R/V SIKULIAQ* (ARRV) Update

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RVTEC Rep to FIC

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UNIVERSITY OF ALASKA FAIRBANKS
America's Arctic University

**sih-KOO-lee-ack*

Current Status

- Contract Start January 7
- All options were exercised in the contract:
  - 12ft extension for anti-roll tank – LOA is now 254ft
  - 0.5 x 1 deg multibeams + all sonar upgrades
- Total construction contract $123M
- Startup Conference January 20
- Ceremonial Signing February 5
  - Representatives from Marinette Marine, UAF, NSF
  - Guests from NSF, UAF, OSTP, Seward, Wisconsin, Michigan
- Full-time staff is on site
- Shipyard Office is up and running
- Coordination across 5 time zones is challenging

Staff and Project Personnel

- On-site Staff
  - Gary Smith (UAF): Shipyard Project Director
  - John Comar (UAF): Shipyard Contract Manager
  - Marc Willis (OSU): Marine Science Technical Director
  - Jenny Sevon (UAF): Office Assistant
  - Expect to hire two inspectors fall/winter 2010

- Frequent Visitors
  - Dan Oliver (UAF): Project Manager (Seward)
  - Steve Hartz (UAF): Scientific Operations Manager (Seward)
  - Lori Nunemann (UAF): Program Assistant (Fairbanks)
  - Terry Whitledge (UAF): Principal Investigator (Fairbanks)
  - Dirk Kristensen (Glosten): Technical Director
  - Matt Hawkins (NSF): Program Manager
  - Bob Houtman (NSF): IPS Section Head

Current Activities – DV&T

- Design Verification and Transfer
  - Transfer of contract design to Shipyard
  - Verification of producibility and regulatory compliance
  - Systematic review of contract drawing/spec package
  - Resolve problems early in the process
  - 1-2 Webconferences weekly
    - Marinette Marine+Guido Perla & Assoc, UAF+Glosten
    - Goal is review of 2-3 drawings per week
  - Result will be a design that the shipyard can move forward with.

Current Activities – Major Vendors

- Purchase Technical Specifications are being issued and vendors selected:
  - Propulsion Systems Integrator: *Siemens*
  - Scientific Sonar Systems Integrator: *Kongsberg*
  - Scientific Handling Systems Integrator: *Rapp Hydema*
  - Noise Control Consultant: *J&A Enterprises*
  - Integrated Bridge Systems Integrator: selection pending
  - Dynamic Positioning System: vendor selection pending
  - Many others (Joinery, HVAC, Deck Coverings, etc.)

Current Activities – Z-Drives

- Z-drive design is coming along
  - Z-drives are Owner-Furnished
    - complicates interaction with shipyard
  - Wartsila LIPS thrusters
    - PC5 Ice classed
    - Tractor (Pulling) mode
    - "Can-mounted" allowing drop-in installation and in-water service
  - ABS has approved propeller design
  - Waiting ABS approval of "ice-pod" design
  - Propeller cavitation tank tests ~July 2010

Current Activities - Mockups

- Mockups will soon be underway
  - Bridge
  - Labs
  - Science Control Room (“Aft Con”)
  - Accessible Stateroom
  - These will evolve as the detailed design evolves
  - Tool for detail design development
  - Will be in place for 12-18 months
  - Visit(s) by Oversight Committee planned

Upcoming Activities

- April
  - Quarterly Review Conference, April 13-15, including:
    - Project Quarterly Management Review
    - Propulsion Integration Meeting
      - MMC team, UAF team, Wartsila, Siemens.
    - Face-to-face DVT review meeting
    - Sub-group meetings
      - Centerboard Design, Integrated Logistical Support, Noise Control Plan, Risk Review
- May
  - Annual Review (NSF), May 19-20
  - ~ Mock-up construction begins
- ~ July-August
  - DV&T Concludes, Detail Design underway
- ~ October
  - Module construction begins
  - Hire 1 inspector
- ~ December
  - Hire 1 inspector
- Questions about the Project?

