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JOINT GLOBAL DISTRIBUTION ARCHITECTURE FOR AIRBORNE FULL MOTION VIDEO

by

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DISCLAIMER

(U) Purpose

(U) In 2014, the CJCS published the DOD's ISR Joint Force 2020 White Paper detailing his vision for how the Joint Force will shape, grow, and integrate ISR capabilities to remain effective in future operations. Of the eight initiatives identified, he emphasized that the most important was the development of a joint PED architecture that will replace the multitude of currently-fielded, expensive, and inefficient service-unique, platform-centric PED architectures. The need for a joint FMV-AISR PED architecture is not just a goal for the future, it is also a current GCC operational requirement as noted in a 2016 CENTCOM Commander memo, "The CCMDs have been pushing for the need for a joint global FMV-AISR data transport infrastructure for several years now, and while we've made some headway in acknowledging the problem, we're really no closer to addressing it."[1] The Air Force should lead/advocate for a DOD level multi-domain Task Force (TF)/ Working Group (WG), in coordination with the IC and CSSAs, to analyze the problem and propose enduring JCIDS compliant POR solutions that will fulfill the CJCS vision and meet the GCC operational requirements for a joint PED architecture.[2]

(U) To accomplish this, the paper is divided into four parts. The first part defines the problem by analyzing how the services current platform-centric FMV-AISR architectures are failing to meet the vision in the JCS ISR 2020 White Paper and the GCC's operational employment requirements. The second part provides an overview of the GCC's operationally developed, joint FMV-AISR system that creatively interconnects service's architectures. The third part provides an overview of USD AT&L and DOD CIO initiative to institutionalize the GCC developed joint architecture and provide insight into the service resistance it is currently facing. The final part provides recommendations for what areas the new TF/WG should focus on in order

to institutionalize and improve the current GCC-driven common FMV-AISR architecture to meet the chairman's vision of a joint PED Architecture by 2020.

(U) Current Service-Unique Platform-Specific PED Architectures & Operational Gaps They Have Created

(U) Before conveying a joint vision, it is important to establish a baseline of the current service capabilities and limitations. Each service has produced their FMV-AISR systems as separate programs of record (PORs) with individual Joint Resource Oversight Council (JROC) validated Joint Capabilities Integration and Development System (JCIDS) CONOPs. Because of this, each FMV-AISR system required that they be built with their own control system and communications architecture to their respective services Process Exploitation and Dissemination (PED) facility.[3] Additionally, each service has written the CONOPS for their FMV-AISR assets to deliberately align with the PCPAD processes. This decision meant that the focus of these assets is on providing the JTF/Functional Component commanders with finished single source intelligence products to answer specific RFIs and are not optimized to provide near-real-time FMV data for other decisions.[4] Each service uses their own version of the Distributed Common Ground System (DCGS) to conduct imagery intelligence analysis once the FMV-AISR data has been delivered to their PED site. While envisioned as a "common" system, current service DCGS only share finished intelligence products. For policy and technical reasons they do not have the ability to seamlessly share raw FMV-AISR information.[5]

(U) Overall, the service's current FMV-AISR systems are meeting the data distribution requirements of the JCIDS CONOPS used to validate their procurement.[6] However, because their current standalone communications architectures as well their service-specific PED facilities inability to support raw FMV-AISR data from other services or coalitions partners

means that they fail to meet the standards for a joint FMV-AISR architecture system outlined in the JCS ISR 2020 White Paper.

