Conversion Design Project

Commercial Offshore Supply Vessel (OSV)
To Arctic Capable T-ATS(X) Replacement

2.704 Projects in Naval Ship Conversion

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Thanks to Our Sponsors

- Don Nalchaljian (NAVSEA 05D)
- Craig Flemingloss (NAVSEA 05D)
- Vince Jarecki (NAVSEA 00C)
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- Andrew Smith (Rolls-Royce POC)
Background

• Ships scheduled to begin phased retirement in 2020:
  – Four T-ATF Class Tug Ships
  – Four T-ARS Class Salvage Ships

• 30 year ship building plan has the lead ship funds for the T-ATF replacement being awarded in FY15.
General CONOPs

• T-ATS(X) to cover the Navy’s towing (T-ATF) and salvage (T-ARS) missions

• T-ATF Missions:
  – Routine and emergency tows

• T-ARS Missions:
  – Dive tasks, shallow and deep
  – Refloating sunken or stranded ships
  – Rescue and salvage operations on sunken submarines
  – Clearing wrecks from obstructed waterways
  – Oil pollution response
  – Recovering objects from the depths of the ocean
Arctic Capability

- Additional sponsor requirement for arctic capability
  - Able to operate independently in the arctic regions spring through summer months
  - Capable of following and ice breaker through

- ABS Ice Classifications considered:

**Ice Class ‘C0’**
- Year round independent operation in light ice
- Light Ice Conditions:
  - 1-2 ft of ‘very open’ ice
  - <1 ft ‘open’ ice

**Ice Class ‘B0’**
- Year round independent operation in medium ice
- Medium Ice Conditions:
  - 2-3.3 ft of ‘very open’ ice
  - 1-2 ft ‘open’ ice
  - <1 ft ‘close’ ice
## General Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Threshold</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck Space</td>
<td>3,600 ft²</td>
<td>4,400 ft²</td>
</tr>
<tr>
<td>Crane</td>
<td>40 LT</td>
<td>--</td>
</tr>
<tr>
<td>Bollard Pull</td>
<td>150 LT</td>
<td>200 LT</td>
</tr>
<tr>
<td>Arctic Capability</td>
<td>ABS C0</td>
<td>ABS B0</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>15 kts</td>
<td>20 kts</td>
</tr>
<tr>
<td>Endurance Range</td>
<td>10,000 nm @ 12 kts</td>
<td>--</td>
</tr>
<tr>
<td>Accommodations</td>
<td>25 MSC, 42 Navy</td>
<td>--</td>
</tr>
<tr>
<td>VERTREP Capability</td>
<td>Level III, Class 5</td>
<td>--</td>
</tr>
<tr>
<td>Firefighting Capability</td>
<td>Fifi Level I w/ AFFF</td>
<td>--</td>
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</tbody>
</table>
UT-722L

- UT-722L is an Anchor Handling Tug and Salvage (AHTS) ship, used as an Off-Shore Supply (OSV) vessel to service domestic and foreign oil platforms.
  - Storage tanks for mud, drill water, recovery oil, and brine
  - Rescue and Assistance (R&A) firefighting capability
  - Large amounts of deck space
  - Towing bollard/winches, two boats, three cranes
- Design is licensed by Rolls-Royce Marine
Variant Analysis

• Quality Functional Deployment (QFD) Analysis completed to determine important traits.
• 7 traits identified and weighted using pair-wise comparison
• 24 Variants selected based on:
  – Crane Type (Straight, Extendible, Knuckle)
  – Crane Location (Centerline vs. Starboard)
  – Ice Class (C0 vs. B0)
  – Ice Belt Material (Mild Steel vs. HY-80)
• Modification costs and OMOE scores assigned, variants assessed

Final Variant Characteristics:
• Ice Class C0
• Ice Belt made of Mild Steel
• Straight Crane
• Crane Positioned Starboard
T-ATS(X) Concept

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**Principal Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>5,644 LT</td>
</tr>
<tr>
<td>LOA</td>
<td>262 ft</td>
</tr>
<tr>
<td>LWL</td>
<td>249 ft</td>
</tr>
<tr>
<td>Beam</td>
<td>59 ft</td>
</tr>
<tr>
<td>Draft</td>
<td>20 ft</td>
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</tbody>
</table>

