Joint Medical Distance Support and Evaluation (JMDSE) Joint Capability Technology Demonstration (JCTD) & Joint Precision Air Delivery Systems (JPADS)

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ABSTRACT

We will describe the technology to be used in JMDSE, a FY09 new start JCTD. DUSD AS&C is the proponent organization for JCTDs and JMDSE is being managed by a Joint Department of Defense (DoD) team with USJFCOM as the Operational Manager and NSRDEC as the Technical Manager. JMDSE is focused on low weight payloads (Micro Light Weight (10-150lbs) and Ultra Light Weight (200-700lbs)) JPADS for delivery of small medical bundles, sensors, robots and Psychological Operations (PSYOP) payloads along with Command and Control (C2) compatible litters from fixed wing, rotary wing and unmanned aerial systems (UASs). JMDSE will focus heavily on US Special Operations Command (USSOCOM) aerial delivery requirements.

The purpose of the JPADS is to meet the Combatant Commander (COCOM) requirement of sustaining combat power using high altitude, precision airdrop as a direct and theater delivery method, into a dynamic, dispersed, and unsecure battlespace. This must be done with speed and flexibility to provide an optional capability previously unavailable to the COCOM, and to enable decisive operational superiority. The JPADS programs include five primary weight classes of self guided systems, an equivalent range of high altitude low opening ballistic non-steerable systems, navigation aids for military free fall jumpers all of which are linked to a common JPADS Mission planner. All payloads are required to be airdroppable from up to 25,000 feet Mean Sea Level (MSL) and each have specific accuracy requirements which will be provided in detail with a focus on the lower end weight classes.

This presentation will also provide an overview of the JPADS programs, the participating organizations, recent Rapid Fielding Initiatives (RFIs) and the status of current Programs of Record.

ABOUT THE AUTHORS

Mr. Richard Benney is an Aerospace Engineer in the Warfighter Protection and Airdrop/Aerial Delivery Directorate, NSRDEC. Mr. Benney is responsible for approximately 80 aerial delivery team leaders, engineers and technicians working on aerial delivery research and development programs for DoD. Mr. Benney was the Technical Manager for the JPADS Advanced Concept Technology Demonstration (ACTD) program from 2004-2008 and is responsible, or a key Army contributor, for the execution of nearly all DoD JPADS Science and Technology and Rapid Combat Fielding programs executed to date. Mr. Benney is also the Technical Manager for the new start 2009 JMDSE JCTD. Mr. Benney has published over 70 technical papers on airdrop systems and related technology and been the primary DoD and NATO organizer of multiple international precision airdrop demonstrations since 1999.

Mr. Andrew Meloni is an Aerospace Engineer in the Warfighter Protection and Airdrop/Aerial Delivery Directorate, NSRDEC. Mr. Meloni is responsible for multiple airdrop systems, including the Mosquito and Provider Micro Light Weight JPADS. Mr. Meloni was lead technical organizer for the Precision Airdrop Technology

Conference and Demonstration 2007 (PATCAD '07) and has supported the fielding of the 2K and 10K Screamer JPADS to Operation Enduring Freedom (OEF).

Mr. Mike Henry is an Aerospace Engineer in the Warfighter Protection and Airdrop/Aerial Delivery Directorate, NSRDEC. Mr. Henry is responsible for multiple airdrop systems, including the lead Army POC for the JPADS-MP. Mr. Henry was the lead technical organizer for the Precision Airdrop Capability Demonstration (PACD) 2008 support by NATO in France.

Ms. Kristen M. Lafond is a Mechanical Engineer in the Warfighter Protection and Airdrop/Aerial Delivery Directorate, NSRDEC. Ms. Lafond has been responsible for over 20 airdrop systems and 14 contracts over her 5 years of service at NSRDEC. Her experience includes small bundle guided resupply of 150lbs-700lbs, guided airdrop of up to 2,200lbs using both round and ram-air canopies from 24,500 ft MSL, High Altitude Low Opening (HALO) airdrop of up to 10,000lbs using standard Army inventory parachutes, Low Cost Low Altitude (LCLA) airdrop of 100lbs-450lbs from 150 ft Above Ground Level (AGL), and development of sensors for airdrop applications. She has also served as the lead engineer on two international airdrop demonstrations, is a co-author on three technical papers on airdrop operations and related technologies, and holds her senior rigger certificate. Currently, she is starting work as the Lead Engineer for the JMDSE JCTD.