(U) The requirement for a joint FMV-AISR architecture is not just a vision outlined in the JCS ISR 2020 White Paper, it is an operational requirement that the GCC's have demanded for the last three years. [7] In today's joint operational environment, FMV-AISR data from one platform can no longer be used in isolation--simply providing answers to one service's RFIs in the standard PCPAD processes. Today GCCs require platform agnostic analytical nodes that have access to FMV-ISR data, in real time, from multiple systems in a specific area. In his book on US unmanned aircraft use in the war against Al-Qaida, Brian Williams, Professor of Islamic History at the University of Massachusetts-Dartmouth, notes, "Reapers and Predators in Somalia have been aided by smaller (LOS) observation drones, such as Ravens, Scan Eagles, and Fire Scouts".[8] Williams details that this trend will likely increase in the future where "unmanned drones may work with killer drones to hunt and kill targets.[9] As detailed in the first part of this paper, today's service-unique, platform-centric PED architectures do not lend themselves to the type of platform agnostic mission centric PED described in Williams' account.

(U) Additionally, current operations in semi-permissive and non-permissive areas have expanded the need for operational access to near-real-time FMV-AISR, from any asset available, as critical part of operations.[10] Operations of this sort include fires, force protection over watch, and politically sensitive missions such as providing real-time route clearance to an allied country's president fleeing a coup.[11] Today many commanders will not approve tactical operations to be executed without the ability to provide FMV-AISR data, in near-real-time, to globally dispersed operational cells coordinating fires, reinforcements, and personnel recovery

operations.[12] However, as detailed in the first part of the paper, service-fielded, platform-specific FMV-AISR PED architectures are optimized to deliver data in real time to only PED cells. This focus means that, as fielded by the services, these architectures fail to meet the critical operational requirement to share the data, in real-time, to other operational forces.

(U) GCC funded Joint FMV-AISR Architecture.

(U) Utilizing the more flexible and responsive Joint Urgent Operational Needs (JUONS) processes versus the more rigid JCIDS processes, the GCC's developed joint FMV-AISR architectures. This system provided the GCC's mission-centric PED and near real time delivery of FMV-AISR data to support globally dispersed forces for operational over-watch, engagement approval, and fires.[13] Figure 3 depicts the currently operating GCC funded joint FMV-AISR architecture.

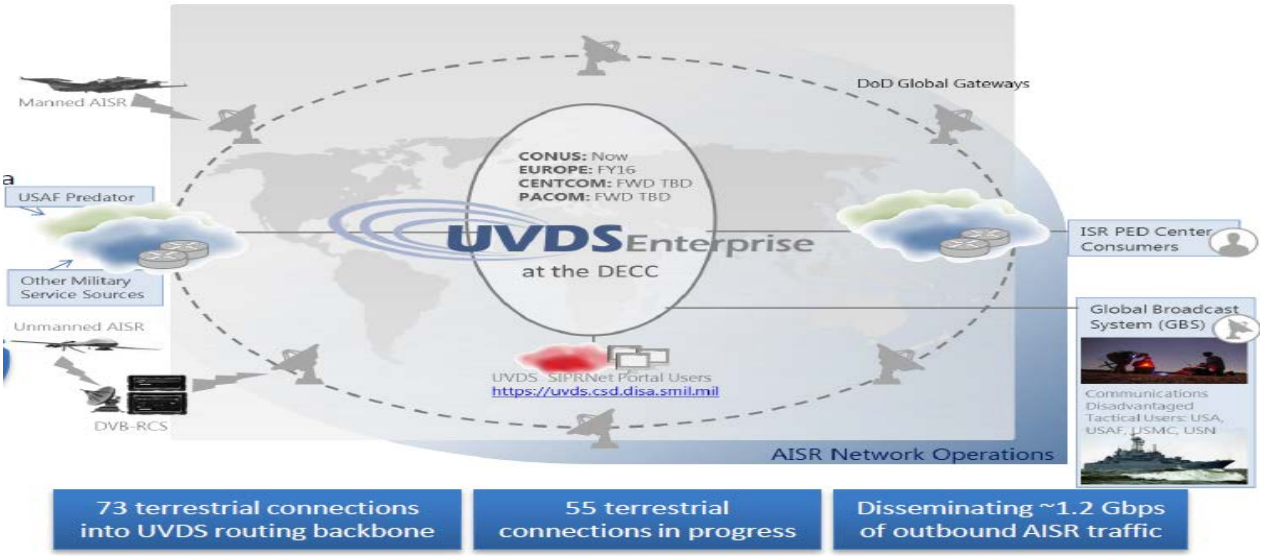


Figure 1: COCOM driven OCO funded common PED network supporting AISR-FMV[14]

(U) The GCC-developed, joint FMV-AISR PED architecture creatively interconnects the service's numerous fielded platform-centric PED architectures and consists of three main pieces:.

