Emerging IADS Threats: Talking Points
National Air and Space Intelligence Center
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(U) **Summary**

(U) The integrated air defense system (IADS) threat today remains a formidable challenge to air operations in nearly any foreseeable major conflict. IADS modernization, coupled with significant advancements in multi-domain military operations (Cyber, Global C4ISR, Offensive Strike, Threats to Coalition Basing, etc.), poses a significant area denial threat to U.S. air dominance that was virtually guaranteed in past military operations. Fundamentally, the foundational pillars of the IADS kill chain have remained unchanged for decades; with mature processes and equipment widely-fielded to perform indications and warning (I&W), find/fix, track, engage, and assessment functions.

(U) Historically, U.S. air dominance employed overwhelming capabilities that broke or dismantled much of our adversary's IADS kill chain with rapid precision. Since the mid-2000s, our power adversaries – primarily Russia and China – are fielding advanced military technologies, improved global C4ISR capabilities, and enhanced joint force concepts in an attempt to erode our capability to target and break the kill chain. The IADS kill chain has never been a linear process where if one link or singular node was broken, the entire system is rendered non-operational. Redundancies, system diversity, and skip-echelon functionality have always been staples of IADS doctrine and employment. However, technological advancements, combined with C4I and multi-domain concepts, have made it exceedingly more difficult to locate and target the critical centers-of-gravity in the kill chain.

(U) The purpose of this paper is to provide insight into the near-term (next 2-5 years) technologies, trends, and concepts emerging in the adversary IADS domain. This paper is not an all-inclusive listing of all the recent IADS developments, but it aims to serve as a primer for a more detailed discussion during the interview process and the drafting of the article. The key points are organized under the three main functional areas associated with the IADS kill chain – air surveillance (ASV), battle management, and weapons control.

(U) **Key Points**

(U) ASV Advancements: adversaries are deploying sensors and fielding global ISR capabilities that extend well beyond traditional line-of-sight radars. This global, long-range detection capability provides the IADS with advanced I&W and situational awareness that enables the threat to mobilize, posture alert forces, and game plan for an incoming threat much faster and earlier in the kill chain than previous IADS generations. Additionally, adversaries are deploying advanced active radar and passive sensors aimed at improving capability against low-observable aircraft and timely and precision tracking against a variety of target sets that include: fixed and rotary wing aircraft, cruise missiles, and unmanned aerial vehicles (UAV). Some of the emerging and aspirational ASV developments include:

- (U) Development of Over-the-Horizon Radar (OTHR) systems operating in the high-frequency (HF) radar band that can detect air targets thousands of kilometers from the battlefield / defended area.

- (U) Global ISR, including space-based detection capabilities that can monitor air activity and emissions around the world and provide combat identification and advanced warning.
- (U) Mass proliferation of ground-based radar technologies in all radio-frequency (RF) radar bands. Many of the newer, advanced radar systems employ active electronically-scanned array (AESA), digital processing, signal diversity, wider bandwidth, improved fusion capabilities, and enhanced electronic protection features.
- (U) Seamless integration of airborne early warning (AEW) aircraft, UAVs, and persistent aerostats – many targeting low-flying and smaller radar cross section (RCS) platforms.
- (U) Large-scale, advanced passive detection systems, acoustic and infrared sensors, and bi-static / multi-static tracking technologies.
- (U) Integration of civilian air traffic control, to include integration of secondary surveillance and identification friend or foe (IFF) capabilities.

(U) **Battle Management Advancements:** for the past 10+ years there has been significant advancement with adversary global C4ISR capabilities and their overall holistic approach to integrating disparate sources into a common, fused C4ISR infrastructure supporting IADS. While many advanced C4ISR concepts remain in their infancy, adversary current capabilities to process data globally in a timely, actionable manner poses a significant obstacle to U.S. global airpower and air operations. Key battle management and C4I developments include:

- (U) Proliferation of modern automated command and control (C2) systems that leverage commercial technology, and have the capability to share and store data in a local or a quasi-unified informational space. This allows for a net-centric approach in which information can be shared effectively between multiple military entities.
- (U) Automated C2 systems that process high volumes of data (tracks and C2 information) in a very short timeframe. Sensor-to-shooter, rapid national-to-tactical integration.
- (U) Development of joint force and multi-domain C4I systems that integrate data seamlessly and create an environment to facilitate joint C2.
- (U) Heavy use of a common operating picture (COP) – facilitates joint integration, timely battle management, and efficient employment of resources.
- (U) Emerging IADS concepts that include: aerospace operations, integrated air and missile defense, cyber-enabled IADS operations, and unprecedented joint C4ISR operations (Air Force, Army, Navy) beyond traditional combined arms doctrine.

(U) **Weapons Control Advancements:** since 2010, adversary IADS modernization has included deployment of long-range anti-access/area denial (A2/AD) weaponry, supported by a vast deployment of layered tactical systems to augment long-range capabilities. These modern weapon systems threaten nearly every aspect of our counter-IADS / suppression of enemy air defense (SEAD) capabilities. Many of the emerging capabilities focus on the denial of airborne ISR, and increasing the threat to 4th/5th Generation aircraft, cruise missiles, precision guided munitions, and UAVs. Emerging trends with IADS weapon system employment include:

- (U) Large-scale concepts involving very long-range surface-to-air missile (SAM) systems (400-500km) that threaten airborne operations at extended ranges. Latest generation SAMs include modern fire control radars in multiple RF bands, and advanced waveforms and EP features.

- (U) A dense, layered environment of modern medium- and short-range SAM systems – many tactical systems are equipped with integrated missile and gun systems with high-rates of fire.
- (U) Proliferation of 5th generation fighter aircraft with advanced sensors, and long-range air-to-air missile systems.
- (U) Mass deployment of advanced electronic warfare systems that target our air dominance sensor and communications capabilities, and are fully integrated with IADS forces.
- (U) Inclusion of 3rd Party targeting concepts with advanced weapon systems.
- (U) Deployment of hyper-mobile IADS weaponry and C2 that complicates targeting.

(U) Additionally, the potential exists for significant future developments to occur in the following technologies and concepts that are emerging, but are not yet fully integrated and or operational.

- (U) Hypersonic defense
- (U) Cyber-enabled IADS
- (U) Roll-out of modern directed energy weapons; combating airborne platforms at tactical ranges
- (U) Full integration of "Big Data," artificial intelligence, and mature net-centric IADS operations

(U) While adversary IADS capabilities continue to advance and pose a significant threat to U.S. air dominance, there are still critical vulnerabilities at nearly every echelon. C4I dependencies and centralized processes permeate these systems – and create opportunities for exploitation.