Mr. Sanjay Patel is an Aerospace Engineer in the Warfighter Protection and Airdrop/Aerial Delivery Directorate, NSRDEC. Mr. Patel has 20+ years of airdrop engineering and program management experience.

LCDR Gregory Cook is a Naval Medical Service Corps Officer, in the Office of the Command Surgeon, USJFCOM. LCDR Cook is responsible for medical concept development for USJFCOM. LCDR Cook is the Operational Manager for the new start 2009 JMDSE JCTD.

Mr. Larry Goodell works at ODUSD AS&C as an oversight executive for JMDSE JCTD.

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BACKGROUND

JPADS General

JPADS Weight Classes

The DoD Joint Precision Airdrop System (JPADS) programs[1] encompass a family of systems being executed through a variety of efforts, partners and funding sources. The JPADS family of systems consisting of "self-guided" cargo parachute systems, navigation aids for MFF parachute systems all linked to a common mission planning & weather system (JPADS-MP[2]). The weight classes are as follows:

- Micro Light Weight (MLW): 10-150lbs
- Ultra Light Weight (ULW): 250-700lbs
- Extra Light (XL, also known as 2K): 700-2200lbs
- Light (L, also known as 10K): 5,000-10, 000lbs
- Medium (M): 15,000-30,000lbs (potentially up to 42, 000lbs)

The "2K" Program of Record (POR) variant (known as Firefly) completed operational testing (OT) in Sept08 and is scheduled to reach a Mile Stone C (MS-C) decision by the end of April 2009. The 10K variant transitioned from the very successful JPADS Advanced Concept Technology Demonstration[3] (ACTD) to a formal POR, MS-B approved in Aug07. The 10Klbs (known as Dragonfly[4]) variant is in design validation (DV) testing, and is scheduled to enter developmental testing (DT) during the summer of CY09. The ACTD residuals (6+ 10K Screamer systems[5]) have been rapidly fielded to US Army Special Operations Command (USASOC) and are in theater for potential use in Operation Enduring Freedom (OEF). The Capability Development Document (CDD) which covers both the 2K and 10Klb increments was approved by the Joint Requirements Oversight Council (JROC) on 5Mar07 and includes an objective weight of 250-700lbs. The USMC is expected to release a Request for Proposals (RFP) for the ULW during fiscal year 2009 (FY09) and First Unit Equipped (FUE) starting 2nd Quarter FY11 (2QFY11) with approximately 700 systems planned to be fielded. An Army Technology Objective (ATO) science and technology project demonstrated a 30Klb JPADS capability parafoil (9,000sqft)[6], dropped from 25Kft MSL and landing within 100M of the pre-planned target numerous times with a 3.4+ lift to drag ratio. A 42Klb demonstration (10,500sqft parafoil) was conducted in Jan09. US Army Combined Support Command (USACASCOM) is the JPADS combat developer for JPADS XL and L. USA CASCOM announced in May08 that they do not plan to pursue a CDD for a 30Klb JPADS capability at this time. Numerous MFF Navigation Aids (NAVAID) have been examined under JPADS. The USMC are fielding one variant and a USASOC CDD is expected to be approved in FY09 with a MS-B start, lead by PM-CIE, soon after. A new 3-year DUSD AS&C supported JCTD known as Joint Medical Distance Support and Evacuation (JMDSE) was approved in Dec08 and will include the JPADS MLW capability focused on 10-150lb payloads and dropped from fixed wing, rotary wing and UAS aircraft to deliver a wide range of payloads to include medical support bundles, sensors, robots and PSYOP items. In addition, JMDSE will mature and demonstrate higher weight payloads with the chosen USMC ULW JPADS.