(U) 1. Universal Video Distribution System (UVDS) Network: An encrypted Internet Protocol (IP) based, globally interconnected transport architecture that utilizes the existing resilient global Defense Information Systems Network (DISN) to provide the underlying connectivity to move FMV-AISR from Beyond Line of Sight (BLOS) service specific PED systems to GCC HQs, Intelligence Community PED locations, DOD globally located satellite teleports, and DISA data centers for distribution to operational users and allies.[15]

(U) 2. Digital Video Broadcast Return Channel System (RVB-RCS): A tactical two-way satellite system that serves two purposes in the joint FMV-AISR network. First, it provides the required BLOS connectivity from in theater tactical FMV-AISR systems to the DOD satellite teleports for ingestion into the UVDS network. Second, it augments the capability of the DOD POR Global Broadcast System to provide tactical units near real time access to FMV-AISR data for mission-centric PED, operational over-watch, engagement approval, and fires.[16]

(U) 3. UVDS-Portal: To provide operational users with the ability to view and use FMV-AISR data a portal was created on SIPR and SIPR//REL-FVEY. FMV-AISR data is taken from the UVDS-Network, at two DISA data centers, and posted on a video server for viewing by US and, when classified for release, to our commonwealth allies.[17] Today UVDS-portal is considered by many in the DOD and IC to be the primary source for viewing DOD and partner nation FMV-AISR data from anywhere on the globe.[18]

(U) Institutional resistance.

(U) Despite over a decade of success, since the GCC-developed joint FMV-AISR architecture was validated with the JUONS process, it has not been validated through the JCIDS process and therefore is not institutionally recognized as an enduring requirement. This is demonstrated by the fact that the services continue to field ISR systems reliant on service-unique, platform-centric PED architectures based solely on previously validated JCIDS capability documents.[19] The CENTCOM and AFRICOM CCDR's highlighted this point in a 2014 joint memo to OSD CAPE. In this memo, they stated that their commands are still required to "fix gaps created by [FMV-AISR] assets delivered under outdated CONOPS that do not support the realities of current GCC Concept of Employment that are driven by the semi-permissive and non-permissive areas we are forced to operate in."[20]

(U) The services argue that the use of FMV ISR is a product of the current operational environment and not an enduring requirement for their forces. Therefore in their analysis they appear to see the current POR systems as meeting the enduring DOD capability without the needed ISR architectures capable of mission-centric PED or near-real-time data distribution to globally dispersed forces. Based on this assessment, the operational joint ISR-FMV architecture will remain a regionally focused COCOM driven overseas contingency operations (OCO) funded capability that is not incorporated into joint doctrine and contrary to the vision of the JCS ISR 2020 White Paper, will not be a viable capability.

(U) Realizing the perpetual capability gap that exists between the services' fielded CONOPS for FMV-AISR assets and GCC CONEMP for those assets, the Under Secretaries of Defense (USDs) for Intelligence and for Acquisition, Technology and Logistics (AT&L) along

