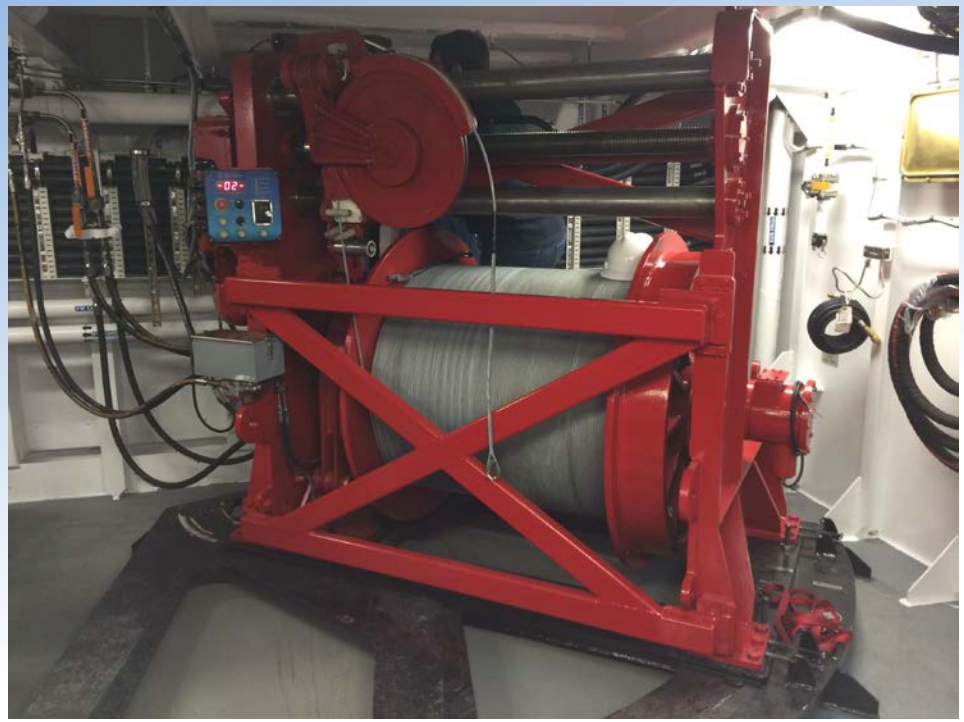
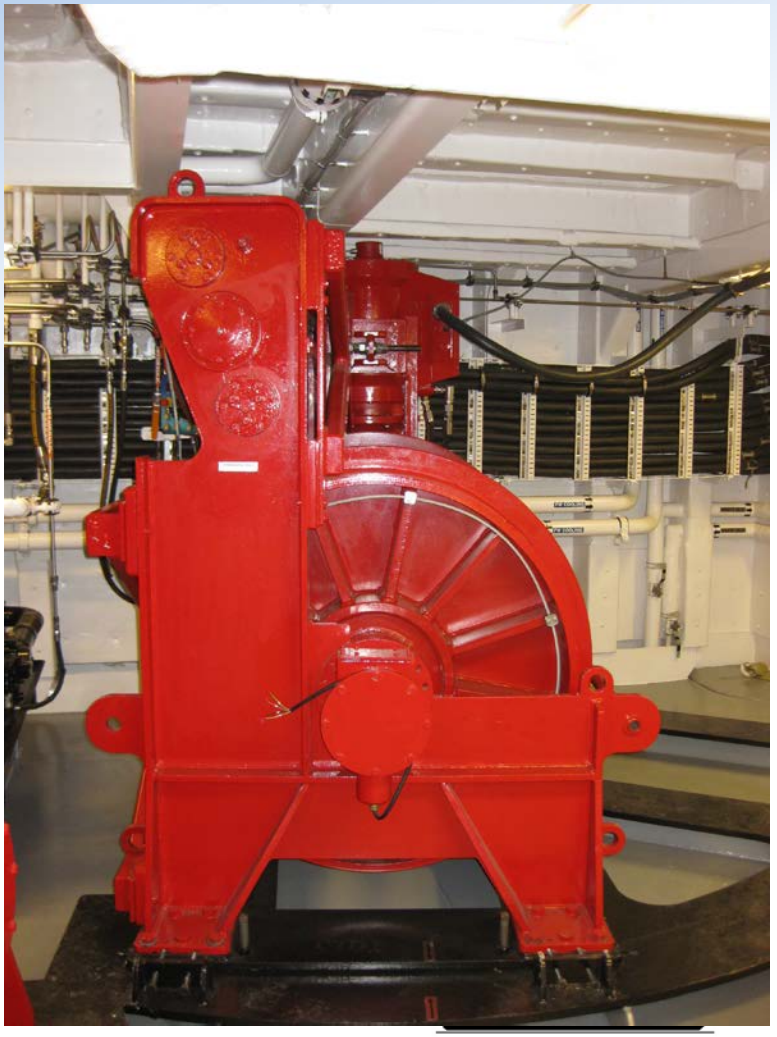
Rapp-Hydema NW T-90 Winches