Comparison of SIKULIAQ with Ocean Class SMR

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Organization of the Comparison

- Organized by SMR Section and Element
- Highlight Differences Between SIKULIAQ and OCSMR
  - NOT a comparison with Ocean Class AGOR Spec
- Based on the FIC Ocean Class SMR Spreadsheet
- SIKULIAQ was designed to a different SMR than OC

Accommodations

SIKULIAQ

- 24 Science Berths
- plus 2 Marine Techs
- 12 Double SR Scientists
- 1 Double SR Technicians
- 14 Single, 2 Double Crew
- Sci: 4 persons/TSM + 3 SR with 2 per TSM
- Crew: 4 w/private TSM, 8 w/2 per TSM, 2 w/3 per TSM

Ocean Class SMR Target (Minimum)

- 27 (20) Science Berths
- plus 3 (2) Marine Techs
- 4 single, remainder double
- 2 single Tech SRs
- all crew (officers only)
- 25% @ 2/TSM, rest 4/TSM (no more than 4/TSM)

Habitability - HVAC

SIKULIAQ

- Cooling Season 70F
  - ambient 90F Air/90F Water
- Heating Season 70F
  - ambient -25F Air/28F Water
- 50% Relative Humidity

Ocean Class SMR Target (Minimum)

- Cooling Season 75F
  - ambient 95F/90F
  - ambient 0F/28F
- 50% Labs, 55% elsewhere

Habitability - Noise

SIKULIAQ

- **Not to exceed (dbA):**
- Machinery Rooms 110
- Workshops 75
- Passageways 65
- Galley 75
- Mess 65
- Library 60
- Staterooms 60
- Bridge 65
- Open deck aft 75
- Open deck forward 70
- Baltic room 85

Ocean Class SMR Target (Minimum)

- **Not to exceed (dbA):**
- Library 65
- Open deck aft 70
- Staging Bay 65

Habitability - Vibration

SIKULIAQ

- In normally occupied spaces 4mm/s max repetitive amplitude in range of 1-100 Hz
- In masts and structures no more than ± 0.1g in range of 1-100 Hz

Ocean Class SMR Target (Minimum)

- "…free of excessive vibration"
  - (SNAME 2-29, SNAME C-5)

Habitability - Lighting

SIKULIAQ

- Main Deck Labs 120 FC
  - In banks for local control
- Upper Lab 50 FC

Ocean Class SMR Target (Minimum)

- Labs 100 FC
  - In banks for local control
- Staging Bay 70 FC
- Storerooms 70 FC

Habitability – ADA Features

SIKULIAQ

- Personnel elevator all levels Main Deck to Bridge
- Elevator access from Main Deck to aft Science Stores
- One Accessible stateroom
- Wide passageways
- Accessible WC on Main Deck
- Wide, no-sill door between Main Lab and Baltic Room
- Accommodation in Mess Room
- Other decisions made using UNOLS ADA Guidelines

Ocean Class SMR Target (Minimum)

- Implement as many ADA features as possible within cost and size constraints

Operational Characteristics

SIKULIAQ

- Endurance: 45 Days
- *Range @ 12 kts: 9400 nmi
- *Range @ 10 kts: 18000 nmi
- Max speed: 14.2 kts
- Speed @ SS5: 12.3 kts
- Ice transit, 2 ft ice: 2 kts
- Navigational draft: 18 ft 9 in

Ocean Class SMR Target (Minimum)

- Endurance: >40 Days
- 10,800 (9600) nmi @ optimal speed
- Speed @ SS4: 11 (10) kts
- Cruising speed: 12.5 (12) kts
- Navigational draft: 17 ft

* at 95% fuel capacity

Over-the-Side Handling Gear

SIKULIAQ

- Stern Frame
  - Dynamic SWL 15T
  - Designed for 60T BS cables
  - 20ft clear width
  - 25ft deck to block attachment
  - Two-stage deployment aft
  - Forward safety position for rigging

Ocean Class SMR Target (Minimum)

- Stern Frame
  - 27ft deck to block attachment
  - Single Stage
  - Platform for rigging

Over-the-Side Handling Gear

SIKULIAQ

- Side Handling Gear
  - Baltic Door with articulating extending boom
  - Hands-off deploy/recover
  - Lowering and Towing
  - Use either CTD or Hydro winch
- Cranes
  - Two articulating cranes aft
    - 15000 lbs @ 50 ft. reach
    - overside operations and self-loading
  - Foredeck crane
    - Stores loading and lighter work

Ocean Class SMR Target (Minimum)

- Side Handling Gear
  - Side boom per UNOLS Functional Requirements
- Cranes
  - One main crane aft
    - 20000 (10000) lbs capacity
  - Two (one) portable crane

Science Working Spaces - Labs

SIKULIAQ

- Total Lab Area: 2010 sq. ft.
- Dry Lab: 1000 sq. ft.
- Wet Lab: 500 sq. ft.
- Computer/Electronics Lab: 310 sq. ft.
- Analytical Lab: 200 sq.ft.
- Baltic Room/Hangar: 490 sq.ft.
- Science Office: 95 sq.ft.
- Climate Control Chamber: 70 sq.ft.
- Science Freezer: 55 sq.ft.
- Electronics Workshop: 320 sq.ft.

