U.S. Navy Puma AE
Sea Trial Report

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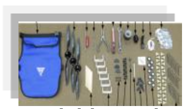
System Overview: Puma AECV

InfiniSpin Payload (3 each)

AECV Aircraft (3 each)

GCS & RVT with Battery and Case [(Same as Raven)]



Field Repair Kit

RSTA Kit

Additionally:
- Cables
- Batteries
- Chargers

Characteristics/Description

Wing Span	9.16 ft
Air Vehicle Weight	12.9 lbs (with payload)
Range	10KM (Omni); 20KM (Patch Antenna)
Airspeed	23-41 mph
Altitude	>500 AGL
Endurance	120 minutes
Data Link	Digital Data Link; AES-128 encryption
Payload	- InfiniSpin (Dual mounted/fully gimbaled) - Electro-optical day camera (side and front: 2592x1944 pixels); 3X Zoom; 5 Megapixel - IR (640 x 480) with Laser Illuminator (25 ft IR spot marking capability)
GCS	- 14 lbs (with RSTA laptop)

Purpose

Provides the small unit with an increased situational awareness and force protection by providing expanded reconnaissance and surveillance coverage of maneuver areas.

Characteristics

- Rapidly deployed/hand-launched
- SAASM GPS
- Combined EO/IR/LI fully gimbaled payload
- Target tracking
- Follow-me mode for mobile operations
- In-flight re-tasking
- Executes lost link recovery procedures
- Flight termination to pre-planned point
- Common mission planning (AMPS/Falcon View)

Status

- Non-POR
- Procured under 2 JUONS—288 total systems (includes systems inherited from REF)
- A 3rd JUONS will add 32 systems
- Uses same controller as Raven
- All systems for theater use

PUMA (AE) UAS
U.S. NAVY AT-SEA TEST REPORT

- USS BENFOLD (DDG 65) supported the demonstration
- Three familiarization flights on 7 October 2011
- One flight on 9 October 2011 conducting surveillance of a constructive strait
- AeroVironment embarked six personnel during the test period to install and operate the system. Operators that flew the Puma AE had previous experience flying in Afghanistan; however, this was their first at-sea experience.

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PUMA (AE) UAS
MEAURES OF PERFORMANCE (MOP) 1

- **Measure of Performance (MOP) 1: Investigate and document electro-magnetic interference (EMI) between Puma AE and USS BENFOLD.**
- **Measure of effectiveness (MOE) 1.1: Identify shipboard emitters that may interfere with Puma AE UAS controls.**

  Completed.

  No interference was noted. No ship sensors or systems operate in the 1.75 to 1.85 GHZ range.
- **MOE 1.2: Determine EMI of shipboard sensors on the Puma AE flight control and data link.**
  - Completed. No interference was noted.
- **MOE 1.3: Determine EMI of Puma AE data link on shipboard equipment.**
  - Completed. No interference was noted.

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MEAURES OF PERFORMANCE (MOP) 2

- **Measure of Performance 2: Determine Puma AE UAS ability to conduct shipboard operations.**
- **MOE 2.1: Determine the ability to launch from DDG flight deck.**
  - Completed.
- **MOE 2.2: Determine Puma AE UAS ability to recover on a DDG flight deck.**
  - Completed. Landing was more difficult. A deep stall is the landing technique; it consists of the aircraft going nose up and the engine shutting down. The operators had never flown from a ship so factors such as turbulence and ship speed resulted in inconsistent and hard landings. The airframes are rugged and suffered no damage in landing that could not be quickly repaired.
- **MOE 2.3: A subjective evaluation on potential for use by Navy operators.**
  - Completed.

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MEAURES OF PERFORMANCE (MOP) 3

- **Measure of Performance 3: Determine tactical utility of Puma AE in a small boat threat scenario.**
- **MOE 3.1: Determine video quality**
  - Completed. Video quality on the control devices was excellent.
- **MOE 3.2: Evaluate timeliness of supplied data**
  - Completed. Time to launch from a standby condition was three to five minutes. The UAV transited at about 40 kts and tactical distance was 5,000 yards to 10,000 yards. The arrival time at the initial search position was measured in minutes. The ship's decision makers were impressed with the ability of the UAV to support operations.
- **MOE 3.3: Determine UAS at-sea limits**
  - Partially completed.
- **MOE 3.4: Evaluate whether data is tactically actionable information that improves the small boat threat scenario.**
  - Completed.

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PUMA (AE) UAS CONCLUSIONS

1. Based on observations, Puma operations could be conducted in any sea conditions that support small boat ops, making the system viable in a small boat threat environment.
2. The CO, XO, and department heads were impressed by this capability. Key highlights included launching in minutes without a large flight deck crew and shipboard control.
3. Puma AE provided increased situational awareness (SA).
4. There was no discernible interference between shipboard emitters and the Puma AE control frequencies.
5. Puma AE is easy to launch. After some experimentation for the best winds, launches became routine
6. A deep stall is the landing technique; it consists of nose up and engine shutdown. The operators had never flown from a ship so factors such as turbulence, crosswinds, and ship movement resulted in inconsistent and hard landings.
7. Crosswind is a critical component of the landing equation.
8. This test provided enough data to conclude that Puma AE operations on CRUDES units are a viable concept.

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PUMA (AE) UAS RECOMMENDATIONS

1. Invest in several systems to determine long-term durability (i.e. a full deployment) and employment tactics, techniques and procedures (TTP).
2. Provide a system to an independent FIFTH Fleet deployer for an extended at-sea evaluation. The CO of USS BENFOLD was confident he could routinely and safely operate Puma AE after several weeks of use; he requested a system for his next deployment.
3. Further investigate the following areas:
   a) Improve the landing process to ease the force of impact and accuracy. Develop procedures that take into account crosswind and shipboard turbulence as a starting point. Software that allows the UAV to land on a moving ship (already developed by AV but not available for this demonstration) or a net should be investigated as well.
   b) Develop command and control TTP as well as employment plans for various scenarios.
   c) Develop search techniques; the best combination of altitude and magnification (zoom) to search and determine intent.