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RECOMMENDATIONS FOR MISSION-CENTRIC AIRBORNE ISR EMPLOYMENT AND ASSESSMENT

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ABSTRACT

The alignment of limited ISR resources against GCCs' highest-priority requirements is a complex problem, and current processes are not ideally suited to manage operations of allocated capabilities nor do they offer essential responsiveness to the demands of a complex and dynamic battlespace. To resolve these disconnects, this research examines the current methods of assessing airborne ISR operations and feedback mechanisms, and recommends a taxonomy of ISR roles to inform a mission-centric employment model. This strategy-to-task model links the ISR Role to a given operational context and provides a structure for assessment based on accomplishing tasks, creating effects, or achieving Commander's objectives. Effective ISR assessment compares projected outcomes with operational events to determine mission effectiveness and provide operational feedback. This assessment and feedback should inform resourcing decisions and guide future employment of ISR assets.

SCOPE

The following constraints apply for the purposes of this white paper:

- The scope of this research is limited to the utilization of allocated Intelligence, Surveillance, and Reconnaissance (ISR) assets within a given Geographic Combatant Command (GCC). It does not investigate allocation processes such as the ISR Global Force Management Allocation Plan (GFMAP).
- Although ISR assets include airborne, cyber, ground, human, maritime, and space sensors, platforms and architectures, this research is focused on US Air Force airborne ISR assets and associated architectures.

- Similarly, only GCC-allocated assets are considered. Allocation and utilization for other intelligence needs, such as Special Operations Forces (SOF) or the national Intelligence Community (IC), are not considered.

MISSION-CENTRIC ISR ROLES & ASSESSMENT

ISR operations rely on asynchronous, but interdependent, management processes that have had the consequence of encouraging requirements framed in terms of platform and sensor instead of articulating the intelligence need. For example, a Joint Task Force (JTF) may request MQ-9 Combat Air Patrols (CAP), rather than the requirement for imagery showing pattern-of-life (PoL) at a target facility, or a GCC may levy a number of Electro-Optical (EO)/Side Aperture Radar (SAR) images per sortie rather than articulate the need to monitor force disposition and order-of-battle. Similarly, there has been a trend of quantifying ISR by number of platforms assigned or hours of Full-Motion Video (FMV) coverage in support of (ISO) a given operation. These asset- and sensor-based requirements communicate resource costs, but this approach encourages an assessment process that directly translates the requirement into a measure of performance (MOP). These measures may communicate efficiency at assigning assets to requirements but are not clearly linked to operational context or effectiveness of employment.

Effective operational assessment requires that we evaluate employment against both measures of effectiveness (MOEs) and MOPs to determine progress relative to the objectives, mission, and desired end-states.[1] These MOEs and MOPs may include both observation-based quantitative metrics and value-based qualitative indicators to evaluate mission execution and help staffs understand the causal relationship between tasks and desired outcomes.[2] Identifying which indicators denote success requires a judgment of factors associated with mission tasks and

effects. For ISR operations, this requires a contextual understanding of the intelligence need and describing ISR employment in terms of tasks, services, products or objectives. These elements can be collated into a taxonomy of *ISR Roles* to link ISR resources with the operational imperative ISO GCC campaign strategies.[3] This taxonomy provides a strategy-to-task structure aligning mission objectives with ISR tasks and functions that support these objectives. These ISR Roles are resource agnostic and instead emphasize ISR capabilities to meet an operational need. Emphasizing ISR Roles as opposed to standalone requirements for a platform or sensor promotes a shared operational context and synchronizes ISR with the larger campaign strategy. ISR Roles may also guide assessment by comparing projected outcomes with operational events to determine mission effectiveness. This allows ISR employment to be measured as an outcome-based return-on-investment (ROI) for ISR capabilities and resource costs. This concept of ISR value in terms of ROI infers an *economics-based* approach to evaluate the projected or real outcomes of ISR employment against the resources costs and time required.

For a given ISR Role, certain task metrics or factors may be designated *Dominant Indicators* to emphasize specific capabilities or constraints and weight those variables for a given ROI calculation. For example, if providing Indications & Warning (I&W)[4], a requirement to identify adversary movement from garrison will drive timeliness to be the governing factor, whereas for Target Development, the need for object-based production (OBP) stresses higher fidelity Analysis & Production (A&P). The Dominant Indicators are key characteristics for a given ISR Role and mission that inform the MOEs in determining progress of operations toward achieving objectives and understanding causal relationships between specific tasks or functions and effects. They guide hypothesis testing for the outcome-based ROI, biasing the ISR Role (tasks) to the operational need (outcome) and measuring it against resource allocation.