JPADS Use to Support Current Operations

Under a Feb06 Operational Need Statement (ONS) generated by Combined Joint Task Force 76 (CJTF-76) which was elevated to a Joint Universal Operational Need (JUONs) by Central Command (CENTCOM) in Aug06 and approved as an Immediate Warfighter Requirement (IWN) on 12Sept06, 50 2Klb JPADS systems (2K Screamers) were rapidly fielded by NSRDEC to OEF by Feb07. A Feb07 ONS requested 300 more 2K systems. PM-FSS delivered 100 more 2K Screamers and began fielding Firefly systems to OEF under an Urgent Material Release in Sept08. The DoD has used the JPADS-MP for USSOCOM Military Free Fall (MFF) missions since FY04. The USAF first used the JPADS-MP in combat on 29Jul06 with the improved container delivery systems (ICDS) which are ballistic Army inventory/fielded cargo parachute systems (26 foot Ring Slot, G-12 parachute system, Hi Velocity and Low Velocity Low Cost Aerial Delivery Systems (HV and LV LCADS)) when used with the JPADS-MP for increased accuracy. The JPADS-MP is also used for all JPADS drops (2K Screamers were first dropped on 31Aug06). The first Firefly 2K combat airdrops occurred in Sept08. Airdrop operations in Afghanistan and to a lesser extent in Iraq have continued to increase. The total pounds of supplies delivered via airdrop per year are as follows: 2005: 2Mlbs, 2006: 3.5Mlbs, 2007: 8.2Mlbs, 2008: 16.6Mlbs. In addition, recent press releases from theater (OEF) have stated that doubling 2008 drops is anticipated in 2009 (i.e. up to 32M pounds of airdrops expected during CY09).

JMDSE JCTD

The JDMSE JCTD will address the military need for a combat casualty care capability to significantly enhance land, air and sea medicine, provide precision logistical delivery and be a force multiplier for high demand low density assets. The JCTD is focused on a twofold approach to accomplish the objectives which are:

1) Joint Combat Casualty Care System (JCCCS) is focused on: Integrated medical support systems and telemedicine: Remote casualty care on land, in air and at sea; Virtual triage (monitoring and automated casualty care) on noncontiguous areas of operations; Automated monitoring and care stations connected to a closed loop casualty care system and to medical forces at a distance; Audio/video data & voice communications between First Responder and higher Health Service Support Capabilities (HSSC); Remote monitoring of vitals, dispense fluids and medicines as directed by higher HSSC, as needed; and Quick reaction response to biological attack scenarios. This aspect of JMDSE will not be elaborated on in this paper.
2) Joint Precision Airdrop System – Medical (JPADS-Med) focused on: Ultra Light Weight (ULW: 250-700 lbs) small medical bundles or equipment delivery; Micro Light Weight (MLW: 10-150 lbs) medical bundles, robot/sensor/PSYOP delivery and manned and UAS deployable variants; Integration into Manned USAF/USMC Platforms such as: HH-60, CH-53, C-130, C-17, V-22; Integration into existing UAS: Tigershark/others, utilize and demonstrate quick reaction response to Biological Weapon of Mass Destruction (BIO WMD) attack scenarios.

DISCUSSION, RESULTS AND PLANS

JMDSE JCTD

The JMDSE JCTD program will refine the warfighter requirements, develop the Concept of Operations (CONOPs), identify the materiel solution and select mature government off-the-shelf or commercial-off-the-shelf technologies (GOTS/COTS) for integration during calendar year 2009 to include technical tests. This will be closely followed by a series of Technical Demonstrations (TD) to validate that the technologies are ready for follow-on Operational Demonstrations (OD) beginning in CY10 in relevant operational environments to assess the military utility of the

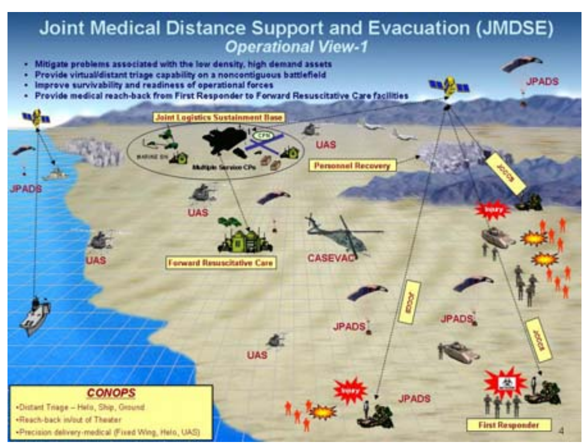

Figure 1. Operational View Concept for the JMDSE JCTD

JMDSE JCTD. The program will conclude in CY11 after the final OD and sponsor approved submission of the Operational Utility Assessment (OUA) with residual support through FY12.

