



**FOCUS AREA: ENDURING AIRPOWER LESSONS
FROM OEF/OIF
SMALL UNMANNED AIRCRAFT SYSTEMS**



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“The capabilities we are called upon to provide the Joint team are essential to our Nation's success. We've made a solemn commitment to deliver those capabilities without fail, whenever, wherever and however we are called upon to serve. How do we do this most effectively? We listen. We evaluate. We adapt. The *AF Lessons Learned process* is how we initiate changes to training, materiel and doctrine and institutionalize those improvements.”

— Gen Norton A. Schwartz, CSAF

EXECUTIVE SUMMARY

“Enduring Airpower Lessons from Operation ENDURING FREEDOM (OEF) and Operation IRAQI FREEDOM (OIF)” is one of three lessons learned (L2) focus areas directed by the Chief of Staff of the Air Force (CSAF) at CORONA Top 2008. This report is the third and last in a series of Unmanned Aircraft Systems (UAS) L2 reports produced for fiscal year 2009 and focuses on Small UAS (SUAS) capabilities and issues.

Five key observations provide insight into SUAS issues:

OBSERVATION 1: Insufficient analysis and education exist on the capabilities of SUAS and how they could be effectively employed by the USAF.

OBSERVATION 2: The USAF does not have a comprehensive strategy for the acquisition, sustainment and development of SUAS capabilities; and the USAF has not properly funded SUAS programs.

OBSERVATION 3: HQ AFSOC received funding and has developed the first Air Force SUAS Formal Training Unit (FTU).

OBSERVATION 4: There are no full-time, dedicated professional uniformed Group 2 and 3 UAS operators and maintainers.

OBSERVATION 5: Frequency and bandwidth management, communications infrastructure and datalinks will only be more stressed with the proliferation of SUAS; and SUAS Ground Control Station (GCS) frequencies are unencrypted and unprotected.

According to the recently released USAF UAS Flight Plan (FP), “Small UAS represent a profound technological advance in air warfare by providing not only the commander, but individual service members’ life-saving situational awareness.” SUAS have the capability to:

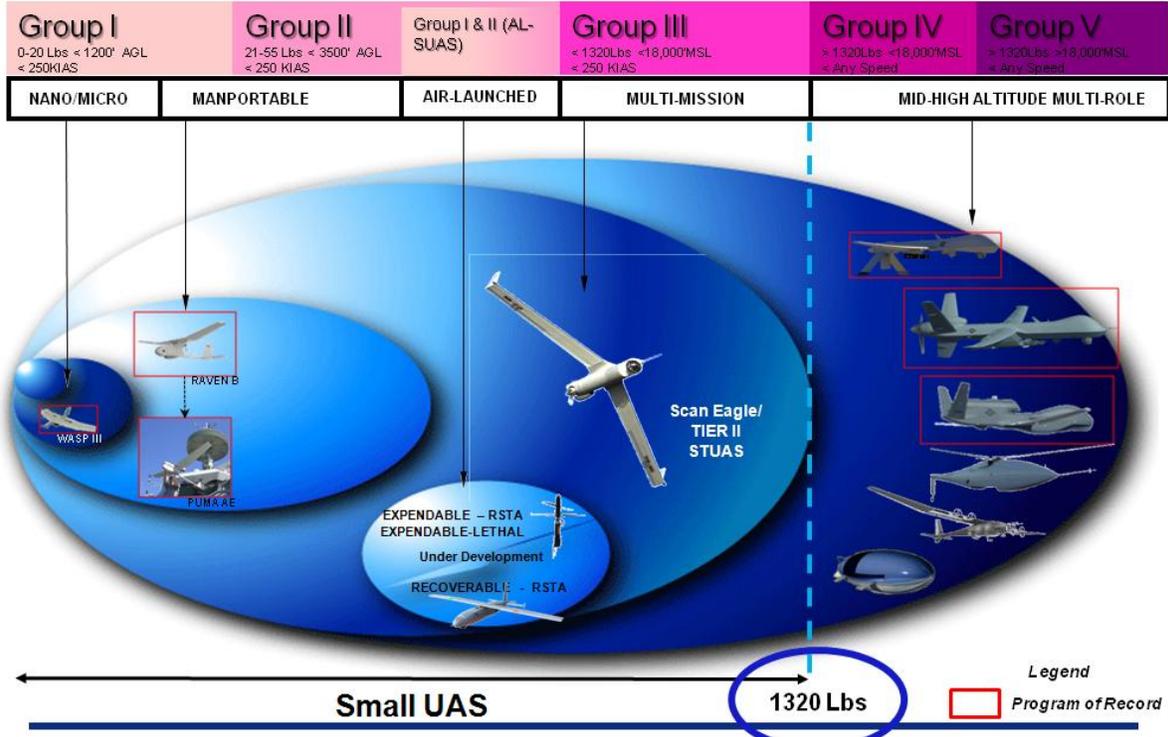
- Provide an electro-optical (EO) and infrared (IR) full-motion video (FMV), low probability of detection capability to tactical units executing lower than theater-level priorities;
- Act as force multipliers extending the reach and vision of tactical commanders into less permissive environments without increasing risk to personnel;
- Enable actionable intelligence for a variety of missions; and
- Contribute to an overall Intelligence, Surveillance and Reconnaissance (ISR) collection plan by providing theater-grade products to tactical units anytime, regardless of priority.