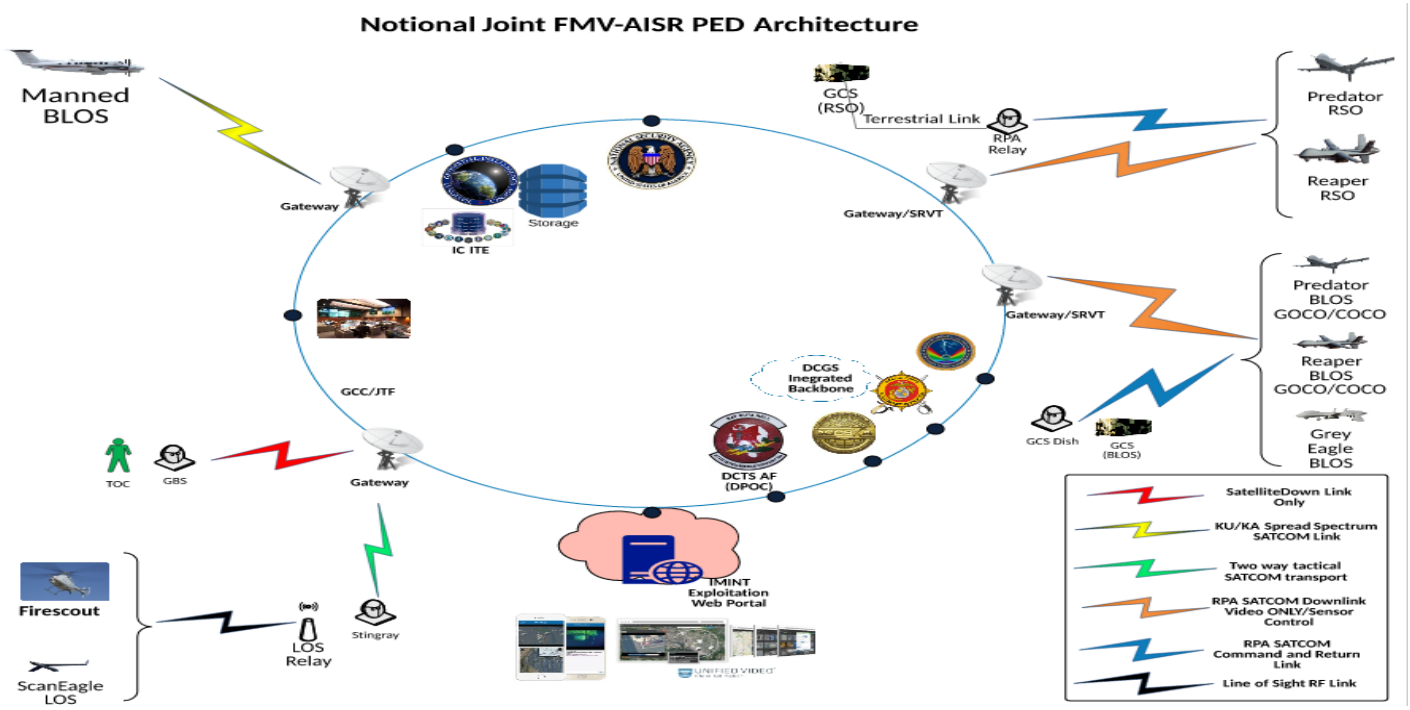
with the DOD Chief Information Officer (CIO) met to discuss these issues. The outcome of the meeting was a request that the Deputy Secretary of Defense conduct a full CJCSI 3170.01 (JCIDS) Capability Based Assessment (CBA) to study the shortfalls and propose ways to instructionally address them.[21] In 2016, the JS (J2/J6), OUSD (AT&L and CIO) conducted a CBA with the assistance of the GCC's and services. As of the writing of this white paper, the Initial Capabilities Document (ICD) and DOTMLPF change request have been stalled in the JCIDS processes and are awaiting service concurrence. Currently, the Army and Air Force have not concurred with the these reports citing service systems, as detailed in part one of this paper, are adequately meeting service CONOP and GCC requirements are unique to the current fight which and therefore no change is required. Clearly, there is still a disconnect in the process.

Figure 4: Notional OV-1 Diagram depicting service adoption of UVDS into a joint FMV-AISR PED architecture.