JPADS (MLW and ULW) will provide aerial deliver of therapeutics, medical equipment, combat care kits, combat critical care systems, expendable re-supply items for biological detection systems, prophylaxis, and robot/sensor/PSYOP systems. Through competitive prototyping, two precision aerial delivery systems will be integrated for the precision delivery mission to include: MLW system for delivery of 10-150 lbs. In addition, the ULW system for 250-700 lbs payloads will be used to demonstrate higher weight medical payload delivery. Each system, guided by an airborne guidance unit (AGU), will be developed to support both land and maritime units and will be integrated into the USAF JPADS MP. The MP will integrate forecasted and actual winds aloft to establish a drop aircraft's launch acceptability range (LAR) to ensure the systems will reach the intended point(s) of impact. This, in effect, will keep aircraft and aircrew out of harms way and enable the anticipated system accuracy threshold for MLW of 50 meters (10m Objective) and ULW of 150 meters (50m Objective) at 80% Circular Error Probable (CEP) with a system reliability of 94%. All payload capabilities will be aerial delivered from representative USAF, USMC and possible other service manned fixed and rotary wing aircraft platforms (ex. HH-60, CH-53, C-130, C-17, V-22) and select UAS. Figure 1 is a graphical representation of the Operational View for the JCTD. The technologies developed during the JMDSE JCTD could be used in a variety of scenarios to include:

- Emergency delivery of medical supplies to a remote SOF team with a venomous animal bite casualty (e.g. jungle snake or spider bite)
- Worldwide delivery of medical supplies within 24 hours after a biological or chemical attack is detected to include treatment for warfighters and local population
- Resupply of stranded or disabled ship or downed pilot at sea
- Pre-positioned medical supplies on board manned aircraft for "on call" resupply
- Aerial delivery of a Unmanned Ground Vehicle (UGV) for IED detection and defeat
- Aerial delivery of sensors and supplies to warfighters operating in an urban environment
- Delivery of PSYOP leaflets from high altitude and high offset
- Humanitarian resupply during a natural disaster

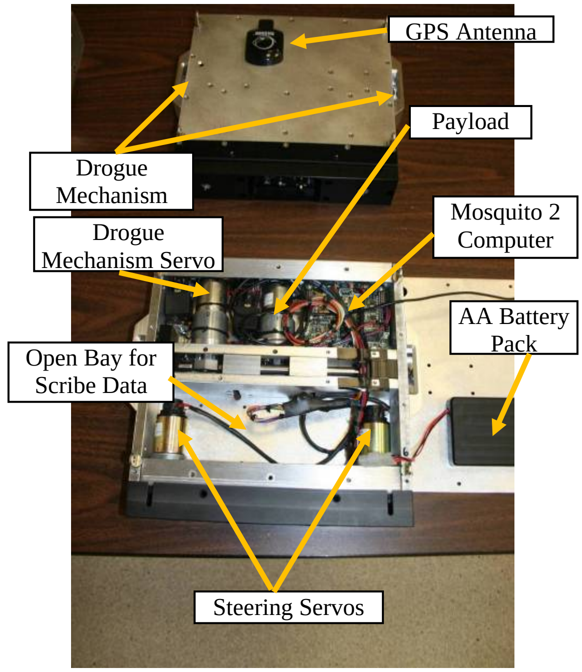

Figure 2. MDS3 Components and Functionality

The JMDSE MLW JPADS capability will compete a Stara Technologies, Inc system and an Atair Aerospace system through at least 2nd Quarter CY10. The Atair system design has just recently begun and will not be described in this paper. The Stara Mosquito system is a guided parachute "kit" comprised of a flight computer, steering servos, payload interface mechanism and parachute that can be packaged into various form factors. The Mosquito 2 technology was repackaged into the MDS3 form factor to accommodate light weight resupply bundles. Stara is also supported through a Phase II Small Business Innovative Research (SBIR) contract with the Armaments Research Development and Engineering Center (ARDEC). Figure 2 shows the current prototype system. The AGU is approximately 12 in by 10 in by 2 in and weighs 10lbs. The MDS3 has been designed to accurately deliver payloads weighing between 1 and 150 pounds within 50 meters of a pre-programmed GPS impact point (IP). It is expected to also be reusable (15 times minimum) and will be tested with inventory MC-5 parachutes with weights up to 250lbs.