Ocean Class SMR Target (Minimum)

- Total Lab Area: 2100 (1850) sq. ft.
- Main Lab: 1000 (900) sq. ft.
- Wet Lab: 400 (350) sq. ft.
- Computer/Electronics Lab: 300 (250) sq. ft.
- Staging Bay: 300 (250) sq.ft.
- Science Freezer: 100 sq.ft.

Science Working Spaces - Decks

SIKULIAQ

- Total deck ~4200 sq.ft.
- Foredeck ~ 400 sq.ft.
- Aft deck ~3800 sq.ft.
- Max clear waist 92 ft.
- 2 van locations, space for 1 additional 20' van aft, one 10' CONEX forward. No van docking.

Ocean Class SMR Target (Minimum)

- Total deck: 2600 (2000) sq.ft.
- Aft deck: 1800 (1500) sq.ft.
- Clear waist: 80 ft.
- 2+2 (2 only) vans

Science Working Spaces – Holds

SIKULIAQ

- Aft Sci. Hold: ~7000 cu.ft.
  - less deductions for equipment/access
  - served by elevator
- Fwd Sci. Hold: ~3400 cu.ft.
  - less deductions for chain pipes/lockers/ladders
- Science Variable Load: 100LT

Ocean Class SMR Target (Minimum)

- Total Hold: 5000 (4000) cu.ft.
- Variable load: 250 (150) LT

Science Working Outfit – Boats

SIKULIAQ

- One solid-hull "Ice boat"
- Two 18" SOLAS rescue boats, one @ SOLAS davit, one in cradle ("workboat")

Ocean Class SMR Target (Minimum)

- SOLAS rescue boat plus one additional work boat >19'

Science Working Spaces – Masts

SIKULIAQ

- Main Mast designed with instrument platforms
- Foremast/Met mast combination in development
- CFD model used to guide mast design and sensor placement.

Ocean Class SMR Target (Minimum)

- Additional portable mast forward

Science Working Areas

SIKULIAQ

- Incubator location identified (top of house), and services provided. Separate temperature-controlled seawater supply.
- Mammal/Bird observing stations identified (top of house or inside bridge)

Ocean Class SMR Target (Minimum)

- 300 (200) sq.ft. unobstructed with power/water

Multibeams, Sonars and ADCP

SIKULIAQ

- 0.5 x 1 deg EM302
- 0.5 x 1 deg EM710
- 75 + 150 kHz ADCP with space for 38 kHz
- 12 kHz echosounder
- Split-beam, multifrequency "fisheries" echosounder

Ocean Class SMR Target (Minimum)

- 1 x 1 (1 x 2) deep water MB
- 1 x 1 (1 x 2) shallow water
- more than one frequency
- Multifreq. (12kHz only) echosounder