DECK SPACE FOR SRDRS

VERTREP STATION

GENRATOR STACK ADDED

SALVAGE STORAGE AND MISSION SPACE ADDED

TOWING WINCHES (194-LT BOLLARD PULL)

7-M RHIB

AFFF R&A FIREFIGHTING

ACCOMMODATIONS FOR 25 CIV, 42 MIL

ICE BELT

35-FT WORKBOAT

52-LT CAPACITY CRANE

NEW GENERATOR ROOM

GENRATOR STACK ADDED
SRDRS Capability

- **Submarine Rescue Diving and Recompression System**
- **Self-Contained Module** that is loaded onto a Vessel of Opportunity (VOO) in the event of a downed submarine.
- **Requirements for SRDRS VOO:**
  - 98ft x 34ft deck space area
  - 0.46 LT/ft² deck pressure
  - Capable of maintaining stability with 227 LT 8.8 ft above deck
- **Deck Space** also capable of hosting NATO Submarine Rescue System (SRS) and US Navy’s Saturation Fly-Away Diving System (SAT FADS).
Major Modifications

• Accommodations modified for an additional 27 personnel
  – 25 MSC personnel, 42 Navy transients
  – Accommodations reconfigured in forward superstructure

• Main UT-722L storage tanks removed to make space for a generator room and salvage storage equipment area

• Other Mission Areas areas modified:
  – Dive Shop
  – Armory
  – RO Equipment Room
  – Crew Gym
  – Various workshops
Arctic Modifications

• Modifications required for ABS Ice Class C0 capability:
  – Bow Hull Section (only) replaced and strengtheners added
  – Modifications to propeller and drive train
  – Crane and equipment improvements for cold weather
Powering and Resistance

- Powering/Resistance and Endurance Analysis
  - Sustained speed met customer requirements
  - Determined effective powers required

### Speed and Endurance* Characteristics

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Endurance Speed</td>
<td>12 kts</td>
</tr>
<tr>
<td>Sustained Speed</td>
<td>16.3 kts</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>17 kts</td>
</tr>
<tr>
<td>Endurance Range</td>
<td>13,000 nm</td>
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<tr>
<td>Surge to Theater</td>
<td>7,500 nm</td>
</tr>
<tr>
<td>Operation Presence</td>
<td>50 days</td>
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*Endurance calculations based on DDS 200-1
Topside Icing Model

- No asymmetric icing models exist within the US Navy
- Criteria developed using standard criteria from DDS 079-1
Topside Icing Model

- LCG and VCG assumed constant
- DOE developed to determine heel angle
  - TCG and Ave. Ice Thickness
  - Transverse and Vertical Moment
- Proposed SOE established

Example Point:
TCG 4 ft
Thickness 8 in

7 Degrees of Heel
# T-ATS(X) Estimated Costs

## Lead Ship Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Ship Cost:</td>
<td>$74</td>
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<tr>
<td>Proposed Modifications:</td>
<td>$78</td>
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</tbody>
</table>

**Lead Ship Cost Estimate:** $152

## Life Cycle Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Investment Costs:</td>
<td>$1,300</td>
</tr>
<tr>
<td>Total Operating and Support Cost:</td>
<td>$4,800</td>
</tr>
<tr>
<td>Residual Value:</td>
<td>$(100)</td>
</tr>
</tbody>
</table>

**Total Program Life Cycle Cost:** $6,000

*All Amounts in FY2012 Millions of $*
Conclusions

• UT-700 design series in service since 1974
  – Reliable, commercially available, over 400 built since 2002

• The UT-722L requires minimum modifications for Arctic C0 capability

• Low Risk Conversion Design
  – No New Technology Required
  – COTS Crane
  – COTS Generator Set
  – Common Hull Plating Thicknesses

• The Rolls-Royce UT-722L to T-ATS(X) conversion is a feasible, low risk, low cost solution for the replacement of the T-ATF and T-ARS Class ships.
Questions

T-ATS(X) Concept Design