The JMDSE JCTD has determined a set of requirements for each weight class to be used during this program (MLW and ULW). The Micro Light Weight system must be able to be deployed from C-130, C-17, V-22, CH-53 or CH-46 aircraft anywhere from 3,000 to 25,000 ft MSL. Ability to be deployed from Unmanned Aerial Vehicles is also an objective. The system must have an accuracy of 50m CEP with an objective of 10m CEP and ensuring 85% load survivability in 17 knot ground winds (25 knot objective). A horizontal offset of 8 km from 25,000 ft MSL is required with an objective of 30 km offset. The Ultra Light Weight system has the same requirements for deployment altitude and aircraft, offset, load survivability and reuse. The accuracy requirement for the ULW is 150m CEP threshold with a 50m CEP objective.

The NSRDEC has supported Strong Enterprises to support the development of three parafoil sizes for the wide (10-150+lb) payload range of the MDS3 system. The parafoils were designed for low cost (rectangular plan form, common sized cells, etc.). Strong is currently collaborating with NSRDEC on materials research and testing to develop a low cost one time use parafoil in this MLW weight range that could be dissolvable, biodegradable etc to help ensure unattended ground sensors are less visually exposed after a predetermined amount of time after landing. Strong Enterprises has also designed and fabricated an AGU fabric/protective cover, a common 30 inch drogue parachute for all three sized parafoils and the parachute/drogue bags for the MDS3. Table 1 shows the top level parafoil parameters.

Table 1. Mosquito Parafoil Properties

Parafoil Size	Estimated L/D	Span x Chord	Cells	Payload Weight
40 sq ft	2.5	7.7 ft x 5.2 ft	7	20 – 40 lbs
80 sq ft	2.5	13.2 ft x 6.1 ft	7	40 – 110 lbs
150 sq ft	2.5	16.8 ft x 8.9 ft	7	100 – 165 lbs

Initial testing of the MDS3 has been conducted during a small series of test weeks to collect performance data on the parafoils and tune the Guidance, Navigation and Control (GN&C) for each size parafoil and weight range. Tests have been conducted at the US Army Yuma Proving Ground (Huey helicopter), Kingman Arizona (C-123), Stara's "Dateland" AZ dropzone from a Buckeye powered parafoil and in Florida (radio controlled tests). During these tests the MDS3 units have been dropped using all three canopy configurations. It should be noted that in each weight class the exact same type of guidance system was used while the only component that changed was the parafoil. Table 2 shows a summary of the best drops from for each canopy size.

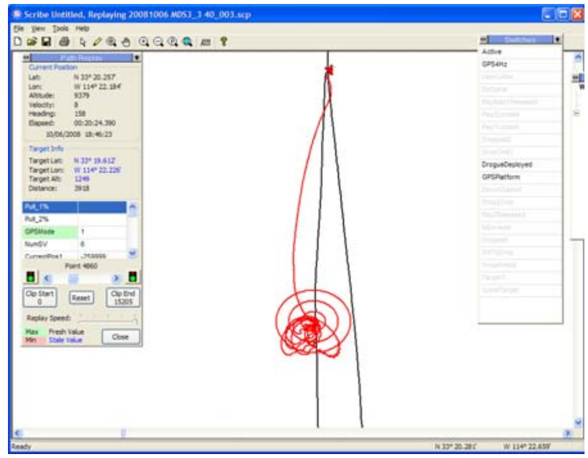

Figure 3. Mosquito Flight Path (Miss Distance: 6m)

Many drops were conducted during the initial series of test weeks, using many different payloads, including cargo bundles, medical resupply bundles, leaflet delivery, an Intelligent Munitions System

Figure 4. Mosquito delivering the IMS under a 150 sq ft parafoil

(IMS) mock-up and an iRobot mass model. Airdrops were conducted from up to 10,000 ft MSL on the previously mentioned aircraft. During successful flights, accuracies have been consistently within 75m of the intended target with a few landings within 10m. These tests were used to improve parafoil and drogue design and rigging as well as the GN&C algorithms. Figure 4 shows the Mosquito system dropping leaflets and the IMS. Figure 5 shows the Mosquito system landing near the target with a mock medical bundle.