Noise

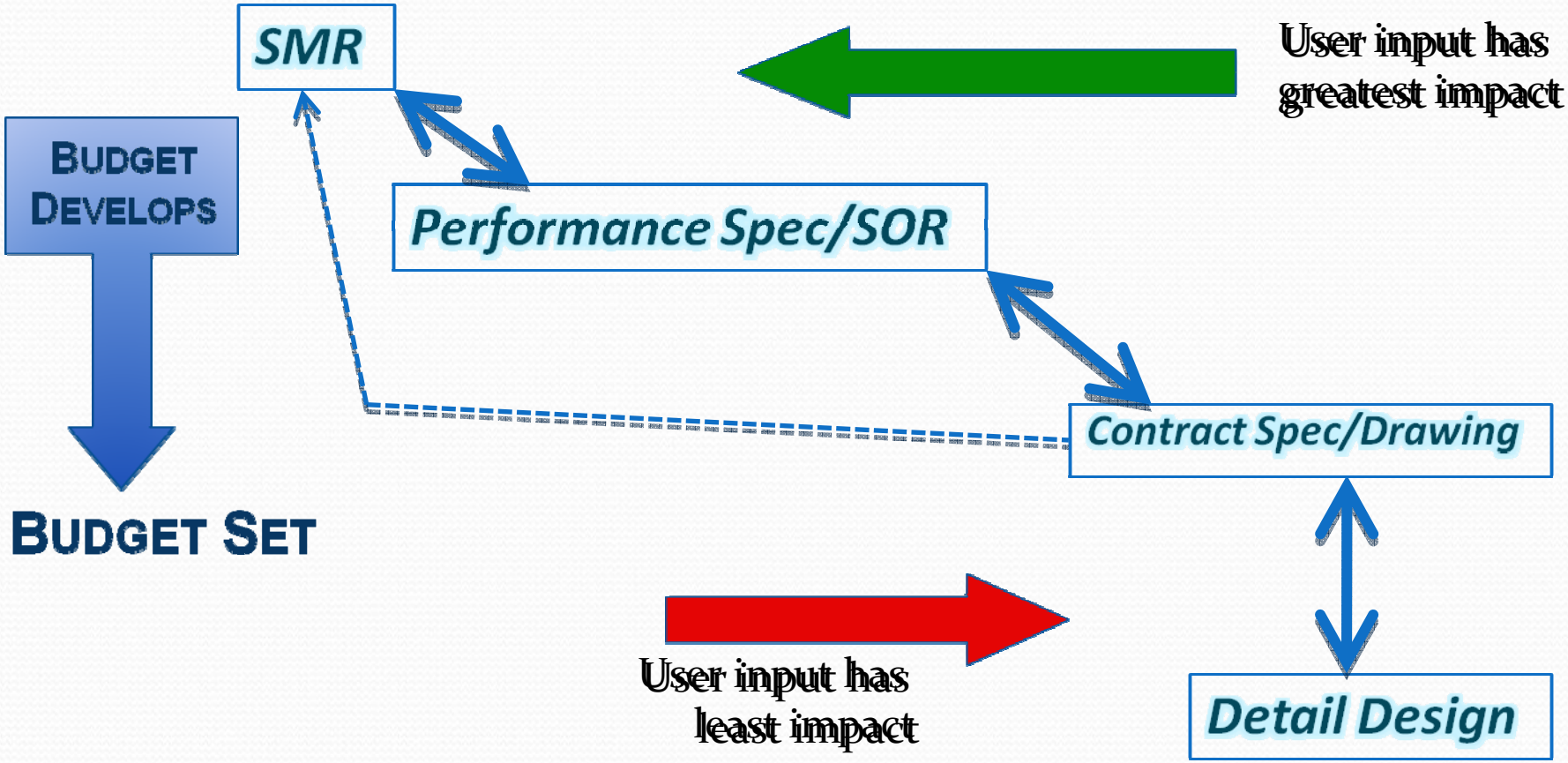
- URN and airborne noise
  - Don't forget space-to-space noise transmission
- You get what you pay for
  - Quieter = more expensive
- ICES is not the answer
  - There are more questions – speed, sea state, etc.
- Define an affordable/achievable curve
- Higher-risk area for shipyards if performance (FRV) rather than prescriptive (ARRV) : Risk = $$

Seakeeping….is complicated

- Criteria tend to be expressed in terms of Operability Index
  - Percent of time ship is able to operate
  - Depends heavily on wave/wind climatology
    - Wave height, period, steepness, prevailing direction vary by ocean and region
  - Difficult to assess or design to without this information
  - "Operate" what? CTDs have different requirements than Piston Cores

- What constitutes "Operability"?
  - User - Subjective: "How do I feel?"
    - Roll amplitude is often cited
    - "Can I work in this weather?"
    - Operability = percent of time that I could do my work
  - Designer - Objective: Motion criteria
    - Roll/pitch displacement or acceleration at key points
    - Operability = percent of time below set limits in set conditions