(U) Recommendations:

(U) As Billy Mitchell wrote, "Airpower is the ability to do something in or through the air" and, as such, FMV-AISR is airpower.[22] The USAF is the primary airpower advocate in the DOD and lists ISR as one of its five core missions. Therefore, the USAF has the greatest interest in ensuring that it is most effectively and efficiently used.[23] Additionally, successful operation of FMV-AISR requires the ability to synchronize, in real time, capabilities, airspace, and cyberspace domain capabilities. As the DOD leader in multi-domain operations, the Air Force is uniquely positioned to lead this effort. Air Force should advocate for the creation and leadership of a DOD-level Task Force (TF) that, in coordination with the IC and CSSAs, analyzes today's GCC developed joint FMV-AISR architectures and conducts

an analysis of alternatives (AOA) to propose enduring JCIDS compliant POR solutions that will fulfill the CJCS vision for a joint PED architecture. Figure 4 below displays a notional OV-1 Diagram of what an enduring FMV-AISR PED architecture would consist of.



To work to making the notional architecture in Figure 4 a reality the TF should initially focus on the following areas:[24]

- **Dissemination:** Determine the most efficient and effective single globally-interconnected transport architecture to replace the numerous service-specific transport architectures operating today or in development. Analyze the existing UVDS-Network and determine what improvements would be required to build a resilient and hardened and globally available system that will meet the service and GCC connection requirements. At a minimum this system should provide direct connectivity to: service-specific PED locations, GCC HQs, IC PED locations,

DOD globally located satellite teleports, FVEY Partners, and DISA data centers for distribution to operational users and allies.

- **Tactical 2-Way transport:** Determine the DOD POR system to provide tactical two-way BLOS connections from DOD satellite gateways to deployed tactical FMV-ISR systems. Analyze whether modifications to the current POR GBS network or architecture? would be more cost effective than a new system.
- **Standardize DOD Gateways to support FMV-AISR:** In accordance with the federated approach for service-unique information systems, outlined in DOD's Information Enterprise Architecture (IEA) 2.0, develop a working group incorporating the services, IC, and industry to determine a set of standard satellite modems to be installed in DOD Gateways for FMV-AISR connections. This group should establish quarterly meetings to ensure the Gateways stay current with FMV-AISR assets.
- **Defense Common Ground System (DCGS):** Establish an enduring coordination working group between the FMV-AISR Architecture working group and with the OSD(I) led Joint DCGS Working.[25] Initially this group should work focus on two areas:
    - FMV-ISR format and metadata standardization: Ensure the standard formats for FMV data are consistent with industry best practices and synchronized across the FMV-AISR and DCGS-Joint programs.
    - Operational User IMINT Exploitation: Analyze current strengths and limitations to the UVDS-Portal FMV viewing solution. Ensure that the tool designed for IMINT Exploitation software in DCGS-Joint informs the development of the tool developed to replace UVDS-Portal for operation use of IMINT data.[26] Additionally, ensure that FMV-

AISR data provided on SIPR is in such a format that can be easily integrated into user developed applications.

- **Partner Nation Integration:** In coordination with the Committee for National Security Systems (CNSS), NSA Information Assurance Directorate, DOD OUSD-I, and GCC Partner Engagement offices develop a comprehensive strategy for sharing US FMV in BILATERAL and Multilateral Exercises and Operations. The solution should rely exclusively on Commercial Encryption standards, in accordance with DODI S-4660.04, for ease of military sale and ability to share securely with non FVEY partners.[27]

(U) Conclusion

(U) This paper has shown that the current service unique platform-centric FMV-AISR PED architectures are not compliant with the CJCS vision in the JCS ISR 2020 White Paper and are not flexible enough to meet the current operational requirements of the CCDRs who are employing them. To meet the CJCS vision outlined in the JCS ISR 2020 White Paper and to start addressing the GCC's operational requirements, the USAF as the leader in airpower, global ISR, and multi-domain operations should initiate a DOD-level TF to start the processes of institutionalizing the capabilities resident today.