Table 2. Mosquito Testing Best Flights

Parafoil Size	Payload	Drop Aircraft	Release Altitude (ft MSL)	Date	Miss Distance (meters)
40 sq ft	Cargo Box – 30 lbs	C-123	7,000	18 Sept 08	25
40 sq ft	Cargo Box – 30 lbs	UH-1 Huey	9,500	6 Oct 08	5
40 sq ft	Cargo Box – 30 lbs	UH-1 Huey	9,500	6 Oct 08	6
40 sq ft	Cargo Box – 32 lbs	UH-1 Huey	9,500	8 Oct 08	55
40 sq ft	Cargo Box – 32 lbs	UH-1 Huey	9,500	9 Oct 08	97
40 sq ft	Medical Bundle – 40 lbs	C-123	10,000	3 Feb 09	26
80 sq ft	Cargo Box – 60 lbs	UH-1 Huey	9,500	19 Aug 08	45
80 sq ft	Cargo Box – 60 lbs	C-123	7,000	18 Sept 08	56
80 sq ft	Cargo Box – 64 lbs	UH-1 Huey	9,500	6 Oct 08	47
80 sq ft	Cargo Box – 61 lbs	UH-1 Huey	9,500	6 Oct 08	41
80 sq ft	Cargo Box – 64 lbs	UH-1 Huey	9,500	7 Oct 08	75
80 sq ft	Cargo Box – 64 lbs	UH-1 Huey	9,500	8 Oct 08	71
80 sq ft	Cargo Box – 61 lbs	UH-1 Huey	9,500	8 Oct 08	50
80 sq ft	iRobot Model – 85 lbs	C-123	10,000	3 Feb 09	50
80 sq ft	iRobot Model – 85 lbs	C-123	10,000	4 Feb 09	77
150 sq ft	Cargo Box – 130 lbs	C-123	7,000	16 Sept 08	21
150 sq ft	Cargo Box – 130 lbs	C-123	7,000	18 Sept 08	57
150 sq ft	Cargo Box – 130 lbs	C-123	7,000	19 Sept 08	68
150 sq ft	Cargo Box – 134 lbs	UH-1 Huey	9,500	6 Oct 08	77
150 sq ft	Cargo Box – 133 lbs	UH-1 Huey	9,500	7 Oct 08	54
150 sq ft	Cargo Box – 134 lbs	UH-1 Huey	9,500	7 Oct 08	10
150 sq ft	Cargo Box – 144 lbs	UH-1 Huey	9,500	8 Oct 08	51
150 sq ft	Cargo Box – 97 lbs	UH-1 Huey	9,500	8 Oct 08	43

Many upgrades are planned for this system over the coming 6 months to include: GN&C enhancements and porting of the Draper Lab/NSRDEC software to the MDS3 AGU[7]. Integration of a RADAR based height sensor[8] for both terrain avoidance and near ground flare timing which will be augmented with the incorporation of Defense Terrain Elevation Data (DTED) within the AGU for the planned area near the impact point coordinates. In addition, peer to peer communications will be utilized to provide measured wind information from lower systems in a stick to upper systems to enhance accuracy and for in-flight and ground impact "tracking" which is described later in this paper.

Figure 5. Mosquito delivering a medical resupply bundle to the target (white post)

JMDSE MLW JPADS Unmanned Aerial Systems (UAS) Variant Plan

The MDS3 is also currently being repackaged in a cylindrical form factor (8 inch diameter) to support UAS "Pod" (i.e. PROVIDER) drops. This repackaging effort will utilize the same AGU components and maintain the same capabilities, software etc. as the MDS3 units. The system will also use the same drogue parachutes and the same three (different packing configuration) parafoil sizes discussed above with the same Pod tail end. The front end and cargo capacity will vary with user feedback o ensure maximum compatibility with priority payloads. The design is modular in that it will allow the AGU to detach a resupply pod while flying under the parafoil by separating the Pod front end at the

AGU fitting. The JMDSE JCTD will focus on integration and airdrop testing from the "Tigershark" UAS on which a similar Stara system has been integrated and tested in the past. Figures 6 shows the Tigershark loaded with a PROVIDER mock up.

Figure 6. Mockup 8 Inch PROVIDER Mounted Under Tigershark UAS

The nose of the PROVIDER is a shock absorbing material that can be reused. The Pod will conform to a 14 inch bomb rack configuration to allow for maximum compatibility with other UAS (Shadow, Predator, Hunter, Hummingbird) and tap the UAS for power to maintain AGU battery only during flight.