The organic nature of SUAS allows a commander greater flexibility in the timing and execution of operations and creates a more responsive and tailored intelligence picture.

In 2006, the AF/XO defined “Small [Unmanned Aerial Vehicle]” as any unmanned air vehicle “smaller than Predator”. In November 2008 the Vice Chairman of the Joint Chiefs of Staff accepted US Joint Forces Command Joint Concept of Operations for UAS, which included a new method of categorization of Unmanned Aircraft (UA). Based on the constants of gross weight, normal operating altitudes, and airspeeds UA fell into one of five Groups. Air Force Policy

Directive (AFPD) 11-5, “Small Unmanned Aircraft Systems (SUAS) Rules, Procedures, And Service”, dated 17 Aug 09, further defined “Small UAS” as comprising Groups 1-3. Group 3 UA weigh less than 1,320 pounds, operate below 18,000 feet above mean sea level, and fly no faster than 250 Knots Indicated Air Speed. [See Figure 1 below for the corresponding UAS Family of Systems operated or contracted by the USAF.] The AF currently has three operational

Figure 1 - USAF UAS Family of Systems



SUAS. The Wasp III and Raven B are man-portable and operated by uniformed Battlefield Airmen and Security Forces. The Wasp and Raven have ranges of three miles and ten miles, respectively, with endurance of 45 to 90 minutes. The Scan Eagle is a larger, more capable system and is contractor-operated. Scan Eagle has a range of 68 miles and can fly more than 20 hours. Raven B and Scan Eagle have been purchased with, and operations are funded by, Overseas Contingency Operations (OCO) supplemental funding. Although there are other SUAS programs of record managed by other services, e.g., Raven B, Battlefield Air Targeting Micro Air Vehicle (BATMAV) is the only AF SUAS program of record (POR). The AF is developing other systems, including air-launched and lethal UA. [See Figure 2 below for the current operational SUAS capabilities and those under development.] Since 2003 Headquarters Air Force Special Operations Command (HQ AFSOC) has been the lead AF major command (MAJCOM) for SUAS and lead U.S. Special Operations (USSOCOM) component command for all UAS capabilities. According to AFPD 11-5, the Air Force Deputy Chief of Staff, Operations, Plans, and Requirements (AF/A3/5) “establishes and interprets SUAS policy”.

SCOPE AND METHODOLOGY

The overarching objective of this collection is to identify lessons to enhance the information contained in the USAF UAS FP. The intent is to complement the UAS FP by providing more granularity to the DOTMLPF recommendations on SUAS. As with all AF/A9L collections, the purpose of the collection was to gather observations to inform a broader USAF audience.

Observations contained in this report were derived from interviewing 41 individuals from the Air Force UAS Task Force, HQ AFSOC staff, SUAS Working Group, and the 820 Security Forces Group (SFG) Scan Eagle Military Utility Assessment Team, 10-14 August 2009. Collection team members also reviewed numerous UAS-related products, including white papers, official government reports, operating concepts and other relevant documents.

Figure 2 - USAF SUAS



ACKNOWLEDGMENTS

AF/A9 would like to gratefully acknowledge and thank HQ AFSOC and the 93 Air Ground Operations Wing for their assistance and insight during this collection. AF/A9L especially recognizes the AFSOC/A9L staff for graciously hosting us during our visit. Special thanks go out to the commanders of both for providing unfettered access to their personnel and facilities during busy wartime operations.

Actions for many of these observations are being worked at the HQ USAF, Air National Guard, major commands, centers and USAF component command levels via lessons learned or other appropriate doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy (DOTMLPF+P) processes and are being tracked to resolution.

“Today, platforms rule the battlefield. In time, however, the large, the complex and the few will have to yield to the small and the many....The advantage of the small and the many will not occur overnight everywhere; tipping points will occur at different times in various arenas. They will be visible only in retrospect.”

The Mesh and the Net: Speculations on Armed Conflict in a Time of Free Silicon by Martin C. Libicki

OBSERVATIONS

OBSERVATION 1: Insufficient analysis and education exist on the capabilities of SUAS and how they could be effectively employed by the USAF.