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[1] ICD Brief for "AISR Architecture" given to the C4/Cyber and Battle Space Awareness (BA) FCB Working Group, May 2016.

[2] Full Motion Video was chosen as the case study for this white paper because it provides the most complex ISR data usage case of the current AISR data. Video is the most intuitive intelligence data for analysts and operators to use. However, it is exactly this intuitive aspect that facilitates its adoption in more aspect of DOD operations and drives Combatant Commanders (CCDR) to increase their requirements for it to be delivered, in near real time to, globally dispersed strategic, operational, and tactical consumers. Additionally, providing FMV-AISR in a joint network centric architecture requires a Multi Domain integrated approach and requires a force able to harmonize actions across air, space, and cyber space domains, in near real time, for the mission to be accomplished.

[3] Interview with Government Civilian in DOD AT&L, 19 Nov 2016. [unattributed interview]

[4] ANNEX 2-0 GLOBAL INTEGRATED INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE OPERATIONS; Reach Back and Distributed operations, and Interview with Government Civilian in DOD AT&L, 19 Nov 2016. [unattributed interview]
[5] Distributed Common Ground System/Surface System (DCGS) Enterprise CONOP.
[6] Briefing, C4/Cyber & BA FCB WG Brief, ICD/DCR for Airborne ISR data transport overview, 11 June 2016.
[7] AISR Architecture deficiencies have been identified in the FY 14, 15, and 16 COCOM Capability Gap Assessments, on 22 of GCC's Integrated Priority Lists, and 11 JROC approved Joint Urgent Operational Needs Statements.
[8] Williams, Brian, Predators, 161. Use full end notes for the first reference to a work by a particular author.
[9] Williams, Brian, Predators, 161. (Ibid?)
[10] AFRICOM Endorsement of DISA POM 2015 paper for AISR Transport Infrastructure
[11] AFRICOM Endorsement of DISA POM 2015 paper for AISR Transport Infrastructure
[12] Buchanan, Joint Doctrine for Unmanned Aircraft Systems: The Air Force and the Army Hold the key to success
[13] Interview Government Civilian Defense Information systems agency on 30 November 2016
[14] Leveraging existing DOD Satellite Ground sites, an emerging DISA managed MPLS global network, and unique commercial relationships the GCC developed FMV-ISR architecture currently receives and distributes data from over 150 Unique FMV-AISR feeds. DISA, provides continuous network monitoring of every FMV-AISR feed and works with the COCOMs to engineer solutions to their emerging requirements. UVDS-Portal through the adoption of commercial cloud technology disseminates, via Secure Internet Protocol Routing network (SIPR), mission critical FMV-AISR in near real time to globally disperse strategic, operational, and tactical users. In the 12 years since the GCC developed FMV-AISR architecture was created it has adopted a model of "ongoing improvement" in order to meet the increasing demands of the GCC's and to become more efficient. DISA partners with the services to better integrate their UVDS-network's distribution architecture into their platform specific PED architectures. For example DISA has worked with the AF. Army and SOCOM to install Satellite Receive Video Terminals (SRVT) at DISA managed Satellite Ground sites to provide better quality HD video at closer to real time speeds. The USAF at this technology as a way to cut the delay and increase the quality and reliability for FMV-AISR data to OCONUS DGS sites. Currently, without the SRVT terminals the data is transmitted back to CONUS for dissemination via the DCGS WAN.
[15] Interview with Government Civilian in the Defense Information Systems Agency office on 30 November 2016
[16] Ibid.
[17] Ibid.
[18] Briefing, NRRB NetOps Certification Information Brief for Unified Video Dissemination System (UVDS), 7 October 2014.
[19] Briefing, C4/Cyber & BA FCB WG Brief, ICD/DCR for Airborne ISR data transport overview, 11 June 2016
[20] AFRICOM Endorsement of DISA POM 2015 paper for AISR Transport Infrastructure.
[21] Interview with Government Civilian in DOD AT&L, 19 Nov 2016. [unattributed interview]
[22] Mitchell, Winged Defense, 3.
[23] USAF, Global Vigilance, Global Reach, Global Power for America (Washington, DC: Department of the Air Force, 2013), 4 .