Linking ISR Roles with an outcome-based ISR assessment provides a normative schema to correlate operational requirements with ISR employment and inform utilization of ISR resources. This schema prioritizes particular tasks, identifies the capabilities desired, and estimates the probability of successful collection, exploitation, and analysis to translate to ISR value against the resource costs. In other words, specific operational requirements are tied to specific ISR actions and specific outcomes, and assessment provides vital feedback to inform employment and resourcing decisions.

DEVELOPING ISR ROLES

To better synchronize ISR with operations, GCCs have used organizing constructs such as Mission Tasking Order (MTO) -driven operations and Focused Collection Operations (FCO).[5, 6] These approaches offer the opportunity to link Commander's Intent and operational objectives, frame PIRs in terms of an intelligence problem, and orient ISR capabilities in time, space and purpose. MTO-driven operations guide collection strategies and inform analysis needs ISO specific intelligence needs. Additionally, this context improves interaction between ISR collectors, PED and A&P elements, and the ISR consumers. Leveraging the MTO concept promotes mission-centric employment and an ISR strategy that shares context with a GCC's campaign plan.

Beyond limited use of MTO-operations and FCOs, there remains a gap in aligning GCC employment paradigms and intelligence needs with ISR operations. To resolve this gap,

Figure 1: Framework for ISR Taxonomy
Adapted from briefing, Judy Wehking, ACC/A2, subject 'ISR Assessment Framework', 15 Nov 2016

CENTCOM, Air Combat Command (ACC), and the 480th ISR Wing are developing ISR Roles to better manage ISR operations and resources. This framework consists of a taxonomy of ISR Roles, Efforts, and Objectives which can be implemented during the Collection Management (CM) processes to promote an *ISR pedigree* from PIRs through collection, PED, and A&P. This taxonomy will in turn support a functional decomposition from Commander's Intent to ISR capabilities and tasks that relate operational effects and achieve objectives (see Figure 1).

The initial categories of ISR Roles address the employment paradigms ISO operations in CENTCOM's AOR. These categories are described in APPENDIX A: ISR Roles. ISR Roles are intended to categorize the functions ISR assets execute and offer a schema to normalize tasks that support a given employment paradigm. ISR Roles provides a strategy-to-task approach that provides an audit trail from Commander's Intent and campaign strategies to operational activities at the tactical level. This approach is defined by identifying the operational need and mission objectives, describing the activities ISR performs, and what needs to happen for ISR to be effective in meeting these objectives. Furthermore, this taxonomy should define modes based on broad operational requirements and desired effects or products; categorize sensors and platform configurations; match & task sensor capabilities; describe exploitation and analysis needs; and construct

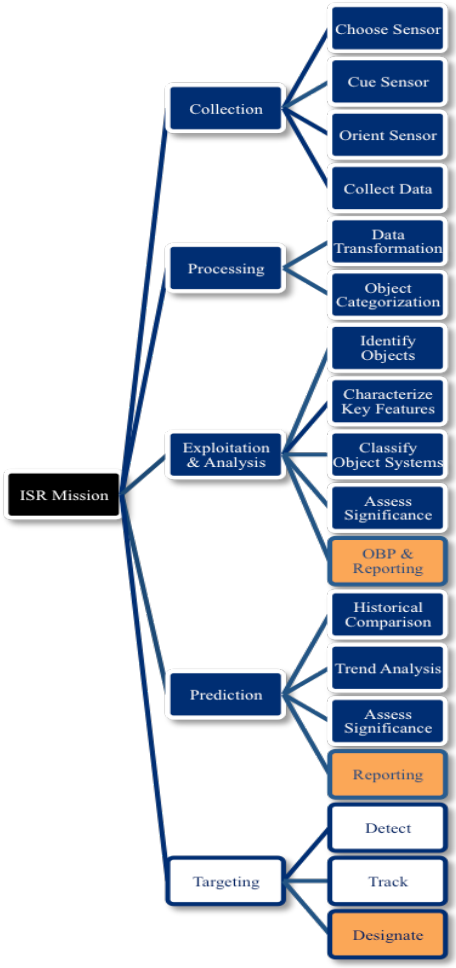

Figure 2: Nominal Functional Decomposition

a feedback mechanism through operational assessment. A nominal functional decomposition is offered in Figure 3. This framework should decouple the emphasis on particular capabilities or 'INTs' and promote a more robust multi-INT and multi-domain resolution to operational requirements. Additionally, ISR Roles enable PED and A&P elements to better inform the collection scheme of maneuver by enhancing cross-cue opportunities to better direct collection against the target.

