The Skjold Class
Fast Reaction Craft
Skjold Background

• Lead Boat of Class Completed in April 99
  – SES Technology Based on Successful MCMV Program
  – 9 MCMVs Built & Deployed

• Successfully Tested in Norwegian and Arctic Waters
  – Norwegian Navy OPEVAL Completed in 2000
  – 1000 Hours of Operation in Rigorous Sea States (1-6)
  – All Performance Requirements Achieved

• World Class, State-of-the-Art Fast Reaction Craft
SES Concept Proven by MCMV Deployment

- SES Technology Matured by MCMV Class
- Royal Norwegian Navy Verified:
  - Low Shock Load Vulnerability
  - Seakeeping Stability
  - Magnetic Signature
  - Maneuvering Capability
- Skjold OPEVAL Validated

Extremely Low Fluid Drag
  - Significantly reduced wave resistance at high speed gives high speed at low power settings
## Skjold Class - Key Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>155 feet</td>
</tr>
<tr>
<td>Beam</td>
<td>44 feet</td>
</tr>
<tr>
<td>Displacement</td>
<td>270 tons</td>
</tr>
<tr>
<td>Speed at Seastate 3</td>
<td>45 knots</td>
</tr>
<tr>
<td>Draft (on cushion)</td>
<td>3 feet</td>
</tr>
<tr>
<td>Range (fully loaded)</td>
<td>800 nm</td>
</tr>
<tr>
<td>Crew</td>
<td>15</td>
</tr>
</tbody>
</table>

**Propulsion:**
- 2 x 8000 hp Allison KF571 gas turbines
- 2 x 400 hp diesel engines for slow speed maneuvering
- 2 waterjets
- 2 x 930 hp 12 cycle MTU 183 for lift fans
Propulsion System

- Twin Hull Waterjet Drive System
- High Speed Operations
- Precision Maneuverability
Surface Effect Ship Design Principles

- Catamaran Hull (Twin Hulls)
- Fans Blow Air Into the *Air Cushion* Between the Hulls
- Rubber Seals Close the Air-leakage
  - Bow Finger Seals
  - Stern Bag Seal
  - Ride Control System Improves Seakeeping and Comfort
Fire Safety

- Fire Safety Significantly Improved By Norway’s Fire Resistant Composite Development Program
- Lightweight Composite Ship Structures Have Better or Equal Fire Safety Compared to Steel Structures
- Smoke/Heat/Toxicity Well Within A 60/ISO 5660 Standards

### A 60 Requirements
- Test Time > 60 min
- Backside Temp < 140°C
- Max Deflection < 97 mm

### Actual Test results
- Test Time: 61 min
- Temp Increase: 27 °C
- Deflection: 3.5 mm

Exceeds A60 Standard By Wide Margin!
Norwegian FPB Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Required</th>
<th>Verified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mission efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calm water: &gt;45 knots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seastate 3: 45 knots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seastate 5: &gt;25 knots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seakeeping performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 % operability in SS4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 % operability in SS5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maneuverability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range 800 nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radar Cross Section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR-signature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optical signature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All Norwegian FPB Requirements Met or Exceeded
Payload Capacity

**Weight Summary**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightship</td>
<td>200 tons</td>
</tr>
<tr>
<td>Fuel/Fluids</td>
<td>35-40 tons</td>
</tr>
<tr>
<td>Payload</td>
<td>30-35 tons</td>
</tr>
<tr>
<td><strong>Fully Loaded</strong></td>
<td><strong>270 tons</strong>*</td>
</tr>
</tbody>
</table>

- Low Lightship Weight Allows for Modular Payload Alternatives and Range Tradeoffs
  - Alternative Modularized Sensor/Weapon Systems
  - Extended Range with Aux Fuel
- Large Bays and Deck Spaces for Modular Mission Flexibility (i.e. Aft Bay can hold 8 Harpoons or 102 Troops or 153 Pax)
* Operated during OPEVAL at 300 tons in all range of sea states
KNM Skjold - Interior Arrangement

- Missile systems
- Gun
- Machinery
- Accommodation
- Lift fan systems
Integrated Bridge