[24] Interviews with DOD civilians in DOD (CIO), OSD-I, OSD-AT&L, DISA and SOCOM HQ.
[25] Interview with DOD civilian in DOD CIO office.
[26] Ibid
[27] DODI S-4660.04, Encryption of Imagery Transmitted by Airborne Systems and Unmanned Aircraft Control Communications, 27 July 2011.

Bibliography

"Army Command and Control," a symposium held at the Maneuver Center of Excellence, 15–16 October 2014

Air Force Association, "Airforce Vs. Army Concepts for UAV Employment" Air Force Association. http://www.afa.org/grl/UAV_CONOPS.pdf (Accessed on 15 Oct 16)

Briefing, C4/Cyber & BA FCB WG Brief, ICD/DCR for Airborne ISR data transport overview, 11 June 2016.

Curtis E. LeMay Center for Doctrine Development and Education, ANNEX 2-0 GLOBAL INTEGRATED INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE OPERATION, 29 January 2015, https://doctrine.af.mil/DTM/dtmisroperations.htm

Mitchell, William. Winged Defense. Tuscaloosa, AL: University of Alabama Press, 2009.

US Department of Defense, AFRICOM Endorsement of DISA POM 2015 paper for AISR Transport Infrastructure.12 September 2014.

US Department of Defense, DCGS mission systems infrastructure architecture, Naval Air Seas Systems Command (NAVAIR) Special Communications Requirements Division (SCR) ST. Inigoes, Maryland.

US Department of Defense, Distributed Common Ground System/Surface System (DCGS) Enterprise CONOP.: Office of Under Secretary of Defense for Intelligence, September 2014.

US Department of Defense, DOD CIO CAPE Submission, Intelligence, Surveillance, and Reconnaissance (ISR) Transport Service: Office of the Department of Defense Chief Information Officer , September 2014

US Department of Defense, Distributed Common Ground/Surface System Acquisition Standards Handbook - Imagery Intelligence (IMINT) (DASH-I), v3, Office of under Secretary of Defense for Intelligence, 20 June 2008.

US Department of Defense, Final Report for the Airborne Intelligence, Surveillance, and Reconnaissance Data Transport Capabilities Based Assessment. Office of under Secretary of Defense for Acquisition Technology and Logistics, 20 June 2008.

US Department of the Air Force, "Global Vigilance, Global Reach, Global Power for America" (U.S. Air Force, August 15, 2013).

US Department of Defense, Joint Concept of operations for Unmanned Aircraft Systems (JUAS CONOPS) Office of under Secretary of Defense for Acquisition Technology and Logistics, 20 June 2011.

US Department of Defense, McChrystal, Stanley A. "ISAF Commander's Counterinsurgency Guidance." Kabul Afghanistan, 2009. International Security Forces.

US Department of the Air Force, RPA Vector: Vision and Enabling Concepts 2013–2038, Headquarters United States Air Force.

US Department of Defense, Supporting documentation for AISR Data Transport Initial Capabilities Document. Office of under Secretary of Defense for Acquisition Technology and Logistics. September 2016.

U.S Army. Army Aviation Doctrine. FM 1-100. Washington, DC: Headquarters Department of the Army, 21 February 1997.

Wels, Patty: Open architecture bringing benefits to Air Force DCGS (http://www.af.mil/News/ArticleDisplay/tabid/223/Article/926750/open-architecture-bringing-benefits-to-air-force-dcgs.aspx) accessed on 19 Nov 2016

Williams, Brian, Predator The CIA's Drone War on al Qaeda, (Dulles, VA: Potomac Books)

Young, Adam; Employing Intelligence, Surveillance, and Reconnaissance Organizing, Training, and Equipping to get it right.