IMPLEMENTING ISR ASSESSMENT

Legacy methods for ISR assessment tend to measure asset utilization and satisfaction of individual collections, such as flight information (such as takeoff/landing times, on-station times (also known as Vulnerability Windows or VULs), Time-Over-Target (TOT), or completion of a given collection deck. Examples of these methods may be found below in Table 1. In addition, feedback mechanisms between the Collection Management (CM) processes and the consumers of ISR products and/or services have limited value, tending to recycle tasking as opposed to addressing deficiencies in capabilities or coverage. These approaches are inconsistent across GCCs and Headquarters elements for US Air Force ISR assets.

Tracking sorties or CAPs conducted ISO a given operation or Line of Effort (LoE)	Quantifying asset utilization by WoE against Priority
Measuring satisfaction of Collection Requirements (CR) from the Planning Tool for Resource Integration, Synchronization, and Management (PRISM) by apportionment to a given platform's collection deck	Reviewing post-mission summaries for highlights or significant events
Tracking hours of FMV coverage against a given target	Issuing a voluntary survey to ISR consumers to gauge their satisfaction with ISR products or services
Auditing post-mission data (mission duration, TOT, VUL, etc)	Qualifying exploitation/analysis by monitoring source citations in other ISR products

Table 1: Examples of Assessment

With these methods, however, RAND analysts noted, "it is difficult to trace any individual collection back to the effect that is to be achieved … As a result, it becomes difficult to identify ties between the top-level strategies and the collection tasks that help to enact those strategies for ISR operations."[7] The disconnect between specific tasks and functions and the operational imperative is a critical issue. Well-defined MOPs and MOEs allow both the evaluation of task performance as well as the determination of progress towards achieving objectives.[8]

Whereas the legacy ISR employment paradigm informs capacity-based metrics such as FMV hours or sorties, the ISR Roles framework defines ISR tasks that better emphasize operationally relevant capabilities and facilitate assessment of ISR effectiveness. In other words, in addition to knowing if a given asset flew and collected a given collection deck, ISR Roles offer traceability from specific operational requirements to specific ISR actions to determine if those actions satisfied the requirements. Beyond platform-sensor utilization, this also has the potential to evaluate exploitation and analysis capabilities.

Although existing Joint and Air Force doctrine addresses ISR employment as well as describing concepts for operational assessment, it does not have the fidelity to guide units to conduct effective ISR assessments. To meet this need, ACC is developing an ISR Assessment Methodology that leverages industry best practices through data-driven, objective assessments and a consistent taxonomy. The intent is to provide definitive guidance and unify Air Force ISR assessment efforts. This methodology will also influence GCC assessments through the Air Operations Centers, and may be integrated into Joint and IC assessments documents.[9]

The premise of ACC's approach is that ISR effectiveness should be measured in context of the ISR consumer's objectives.[10] This orientation to operational context should guide the assessment need. The development of ISR Roles provides this context. Potential metrics schema evaluate the relative capabilities, coverage, capacity and constraints of the employment paradigm to communicate whether objectives were met and inform future ISR utilization decisions. ACC offers a representative set of data categories and types including mission data, object data, and administrative data,[11] and a functional decomposition of ISR Roles similar to above classifies measurable elements or task indicators.[12] The goal is to analyze relevant data from ISR employment to discern transactional indicators driving ISR performance and effectiveness.

Operationally, CENTCOM is employing the ISR Roles framework referenced previously to better manage ISR operations, and is implementing an assessment methodology to track ISR task completion, source attribution, and CR satisfaction. Similarly, the 480th ISR Wing is using a version of CENTCOM's ISR Roles construct to bin ISR services and production in order to delineate objectives, ISR tasks, and objects. The goal is to merge ISR production data with platform performance to inform utilization decisions.

Combining ISR Roles and Assessment under a strategy-to-task framework allows for identified elements to be tagged and linked to mission execution data. Assessment should be an ongoing-process through and across command levels to guide the planning and execution of ISR operations and inform prioritization and utilization of ISR resources (see Figure 4).