The exterior components of the Mosquito 2 are:

- Packed Parafoil (not shown packed)
- Housing
- Status LEDs
- Pull Out Power Switch
- Payload Attachment Mechanism

The interior components of the Mosquito 2 are:

- GPS Receiver (4hz Commercial)
- Drogue Release Mechanism
- Winch Drum / Steering Servos
- Mosquito 2 Flight Guidance Computer
- RF Modem (Optional)
- Battery

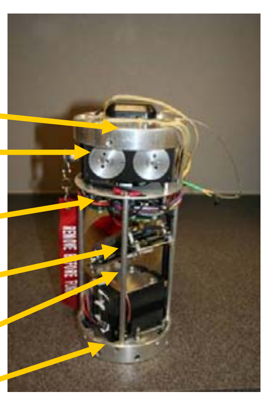

Figure 7. Stara Mosquito 2 Repackaged in Navy Sonobuoy sized (4 7/8" diameter) Tube

The repackaging is anticipated to be very similar to the Mosquito 2 Packaged in a Sonobuoy Tube shown in Figure 7, which is a 4 7/8 inch diameter AGU with no front end payload area shown. The deployment sequence for UAS drops is planned as follows:

1) Target located/defined, UAS ground controller provides to PROVIDER/JPADS-MP ground control operator (will likely be same person with software run on same ground laptop)
2) JPADS-MP ground operator utilizes GPS target point to determine a Launch Acceptability Region (LAR) within which the PROVIDER can be dropped.
3) JPADS-MP ground operator computes a mission file for PROVIDER, sends it via Iridium (A Satellite Communication (SATCOM) system being used for concept demos) ground unit linked to JPADS-MP laptop to an Iridium system mounted on the UAS.
4) The Iridium on the UAS utilizes 802.11 WI-FI to wirelessly update the mission file to the (each) PROVIDER. The AGU acknowledges the new mission, which is fed back via SATCOM to the JPADS-MP ground user who in turn informs the UAS ground control operator of the LAR for the UAS to drop the PROVIDER within to ensure delivery to the planned target.
5) The UAS operator instructs the UAS to release the PROVIDER from within the LAR.
6) A spring loaded mechanism is used to deploy the PROVIDER drogue chute after safe clearance from the UAS (2-3 seconds). The AGU drogue release time begins count down and the PROVIDER operates as a self guided parafoil system for the remainder of its flight to ground impact.

Figure 8 shows the initial sequence of a UAS drop of PROVIDER.

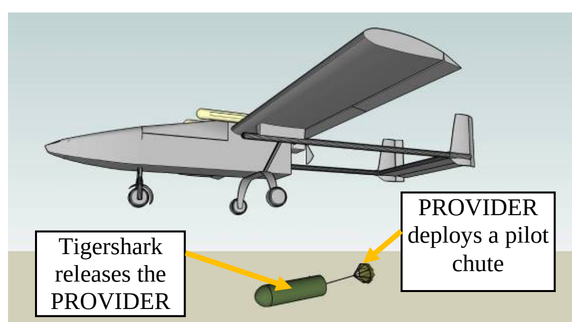

Figure 8. PROVIDER releases from Tigershark UAV

After flying to the target area the modular PROVIDER can (optional) release the Payload Pod(s) which descends downward to the ground and lands on a crushable nose cone that reduces shock of impact, as shown in Figure 9.

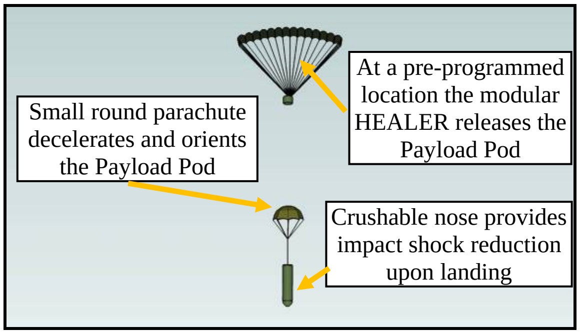

Figure 9. PROVIDER releases the Payload Pod at a pre-programmed location

The mounting rack will tap into the external aircraft/UAS power system for continuous AGU power during flight and may also connect to the serial connection of the UAS autopilot for tactical payload mission reprogramming in flight in the future.