Discussion: Interviews indicated that, institutionally, the USAF does not fully grasp the utility of employing SUAS, especially in support of the Force Protection mission sets. According to members of the SUAS Working Group (WG), as demand for FMV continues to escalate from small unit tactical and local area commanders, SUAS could fill capacity voids in both the short and long term at reasonable costs. Current SUAS technology has the potential to provide dedicated 24/7 FMV in areas where



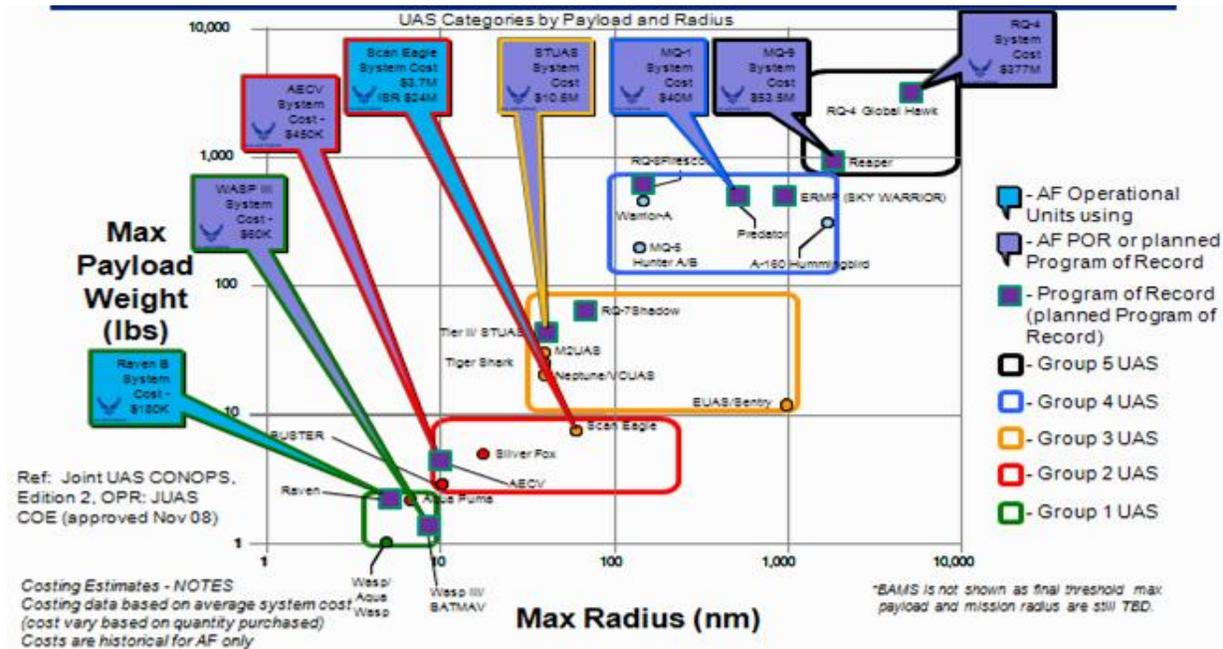
theater-level FMV assets are not routinely available or to enhance or augment MQ-1 Predator/MQ-9 Reaper coverage. In fact, materiel costs for the longer range and endurance SUAS like Scan Eagle are lower than the costs associated with the MQ-1 or MQ-9 programs and can be tasked by base commanders in support of the local air base defense mission. Each Scan Eagle system costs approximately \$3.7 million which includes four aircraft, a GCS, a launcher, a vehicle recovery system and sensors. One MQ-1 Predator system costs approximately \$40 million which includes four aircraft, a GCS and sensors. One MQ-9 Reaper system costs approximately \$53.5 million and includes four aircraft with associated sensors. [See Figure 3 for Costs/Use Comparison.]

According to the USAF UAS FP, “SUAS are highly effective in supporting integrated manned and unmanned mission sets beyond those met by the MQ-1/9 and RQ-4 [Global Hawk].”

Intelligently employed, SUAS are force multipliers. Missions include:

- Force Protection missions of point, route and area reconnaissance and base and convoy security to include Counter Improvised Explosive Device (CIED) and Counter Indirect Fires tasks;
- Enabling beyond line-of-sight targeting for Battlefield Airmen;
- Overwatch for convoys and Civil-Affairs/Provisional Reconstruction Teams (PRT);
- Support to route clearance;
- Providing Explosive Ordnance Disposal (EOD) the capability to fly a small UA to an IED they otherwise would not be able to access with terrestrial robots; and
- Enabling Partner Nations (PNs) to acquire and field ISR capabilities that are within their absorptive capacity.