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Triplex overboarding boom (LHS)

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Triplex overboarding boom (LHS)

Factory Test at Rapp Hydra Pro, Seattle, WA

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Triplex overboarding boom (LHS)

Installed in SIKULIAQ Baltic Room

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Deployment Sequence

Out the door and towards the water

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Deployment Sequence

To the water's edge and released

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Be Wary Of New Tech, But Don't Be Afraid

- "We never did it that way before" is a lousy excuse for not improving.
- More sophisticated systems are more complex, but they are also more powerful.
- Don't forget extensive training and live exercises prior to "the real thing."
- Aim for "State of the Market,"

  not "State of the Art."

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Lesson #3

Clearly Define Requirements

- As with most large projects, SIKULIAQ was bombarded (plagued?) with wish lists, drifting requirements and “suggestions.”
- These are rarely prioritized or vetted, so they live on as “zombie requirements.”
- “Better is the enemy of good” - Voltaire

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Requirements, Drifting Requirements and Wishes

- *Requirement:* "The crane shall be capable of lifting a load of X tons to the water surface at Y feet from the side in Sea State Z"
- *Drifting Requirement:* "The crane should be capable of lifting my future thing of unknown (and growing) weight over the side of the ship at sea. I'll get back to you when it firms up."
- *Wish:* "Well heck, the crane should be able to do *that*!" (Whatever *that* is)

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Clearly Define Requirements

- The A-frame on SIKULIAQ was specified to be “designed for a dynamic safe working load of 30,000 lbs through its full range of motion and structurally engineered to handle the breaking strength of cables up to 1 inch (120,000 lbf) breaking strength”
- The frame was not clearly specified, and we spent a lot of time explaining what we meant. This is the sign of a bad spec.

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Clearly Define Requirements

- The specs were misinterpreted by some to mean that the frame had a 120,000 lbf *SWL.* Not true.
- The final engineering looked solid, but we suspected that there was some “piling on” of safety factors.
- Then we saw it…….

Framezilla sleeps…… and waits for spring…….

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For scale

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Prep for 125% lift test (37,500 lbs)

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Marc: "Are you sure?"
Shipyard: "Yes, we're sure.

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Bang! Pop! Zing!

A-frame to Lawn Ornament in 15 seconds

Safety factors were piled on in some areas,

Inadequate in others.

Result was a frame that was much heavier than it needed to be.

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Clearly Define Requirements

- Make sure that your requirements are clearly spelled out, even if you have to state them in several different ways.
- Define the requirements tightly enough so that they can be accurately bid, and the result is what you want.
- If it's not in the spec, it's not in the ship, so be clear and complete.

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Lesson #4

~~Don't~~ Sweat The Small Stuff

- There are $1*10^{23}$ small and niggling details in any ship.
- During the design and construction, there are $2*10^{23}$ small and niggling details that need to be watched for.
- As soon as you let your guard down……

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“Hey, I can’t get my hand past there! It’s a knucklebuster”

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Mockups are great for identifying problems with arrangements while changes are low/no cost.

- For SIKULIAQ, we required the shipyard to mock up all Labs, Acessible stateroom, Aft Control Room, Bridge and Side Control room.
- These were left up until Design Verification and Transfer was complete and the shipyard began construction.
- Bridge mockup was reviewed by a panel of ship captains
- Lab mockups were reviewed by a panel of scientists
- They were a valuable tool for UAF and for the shipyard

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Mockup Warehouse

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Main Lab

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Wet Lab Inboard

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Wet Lab Outboard

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Sweat the Small Stuff

- It's the little details that make the difference between a good ship and a great ship to work on.
- Changes can be made at little to no cost if they are early in the process – lines on paper are easier to move than steel bulkheads.
- Mock ups are a great tool for finding and fixing issues.
- Keep the faith with those who have to work on the ship long after you are gone.

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Other Lessons

- Be careful with lists – they can be good and bad, mostly bad.
- Everything has to go somewhere.
  - Corollary: Two things can't occupy the same space
- If you can't clearly state what you want, then you haven't thought about it enough.
- *Don't assume that the shipyard "knows what you mean," because they don't.*

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Thank You for Your Attention

There is much more to SIKULIAQ.
Find out more at:

https://www.sikuliaq.alaska.edu

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