- Improved Command & Control Features
- Improved Ship Handling
- Reduced Manning
Low Radar Signature Achieved

- **90-99% Reduction of RCS** Compared to Hauk Class FPB
- Radar Reflective and Radar Absorbent Materials Design
  - No 90 Degree Corners
  - Deck Outfitting Covered or Demountable
  - Flush Doors and Hatches
  - Air Intakes to Gas Turbines and Lift Fans Covered With Radar Absorbing Grid/Mesh
  - Flush, Radar Reflective Window Screens

- Constructed With Large Areas of Load Bearing, Radar Absorbing Structures (RAS)
- NATO Exercise Validated LO Performance
  - All Other FPB Units Detected
  - Skjolds Not Detected & Not Attacked
Low Optical Signature

- Paint Scheme Tailored to Norwegian Coastal Background
Demonstrated ”High Operational Effectiveness”

• **Large Engagement Zones & Suppression Area**
  – Multiple Coordinated Operations With Shared Sensors
  – High Sustained Speed

• **High Sustained Seaworthiness**
  – Full Operational Capabilities Without Degrading Crew's Performance Up To and Including Sea State 5

• **High Stealth Capability**
  – Low Radar Signature
  – Low IR Signature
  – Low Optical Signature
  – Low Acoustic Signature
  – Low Magnetic Signature
Demonstrated ”High Overall Effectiveness”

- **Flexible Payload Configurations**
  - High Payload Ratio
  - Spacious Crew & Payload Arrangement
  - Excellent Potential for Modular Payloads

- **High Operational Management Capability**
  - Coordinated Operations
  - Command & Control
  - Information Collection & Analysis
  - Effective NBCD
  - Gas Citadel With Cleansing & Sluicing Facilities
Mission Configurable Options

• Flexible Operations
  – Command & Control
  – Seal Delivery/Extraction
  – Combat SAR
  – SAR/Disaster Relief
  – Law Enforcement
  – Gunfire Support
  – Counterinsurgency
  – Anti-Terrorist Operations
  – OOTW Missions

• Warfare Areas
  – ASUW
    • Missiles/Guns/UAV Ops
  – ASW
    • VDS/LFS/Torpedoes
  – AAW
    • Lightweight SAM/CIWS
  – MCM
    • Towed Sensors/UUV Ops
  – AEW
    • Sensors/Jammers/Chaff
# Notional U.S. Littoral Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Skjold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (&lt;200 FT Length; &lt; 46 FT Beam; 5FT Draft)</td>
<td>155 FT Long; 44 FT Beam; 3 FT Draft On Cushion</td>
</tr>
<tr>
<td>Stealthy</td>
<td>Low RADAR/IR/Optical/Acoustic/ &amp; Magnetic Signatures</td>
</tr>
<tr>
<td>High Speed</td>
<td>Speed &gt; 55 KTS @ Low Sea State</td>
</tr>
<tr>
<td>Agile</td>
<td>Highly Maneuverable Twin Jets</td>
</tr>
<tr>
<td>Highly Automated (&lt;20 Crew)</td>
<td>Crew Size 10-15</td>
</tr>
<tr>
<td>Reconfigurable</td>
<td>Large Gun/Missile/Equipment Bays - Customer Dependent Load Outs</td>
</tr>
<tr>
<td>Long Loiter Capability (&gt;21 Days)</td>
<td>On Station Time Dependent on Speed/Mission/Aux Fuel Load</td>
</tr>
<tr>
<td>Chem/Bio/Radiation Protection</td>
<td>Effective NBCD Citadel with filters, airlocks and cleansing stations</td>
</tr>
</tbody>
</table>
Conclusions

• **Skjold Class FPB Provides Significant Tactical Advantages for Littoral Operations**
  – Extremely High Transit Speed/Maneuverability
  – Cost Effective Equipment and Structures
  – Lightweight, Robust, Firesafe Materials
  – Stealth at All Tactical Bandwidths
  – Flexible Payload Configuration

• **Skjold Offers Significant Improvement in Seakeeping and Operability Compared to Monohulls**

• **Skjold Is a State-of-Art Fast Reaction Craft**

  ***Ready Now for Full Scale Production***