Figure 3 - UAS Costs/Use Comparison



In short, they have the potential to extend the situational awareness or provide tactical reconnaissance for any team going “outside-the-wire” that would not otherwise have dedicated ISR support. They can also be tasked to conduct the traditional ISR missions of intelligence preparation of the battlespace, target development, situational awareness (SA) development, and battle damage assessment. Near term developmental capabilities suitable for SUAS include semi-automated and automated cooperative teaming by multiple UA, as well as improved sensors and other payloads. These capabilities include airborne communications relay, electronic intelligence intercept, weather sensing, synthetic aperture radar for mapping, moving target indication, acoustic sensing, magnetic anomaly sensing and others.

This discussion leads to issues of roles, responsibilities and reporting authorities of all actors in the employment of SUAS. Since SUAS capabilities and employment are outside the experience of most personnel within the USAF, leadership often lacks the background to make educated decisions on the efficient and effective employment of SUAS. Accounts from SUAS operators and functionals experienced with SUAS training and deployments indicate there are many examples of conflicting support and operational guidance, especially in regards to administrative, operational and tactical control authorities, and logistics support. Mishap reporting and investigation for each of the different groups of SUAS is just one example of SUAS policy that needs to be reviewed.

Another example is the role SUAS might play in Building Partnerships (BP) and Aviation Foreign Internal Defense (AvFID) plans and activities. The SUAS family provides transferable, affordable, modular and interoperable (TAMI) options that could enable less developed PNs to field ISR capabilities. These capabilities could be significant in enabling them to secure borders, monitor activities in remote areas and provide ISR coverage of otherwise ungoverned spaces.

Lessons Identified:

- Undertake a concerted effort to analyze the capabilities and benefits of SUAS.
- Develop a concept for employment for the introduction and integration of SUAS into all aspects of USAF operations and planning including employment in AvFID and BP.
- Review mishap reporting guidance for the different SUAS groups.
- Develop and codify doctrine in appropriate Force Protection and ISR documents to include SUAS capabilities.

DOTMLPF Implications:

- **Leadership:** Support SUAS mission analysis to determine requirements to support various USAF mission sets, for example, Force Protection, BP, AvFID, ISR, etc.
- **Personnel:** Enhanced security with embedded professional SUAS Force Protection capabilities within Security Forces units, including USAF missile field security.
- **Education:** Increased knowledge on the utility, risks and rewards of utilizing SUAS.

“Air Force leadership does not truly understand the capabilities and possibilities of SUAS. This lack of understanding hampers the deployment and operation of SUAS.”

AFCENT Functional

OBSERVATION 2: The USAF does not have a comprehensive strategy for the acquisition, sustainment and development of SUAS capabilities; and the USAF has not properly funded SUAS programs.

Discussion: Although the USAF UAS FP provides a vision for the direction of AF UAS initiatives, the FP does not contain specific policy, an employment concept, an acquisition and sustainment programming strategy or an implementation plan for any of the DOTMLPF recommendations included on SUAS-related programs and initiatives. As the USAF MAJCOM lead for SUAS, the USAF UAS FP directs AFSOC to “establish concepts, draft requirements and accomplish all aspects of the organize, train and equip mission” for SUAS. However, it has not received the level of HQ USAF support required to develop overarching planning, programming and budgeting requirements, and very little USAF resources for any of the AF SUAS programs. The absence of an existing operating concept, strategy or USAF resources hinders establishment of current and future requirements, required research of capability gaps and the assessment, prioritization and presentation of technological and platform initiatives for future SUAS.



As a result of the USAF not having an acquisition and sustainment plan complete with a SUAS Program Office, it does not possess a proper logistics supply network for SUAS. Consequently, with no professional USAF logistics supply network, HQ AFSOC or other customers are forced to buy products directly from the manufacturers based on their stovepiped requirements or via

the U.S. Army SUAS Program Office. As size and cost of the weapon systems increases, it becomes more important that SUAS be engineered to interface with our enterprise logistics systems and processes in order to minimize lifecycle sustainment costs.

As a specific example, the 820 SFG deployed to theater to accomplish a Military Utility Assessment (MUA) of the Scan Eagle. The supply network consisted of what parts and consumables they deployed with, and they coordinated through their headquarters for additional parts requests from the manufacturer. The headquarters received a quote, created a contract, purchased the part and shipped directly to the theater. This process led to huge delays in the ordering and delivery process negatively impacting the MUA.

Although the BATMAV (Wasp III), the only USAF SUAS POR, is fully funded through FY11, full production did not begin until FY10. Consequently, this resulted in a lack of spares to routinely schedule and conduct continuation training (CT).

