Determination of the Utility of Submarine Launched Unmanned Aerial Systems (UAS)

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Excellence Through Knowledge
Motivation for Research

• Advanced Weapons Enhanced by Submarine Unmanned Aerial System against Mobile Target (AWESUM) JCTD, dtd 10APR2012

• USFF, PACFLT, COMSUBPAC, COMSUBFOR Requirements for Submarine Launched-And-Operated Unmanned Aerial Systems letter, Ser N03/017, dtd 28 SEP 11

• PACOM & SOCOM Fiscal Year (FY) 14-17 Integrated Priority Lists (IPLs)

• CSF Requirements for Submarine Launched and Operated UAS, letter, Ser N00/00019, dtd 16 Jan 07
Submarines need the capability to launch and operate Unmanned Aerial Systems in order to conduct a variety of missions in support of COCOM, CJCS, and national tasking, including but not limited to:

- I&W
- ISR
- mission planning and targeting for SOF
- OTH-Targeting for ASuW
Submarine Launched History
Submarine Launched Aerial Assets

- **September 9, 1942**
  - Japanese drop incendiary bombs in forest near Brookings, OR from submarine launched plane
- **Post WWII**
  - Multiple nations develop / test submarine launched aerial assets
- **1996**
  - USS Chicago controls a Predator UAV from periscope depth
- **2005**
  - USS Albany launched first UAV from surfaced submarine
Historical attributes

**Pros**

- Aerial Assets were recoverable
- Ability to refuel / rearm / reuse
- Divorced operations of aerial / submarine asset
- Weaponized

**Cons**

- Organic Launch / Recovery required surfacing
- Sea-state could inhibit launch
- Manned aircraft
- Limited communications
• Surface launch / recovery removes submarine tactical advantage of stealth for short period
• ISR capabilities limited by range of aerial assets and ability to close target prior to launch
• Limited weapon payload capability made strike tactically irrelevant
• Launch of aircraft put submarine at risk
**Pros**

- Submerged launch
- Unmanned assets
- Advanced sensor payloads

**Cons**

- Not organically recoverable
- Requires constant LOS communications
- Limited on-station time
- Not serviceable
- Not lethal
System Engineering Process

Primitive Need

- Needs Analysis

Problem

- Functional Analysis

Requirements

- Allocation

Design

- Simulation

Decision Analysis

- Analysis of Alternatives

Recommendations
• Simulation
  – Explore impacts of UAS on weapon employment
  – Method yet to be defined

• Surveys
  – Determine preferences from stakeholders

• Trainer Exercise
  – Utilize fleet assets to compare simulation results
• **UAS parameters**
  – On-station time (min)
  – Launch time (min)
  – Personnel required for launch

• **Weapons Employment**
  – % Range error in target solution
  – Number of weapons launched in DRM
  – % hits on HVU
  – % hits on any vessel
Goals

• Determine if submarine launched-and-operated UASs are the proper tool for capability enhancement
• Identify universal UAS payload to cover identified areas of capability enhancement
• Determine acceptable impacts on weapons load out
• Submit IRB proposal to allow for survey data collection
• Continue application of system engineering process
• Design and implement simulation experiment
Questions
References

• Clough, B. (2002). UAV Swarming? So What are Those Swarms, What are the Implications, and How Do We Handle Them? Paper, Air Force Research Laboratory, Control Automation.
Approach

- Conduct stakeholder analysis
- Decompose desired capability enhancements
- Determine requirements
- Develop concept of operations
- Develop design
- Survey current technologies
- Conduct analysis of alternatives
- Synthesize desired UAS design
Basic Decomposition

Submarine Launched and Operated Unmanned Aerial System

Capabilities
- Full motion Video
- Color
- Black & White
- AIS
- GPS
- Radar
- Synthetic Aperture Radar (SAR)
- Communications
- LOS
- OTH
- Missile
- Weapons
- Imbedded (Kamikaze)
- Infrared (IR)

Missions
- Intelligence, Surveillance, Reconnaissance, Targeting (ISRT)
- Indication & Warning (I&W)
- Weapons System Employment
- Movements
- Safety of Ship
- Force Protection
- Mission Planning
- Mission Assessment
- Battle Damage Assessment

Stakeholders
- Submarine Force
- Units
- Operators
- Junior Officers
- Enlisted
- Commanding Officer
- Senior Officers
- DEVRON 12
- DEVRON 5
- COMSUBFOR
- Newport, RI
- Naval Undersea Warfare Center (NUWC)
- DARPA
- Naval Warfare Development Command (NWDC)
- Naval Postgraduate School (NPS)
- Office of Naval Research (ONR)
- Boeing
- Lockheed
- AeroVironment
- Northrop Grumman
- Industry
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Technologies
- BUSTER
- Past
- Current
- Future
- TDU Launch
- Switch Blade
- SLUAS
- Global Hawk
- UAS
- BAMs
- scan eagle
- Reaper
- 3" Launcher
- Switch Blade
- XFC / SeaRobin
- SLUAS

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Future
- SLUAS
- Global Hawk
- UAS
- BAMs
- scan eagle
- Reaper
- 3" Launcher
- Switch Blade
- XFC / SeaRobin
- SLUAS
# Unmanned Aerial Systems

## DoD Unmanned Aircraft Systems

(As of 1 JULY 2011)

<table>
<thead>
<tr>
<th>General Groupings</th>
<th>Depiction</th>
<th>Name</th>
<th>(Vehicles/GCS)</th>
<th>Capability/Mission</th>
<th>Command Level</th>
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<tbody>
<tr>
<td><strong>Group 5</strong></td>
<td><img src="image" alt="MQ-9 Reaper" /></td>
<td>USAF MQ-9 Reaper</td>
<td><img src="image" alt="Image" /></td>
<td>ISR/RSTA/EW/STRIKE/FP</td>
<td>JFACC/AOC-Support Corps, Div, Brig, SOF</td>
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<td>Group 4</td>
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<td>* 21-55 lbs</td>
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