Simplified Design Process



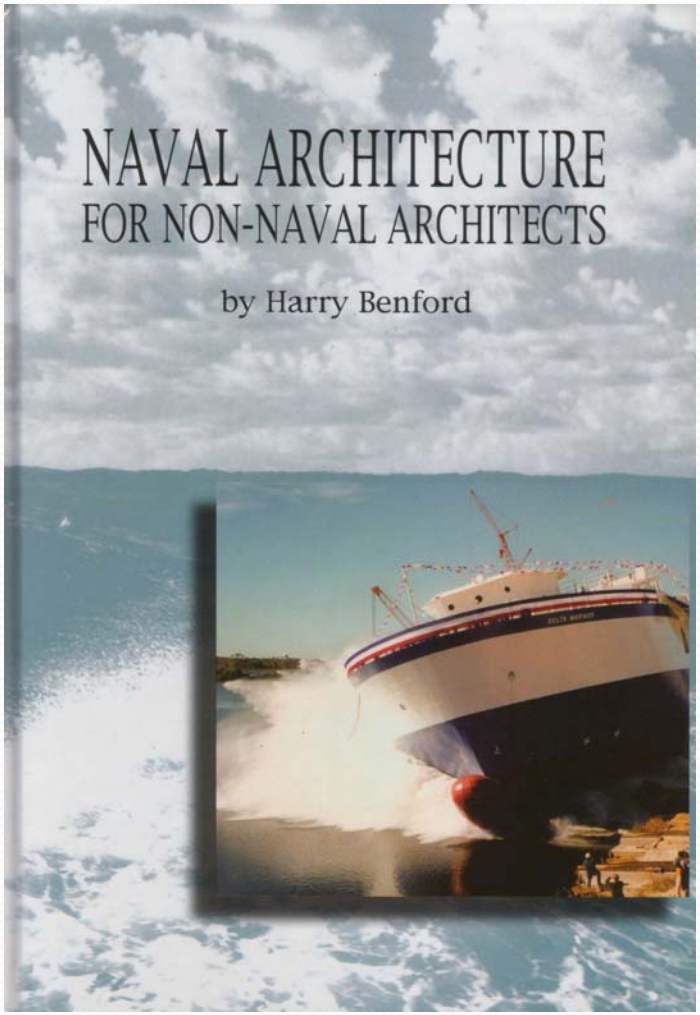
SMRs in General

- Need more definition and precision
  - More homework during SMR development
- Critical elements need critical consideration
  - Are “Critical” – “Very Important” – “Important” priorities useful?
  - There are inevitable tradeoffs between competing priorities
  - Prepare for tradeoffs in advance by identifying them, and providing guidance
  - Define “Critical” requirements in more detail than “Important” ones
- If you really want it, you have to ask for it and be specific
  - “If it’s not in the spec (or SOR), it’s not in the ship”
  - The earlier in the process, the better
- Challenge designers, but give good guidance
  - Naval Architects and Engineers are not mind readers
- Statements of values and intent sound good, but can be difficult for designers to implement – require interpretation
  - What’s obvious to you may not be obvious to someone else

SMR Homework

- Compare Ocean Class SMR to RFP Performance Spec
- See how designers and spec writers have interpreted the SMR
- Did they “get” what you meant?

Recommended Reading



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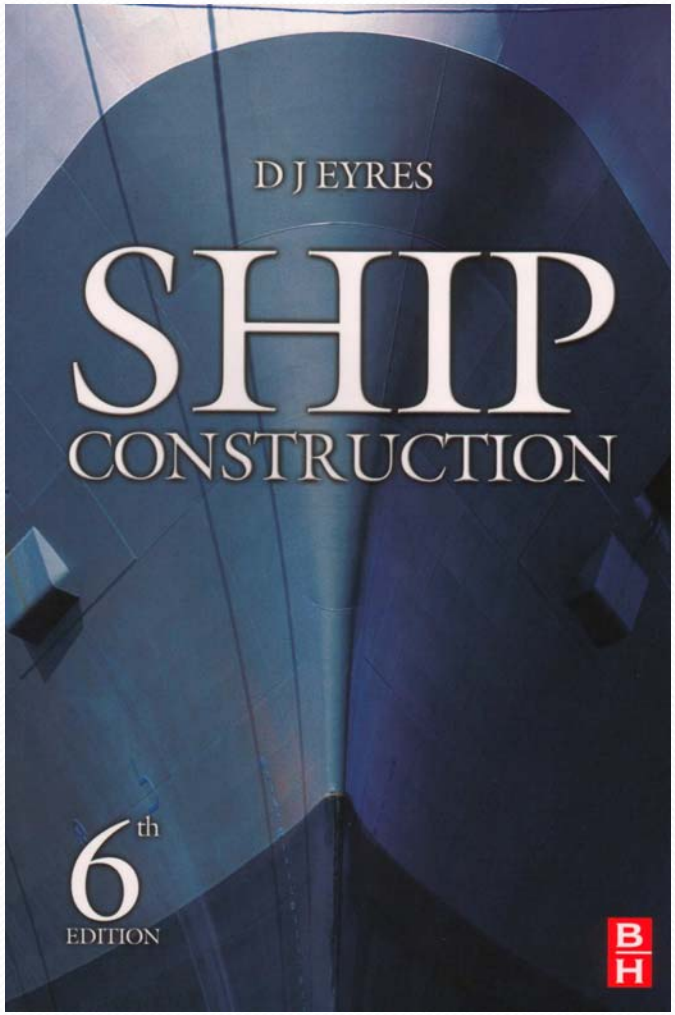