Another issue identified from the Scan Eagle MUA was deficiency in training for the deployment. Since there was no USAF SUAS program including a dedicated military training “pipeline”, the 820 SFG had to procure operator and maintenance training directly from the manufacturer using OCO supplemental funding at great cost. The DoD cannot continue this model for each of the 20 different proprietary SUAS currently in its inventory. Training for each of the different groups of SUAS needs to be programmed and resourced with a permanent programmed funding stream.

Lessons Identified:

- Develop an approved strategy and operating concept for the use and purpose of SUAS to help provide the framework for further research and development, acquisitions, and permanently programmed resources.
- Move away from ad hoc funding and procurement that leads to ad hoc proprietary solutions for training and sustainment.
- Develop an implementation plan for each of the SUAS DOTMLPF recommendations found in the USAF UAS FP.

DOTMLPF Implications:

- **Leadership.** Developed SUAS strategy, concept of employment and implementation plan that meets the vision of the USAF UAS FP.
- **Organization:** A dedicated and programmed SUAS requirements office with program management as one part of its function.
- **Materiel.** Once SUAS requirements are established, a permanent funding line in the USAF budget that adequately resources SUAS programs.

OBSERVATION 3: HQ AFSOC received funding and has developed the first Air Force SUAS Formal Training Unit (FTU).

Discussion. SUAS training has not been standardized and consistent. A variety of contractors using various curricula and non-standard facilities resulted in fluctuating quality of training. In response, HQ AFSOC took the initiative and requested monies from the USAF and USSOCOM

via OCO supplemental monies to develop the SUAS FTU. It is located at Naval Outlying Field Choctaw (Eglin Aux Field 10) and also uses the Eglin restricted airspace and ranges. Training will comply with the Joint Requirements Oversight Council (JROC) requirement to provide Joint training for Tier II Small Tactical UAS and CSAF direction to explore using enlisted personnel to fly sub-Predator class UAS. Initially, the FTU will focus only on Group 1 UAS training. However, the intent is that it will evolve to provide training on Group 2 and 3 UAS as well. The USAF UAS FP states, “training includes Basic Qualification Training (BQT) (screening and airmanship) [and] Initial Qualification Training (IQT)” for all Services. It will eventually provide USAF-unique Mission Qualification Training (MQT).

The FTU will train individuals up to the standards prescribed in the CJCSI 3255.01, *Joint Unmanned Aircraft Systems Minimum Training Standards*, dated 17 July 2009. CJCSI 3255.01 sets the Joint policy to “[standardize] training and certification...[to ensure] the qualification standards meet or exceed existing manned aircraft Federal Aviation Administration (FAA) standards to facilitate UAS access into the National Airspace System (NAS)”. The CJSCI describes the minimum training and certification standards required to fly each group of UA in the various classes of airspace. Standards correspond to FAA civil and military requirements to operate manned aircraft in similar airspace.



Lessons Identified:

- Quickly standardize and validate the SUAS FTU training curricula.

DOTMLPF Implications:

- **Training:** Specialized training for SUAS maintainers.
- **Training:** Use of the Eglin Range facility to develop CT curriculum and conduct CT for USAF SUAS operators.
- **Materiel:** USAF permanently programmed and budgeted resources for training.

OBSERVATION 4: There are no full-time, dedicated professional uniformed Group 2 and 3 UAS operators and maintainers.

Discussion: The Scan Eagle MUA also demonstrated that there is a requirement for dedicated Group 2 and 3 UAS operators and maintenance technicians. Groups 2 and 3 UAS will probably not be flown by rated officers but are sufficiently complex and will fly in classes of airspace that will (at least from the USAF perspective) require flying as a primary duty. The USAF UAS FP corroborates this requirement: “Today, SUAS operations are considered additional duties to most other career fields, such as security forces...Most SUAS operators are also the maintainer and [sensor operator]. However this additional duty adds a significant workload to units operating SUAS...[This results] in flight operations [and training being] conducted inconsistently across AFSOC, USAF Office of Special Investigation (AFOSI) and Force Protection forces...Aircraft maintenance, logistics, flight authorization, safety risk mitigation and

crew currencies are not conducted and documented to a common standard appropriate for [these classes of vehicles] by all users.” In addition, no tracking system exists for USAF personnel trained and experienced as SUAS operators and maintainers; and the U.S. Air Forces Central Command (AFCENT) does not have the authority or ability to keep personnel current after deployment.