Tracking and Other Iridium (SATCOM) Data Link Usages

The CPU records system flight data and tracking of JPADS (single or multiple systems) during flight via SATCOM to relay information to ground users and other aircraft in the area is a desired capability. To demonstrate these capabilities, each system will transmit its location information to the master system which includes a non-integrated SATCOM system (Iridium and 802.11 link for concept demonstrations). Through the use of a long range RF link between systems (line of sight) each system will be able to pass/receive information regarding other systems such as current location and/or measured winds. Measured winds will be passed from lower systems to higher altitude systems to improve accuracy, while location information will be passed from lower system to the highest altitude (SATCOM equipped) system to allow for remote tracking and ground impact locating. This capability will be demonstrated by passing live (10-30 second latency) position information of MLW JPADS airdrops to a web browser (Google Earth mapping application) anywhere in the world during a flight. Military tracking systems are also being explored by NSRDEC and others but will not be discussed in this paper. The concept is depicted in Figures 10 and 11.

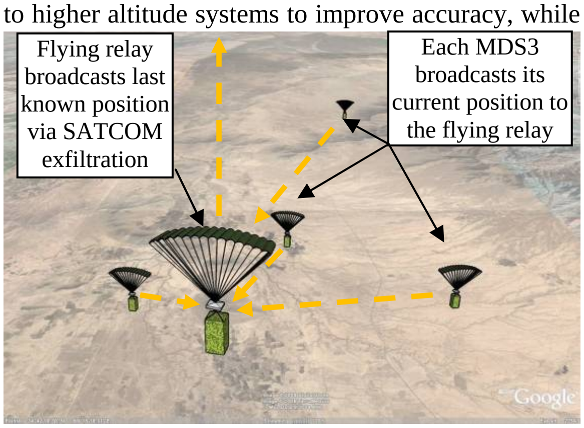

Figure 10. In-flight RF information passing and SATCOM link for tracking, etc.

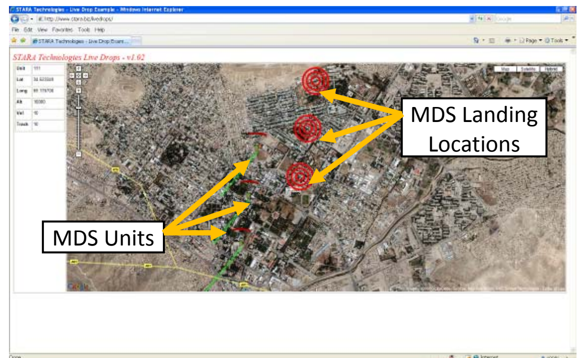

Figure 11. Graphical Display of MLW JPADS systems in flight over Google Earth Mapping Engine displayed in a web browser

Some flight tests of Stara and Draper Labs GN&C software and a very low cost test bed are executed by integrating new NSRDEC technologies with the Mosquito powered GU-11 autonomous powered parafoil. This system will be used to quickly and efficiently evaluate performance at the Dateland, AZ test facility. The system is shown in Figure 12 and can carry a 400lb payload.

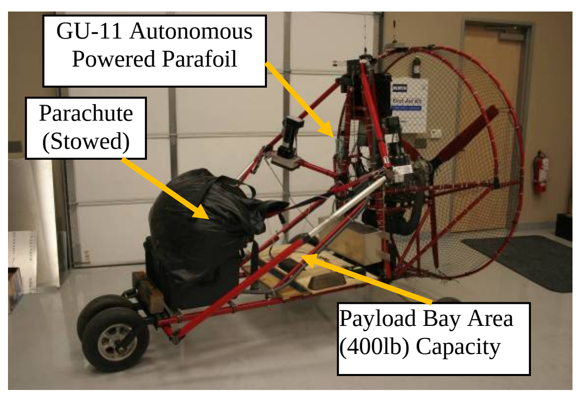

Figure 12. GU-11 "Buckeye" Autonomous Powered Parafoil

CONCLUSION

JPADS interest and usage continues within the DoD and other allied nations. Use of precision airdrop has saved numerous lives through emergency resupply and as an alternative to helicopter or truck convoys for resupply of remote Forward Operating Bases (FOBs). The use of precision aerial resupply doubled from CY07 to CY08 to 16 million pounds of supplies delivered to troops in OEF. This number is expected to double again in CY09 to over 32 million pounds. New JPADS programs continue to develop systems to support many new anticipated missions in many weight ranges.

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