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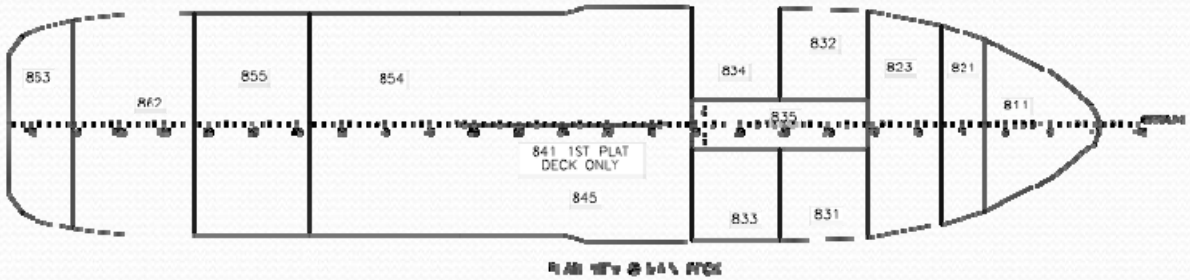
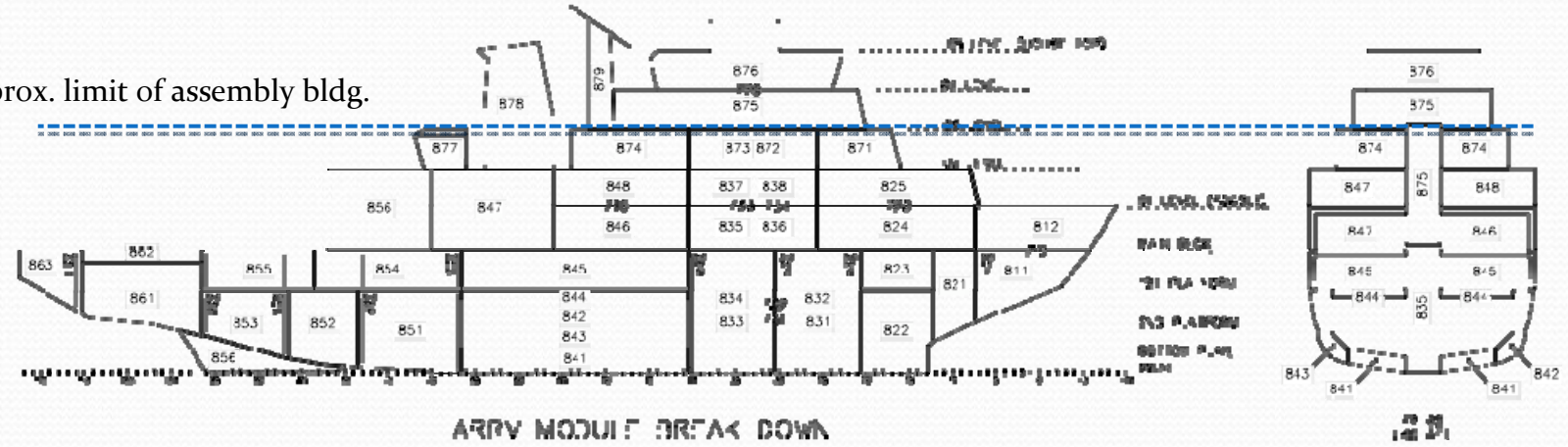
Modular Construction Approach

- Define modules (construction units)
  - largest units that fit in the fabrication buildings
  - modules are outfitted as much as possible prior to moveout
- Define grand modules (combinations of modules)
- Define erection sequence (assembly of modules)
  - assembled inside until height exceeds building limits
- Define zones (outfitting units)
  - areas with similar requirements or elements
  - zones cross module boundaries
  - e.g.; Labs fall into 6 modules, but a single zone
- Detail design based around the module/zone concept

Preliminary Module Breakdown



Approx. limit of assembly bldg.



Modular Ship Construction

(Photos of GLIB construction courtesy of John Comar, UAF Shipyard Contract Manager)

From Module Construct

Module move out

To Assembly Building

On Floor

Lined up for assembly

Assembled

Rollout to Launchway