To address these issues, SECAF approved AFD 11-5, “*Small Unmanned Aircraft Systems (SUAS) Rules, Procedures, and Service*” on 17 Aug 09. AFI 11-502, Volumes 1-3 is in MAJCOM coordination, to be followed by AFIs 11-5Gp1 Volumes 1-3, 11-5GP2 Volumes 1-3, and 11-5GP3 Volumes 1-3. AFSOC also proposed that at least two Group 2 and 3 SUAS squadrons consisting of professional uniformed Airman be stood up to help institutionalize SUAS activities across the Air Force. These two squadrons would have a professional cadre of Airmen to develop specific programs to address concerns like safety, maintenance and mishap avoidance. According to the USAF UAS FP, “The best practices developed within AFSOC augmented by flight considerations developed by Airmen across services over the past 60 years need to be codified in SUAS flight standards. [The squadrons are] essential to successfully develop and implement a safe flying program. Tactics from operational lessons learned can be developed and employed across all SUAS platforms to support all missions. This is particularly significant for weapons employment and integration with air and ground operations. These squadrons will also be essential to advance integration of SUAS with other aircraft in the [NAS]. Sound maintenance and logistics can be developed through consolidation to increase the system effectiveness rates...[Further, the squadrons] will be scalable to support specific AFSOC Force Protection, and OSI SUAS missions as well as theater missions directed by the [Air and Space Operations Center].”

The development of a professional cadre of Airmen to train and develop SUAS tactics may also demonstrate the utility of certifying non-rated enlisted Airmen as qualified to release weapons from small UA. Technology has evolved to the point that SUAS are being weaponized. This technology will continue to be refined and miniaturized over the next several years resulting in proliferation on the battlefield. Current USAF policy authorizes only qualified rated officer aircrew to release weapons from UA, which suggests the USAF will authorize only rated officer aircrew to operate weaponized SUAS as well. This restriction will further strain the already stressed rated officer career fields. Other military services will train and certify non-rated enlisted personnel to use weaponized SUAS in support of Joint Forces Commander (JFC) requirements, forcing the USAF to reassess this policy.

“All this may require rethinking long-standing service assumptions and priorities about which missions require certified pilots and which do not.”

Secretary of Defense Robert M. Gates’ remarks to Air War College, April 2008

Finally, once Airmen are trained and qualified to operate and maintain SUAS, it is difficult to retain them. The ad hoc system in place to train Airmen is costly and the training time to certify on systems like Scan Eagle is lengthy. The SUAS squadron concept proposal may assist with these issues. Building a permanent professional training cadre may not only be less costly, but

will open up career avenues as trainers. In addition, development of a broader career path for Career Enlisted Aviators and other enlisted technicians like UAS sensor operators, security forces, communications personnel, etc., to qualify to operate and maintain SUAS midway through their careers would provide exciting assignment opportunities and challenges not previously available to them. A separate Air Force Specialty Code (AFSC) should also be considered for Groups 2 and 3 SUAS operators, with an associated active duty service commitment following training. A separate career field would not penalize enlisted personnel performing SUAS duties as their primary responsibility, as opposed to performing them as additional duties outside of their core AFSC functions. A potential AFSC to expand is the newly formed 1UX1 Sensor Operator. All of this would logically evolve into a natural career progression complete with advancement and promotion opportunities. This methodology supports a normal build to a capability; if operations requirements dictate an accelerated build, then SUAS Operators should be developed from volunteers from all Air Force specialties and should be identified by a Special Experience Identifier. The precedent for this approach is illustrated with the development of the Gunship Sensor Operator career field.

Lessons Identified:

- Develop a dedicated career force to operate Group 2 and 3 UAS in response to the number of potential missions coupled with the ever evolving technologies.
- Deploy personnel in dedicated SUAS Unit Type Codes (UTC) versus deploying within other UTCs, for example, OSI, Force Protection and ISR UTCs.
- Undertake analysis to determine USAF Group 2 and 3 UAS mission requirements and whether a professional career path and appropriately manned squadrons are warranted.

DOTMLPF Implications:

- **Organization:** The establishment of SUAS squadrons as recommended by the USAF UAS FP will enable SUAS career force development.
- **Organization:** UTCs enable units to have flexibility in supporting various missions.
- **Leadership:** Debate and deliberation on the certification of weapons delivery by enlisted personnel employing SUAS.
- **Personnel:** Group 2 and 3 UAS operators may require a distinct career field.
- **Personnel:** Evolution of a plan to develop Career Enlisted Aviators into large UAS sensor operators and then transition to Group 2 and 3 UAS operators. (Consideration should be given to merge the newly-formed 1UX1 UAS Sensor Operator career field into the 1A4X1 Manned Sensor Operator career field since the core skill sets are identical.)
- **Personnel:** Assignment flexibility and crossflow of experience between weapons systems with similar missions.
- **Personnel:** A Special Experience Identifier (SEI) is developed to track trained and experienced SUAS operators and maintainers.

OBSERVATION 5: Frequency and bandwidth management, communications infrastructure and datalinks will only be more stressed with the proliferation of SUAS; and SUAS GCS frequencies are unencrypted and unprotected.

Discussion: With the proliferation of SUAS on the battlefield of the near future, the current SUAS GCS proprietary datalinks are not flexible and sustainable. Many of the current SUAS use datalink equipment that is not interoperable with other datalinks or tunable to other frequencies. In fact, the number of available proprietary SUAS frequencies is so limited US military SUAS operations are threatened by interference from other operations. Additionally, SUAS datalinks are unencrypted and are thus susceptible to enemy exploitation. Since datalinks are also unprotected, GCS are jammable and locations can even be triangulated and possibly physically attacked.

Not all Group 2 and 3 UAS are Cursor on Target (CoT) capable. Among other capabilities, CoT enables users to communicate from a common set of applications to various datalinks such as Link-16 and Situational Awareness Data Link (SADL). Any GCS standards must deliver CoT compatibility to enable existing CoT systems to seamlessly integrate, thereby decreasing integration costs and simplifying transition.

Given that SUAS datalink frequencies are not tunable, they may be prohibited from operating in other regions and countries of the world. This limitation is due to the potentiality of interfering with host-nation communications frequencies. Additionally, SUAS datalinks are not interoperable with manpack radios, burdening operators to transport multiple pieces of communications hardware on the battlefield.

Effective 1 October 2009, Assistant Secretary of Defense (Networks and Information Integration) (ASD (NII)) mandated the use of Common Data Link (CDL) for all UAS greater than 30 lbs. As it was originally designed and fielded in the late 1970s, CDL was adequate. According to HQ AFSOC, CDL is not small enough for Group 1 SUAS operations, but will be leveraged on Group 2 and 3 systems. However, the continued proliferation of CDL enabled airborne assets has already reached a tipping point. CDL is a huge and inefficient frequency space consumer. This dated, yet capable, waveform needs modernization, to include “dial-a-rate” speeds, more efficient error correction coding, multiple encoding rates, expanded frequency band alternatives (e.g., into L, S, C and extended Ku) and importability to software defined radios. Such modifications could improve UAS density 3 to 15 times what it is today. As it stands, failure to modernize the CDL waveform will limit the number of participants that can operate within a region (or suffer degraded video quality) and require strict frequency deconfliction.

Lessons Identified:

- Develop tunable, interoperable, and unrestricted SUAS GCS frequencies since available radio frequency spectrum is an essential enabler for UAS operations.
- Secure and protect SUAS GCS frequencies.
- Develop SUAS GCS datalinks capable of Voice-Over Internet Protocol (VoIP), video and data multicast.
- Make all Group 2 and 3 UAS CoT capable.
- Develop digital SUAS GCS datalinks that are interoperable with field radios.
- Modernize CDL waveform.

DOTMLPF Implications:

- **Materiel:** Non-proprietary digital, open-architecture communications equipment for use in SUAS operations that are tunable can be used as a GCS datalink, act as a transmitter and receiver of FMV, and comply with ASD (NII) frequency and bandwidth requirements for spectrum diversity, security, protection, VoIP and multicasting.

CONCLUSION

SUAS show tremendous promise with a wide range of applications to support multiple service core functions. With proper acquisition, manning, training and employment, SUAS could be a significant enabler and complement manned and unmanned aviation. The most prominent near term capability of SUAS is providing enhanced SA for the tactical warfighter. SUAS provide:

- The ability to “see” around close obstacles or terrain which block the ground-level field of view;
- The ability to provide “eyes on” targets or areas of interest at ranges beyond visual line of sight (up to tens of miles) quickly and without putting military personnel at risk;
- Much greater SA to personnel outside the wire and at the base Defense Operations Center via remote viewing terminals.
- TAMI options for training and equipping PNs with the ability to field ISR capabilities as a part of BP and AvFID plans and missions.

Midterm capabilities will comprise extended endurance, varied and multispectral sensor payloads and the ability to cooperatively team multiple disparate UA in a persistent network of sensors, weapons and communications relay links. The cumulative enhanced tactical base security resulting from SUAS operating at every forward US operating location has the potential to translate into theater and strategic success.

“The Navy is getting Predator capability at the Scan Eagle price.”

AFSOC SME

Another important consideration with SUAS is lower cost. With a cogent acquisition strategy, a wide range and depth of SUAS capabilities can be procured and quickly fielded for a host of mission sets. With an insatiable need for tactical ISR, there is real danger of fielding competing systems in an ad hoc manner, jeopardizing the capability as a whole and creating lasting impediments for these revolutionary technologies. Standing up a programmed and fully funded SUAS Program Office with multiple program elements for the various categories of SUAS would provide the oversight needed for acquisition stability based on the requirements identified in the USAF UAS FP. This action would also create a much-needed logistical process which includes a military level depot for supplying spare parts.

An implementation plan should be developed immediately to stand up the two SUAS squadrons as recommended in the USAF UAS FP. These squadrons should form the backbone for training the projected requirement for approximately 370 SUAS operators for air-expeditionary operations. They should have the benefits of dedicated programmed CT from a fully funded program office. They should include not only the UA and sensor operators, but also a complement of maintenance personnel. This move would help professionalize and legitimize the

SUAS force. A formal training curriculum for all categories of SUAS and positive track record fostered by the two squadrons would diminish challenges to DoD by outside agencies like the FAA.

The USAF UAS FP summarizes UAS capabilities best: “The asymmetric game-changing capability of SUAS impacts all levels of conflict...SUAS will play a key role in supporting manned assets in engaging more targets, providing decoys, jamming and disrupting enemy attacks. Other nations are allocating increased resources to develop SUAS to counter and possibly negate expensive and more capable systems by saturating them with large numbers of SUAS simultaneously. SUAS will play a key role in warfare including emerging counter-UAS missions due to their expendability and low cost. It is possible that the next inexpensive asymmetric threat will be a SUAS, i.e. an ‘airborne IED’.”

“The dogmas of the quiet past are inadequate to the stormy present.”

Abraham Lincoln

APPENDIX A: Acronyms and Abbreviations

AECV	All Environment Capable Vehicle
AF	Air Force
AFB	Air Force Base
AFCENT	United States Air Forces Central Command
AFOSI	USAF Office of Special Investigation
AFPD	Air Force Policy Directive
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
ASD (NII)	Assistant Secretary of Defense (Networks and Information Integration)
AvFID	Aviation Foreign Internal Defense
BP	Building Partnerships
CDL	Common Datalink
CIED	Counter Improvised Explosive Device
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
COT	Cursor On Target
CT	Continuation Training
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities
DoD	Department of Defense
EO	Electro-Optical
EOD	Explosive Ordnance Disposal
ERMP	Extended Range Multi Purpose
EUAS	Expeditionary UAS
FAA	Federal Aviation Administration
FP	Flight Plan
FMV	Full Motion Video
FTU	Formal Training Unit
GCS	Ground Control Station
IR	Infrared
ISR	Intelligence, Surveillance and Reconnaissance
JFC	Joint Forces Commander
M2UAS	Multi-Mission UAS
MAJCOM	Major Command
MUA	Military Utility Assessment
NAS	National Airspace System
OCO	Overseas Contingency Operations
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
PN	Partner Nation
POR	Program of Record
PRT	Provisional Reconstruction Team
SA	Situational Awareness
SFG	Security Forces Group

UNCLASSIFIED//FOR OFFICIAL USE ONLY

STUAS	Small Tactical UAS
SUAS	Small Unmanned Aircraft Systems
UA	Unmanned Aircraft
UAV	Unmanned Aerial Vehicle
UAS	Unmanned Aircraft Systems
USAF	United States Air Force
USSOCOM	United States Special Operations Command
UTC	Unit Type Code
VCUAS	Vehicle Craft UAS
VOIP	Voice-Over Internet Protocol
WG	Working Group

APPENDIX B: Identified Lessons in the Joint Lessons Learned Information System (JLLIS)

The table in this appendix contains the identified lessons from the CSAF Lessons Learned Focus Area Enduring Airpower Lessons from OEF/OIF: Small Unmanned Aircraft Systems. The entire report and all the lessons within the report (using the JLLIS ID) can be accessed from the unclassified JLLIS database at <https://www.jllis.mil/USAF>.

JLLIS	Title	OPR	AF/A9L Contact
36708	Insufficient Analysis on SUAS Capabilities	AF/A2	AFA9.JLLISAdm@pentagon.af.mil
36711	No Comprehensive Strategy for SUAS	AF/A2	AFA9.JLLISAdm@pentagon.af.mil
36712	USAF Has Not Properly Funded SUAS Programs	AF/A3/5	AFA9.JLLISAdm@pentagon.af.mil
36713	No Full-time, Dedicated Professional Uniformed Group 2/3 UAS Operators and Maintainers	AFSOC	AFA9.JLLISAdm@pentagon.af.mil
36715	Certification of Weapons Delivery by Enlisted Personnel Employing SUAS	AF/A3/5	AFA9.JLLISAdm@pentagon.af.mil
36723	Frequency / Bandwidth Management, Communications Infrastructure and Datalinks Issues for SUAS	SAF/AQ	AFA9.JLLISAdm@pentagon.af.mil
36724	SUAS Formal Training Unit	AFSOC	AFA9.JLLISAdm@pentagon.af.mil



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