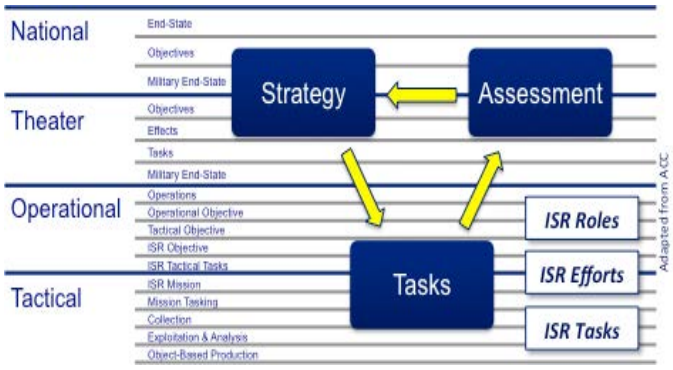

Figure 3: ISR within Strategy-to-Task Framework
Adapted from *ISR Assessment Framework* (Draft), ACC/A2, 20 Sep 2016.

AN ECONOMICS-BASED APPROACH TO ASSESSMENT

Beyond these metrics, the Commander's Intent and operational context determine the expected ISR value. Translating these into ISR Roles establish common definitions for demand and communicate planning factors for the CM processes. This does not replace a collection deck but provides the operational imperative and informs apportionment to resources and the ISR product or service desired.

RAND describes the expected value of any given collection as 'the product of the utility of collection with the probability of success given that collection.'[13] With the ISR Role construct, the *utility of collection* may be decomposed in terms of the platform's ability to collect required target signatures and the ability of PED and A&P elements to describe target characteristics and trends (such as Identity, State or Configuration, Location, Track, Activity, etc.). Additionally, there may be requirements to support other missions such as designating a target for Find/Fix/Finish operations, conducting a kinetic strike, or consideration of platform characteristics such as the relative observability to adversary sensors.

An economics-based analysis can guide objective assessment and provide feedback of the effectiveness of ISR task completion. The Return-on-Investment (ROI) should represent the expected value of ISR products or services in resolving intelligence gaps or decision needs against the planned resource and time costs. The expected value supports planning processes and the ROI estimation can be iterated during execution to provide immediate feedback. A post-mission assessment can translate the expected value to the actual value to assess effectiveness. The resources and time costs are a sum of the assigned resources and can be considered opportunity costs for a given activity.

ISR Roles exhibit various combinations of characteristics that define how tasks are accomplished and resources used. The Commander's Intent and operational context for a given mission will drive the ROI calculation by specifying the key variables for a given ISR Role and identifying the Dominant Indicator, or key variable, which will drive the ISR Value assessment.[14] For example, for a Force Protection role, the Dominant Indicators may be to monitor a given Area of Interest and provide immediate warning of any changes to local friendly forces or unique capabilities such as Wide Area Aerial Surveillance. The Dominant Indicators weight ISR tasks for a given objective and in turn bias the ROI calculation for ISR value. These Dominant Indicators are particular important when outcomes are tied to a specific decision point such as for Commander's Critical Intelligence Requirements.

IMPLEMENTATION & FURTHER RESEARCH

Properly defined ISR Roles will promote better alignment of ISR capabilities against GCC campaign objectives, and operationally-focused ISR assessment informs employment and resourcing decisions. Elements of this approach are being fielded by ACC and CENTCOM. However, broader implementation relies on outstanding tasks for both defining ISR Roles and instituting a framework for ISR assessment.

The ISR Roles described above were developed by CENTCOM and addresses its particular operational contexts. Other GCCs may require different ISR employment paradigms, such as EUCOM or PACOM with high priority strategic intelligence needs in their respective theaters. Additionally, airborne ISR assets often fly with collection requirements from National IC agencies or ISO SOF operations; by their nature, there is often limited operational context and assessing ISR Value may devolve into a question of asset utilization. These various employment paradigms should be investigated and categorized into appropriate ISR Roles. The scalability of

the ISR roles taxonomy should be based on broad operational requirements and desired outcomes; the applicability to employment paradigms beyond GCC operational contexts and AF airborne ISR assets and architectures is an outstanding question.

As noted above, as ISR Roles are defined, each role can be translated into a schema of ISR efforts, objectives, and tasks. Each ISR Role or sub-Role should have Dominant Indicators, weighting specific factors to guide collection strategies and inform analysis needs. Special attention should be paid to the need for exploitation and analysis. These Dominant Indicators then feed ROI assessments to guide planning and employment and should be considered with assessment data post-mission to assess overall ISR effectiveness.

CONCLUSION

The complex management of ISR operations has incurred a disconnect between the employment of ISR resources and the GCC's operational imperatives. To resolve this disconnect, this research recommends a taxonomy of ISR Roles to link campaign strategy to ISR Roles and specific tasks, synchronizing ISR with the GCC's campaign strategy and promoting a shared operational context to inform ISR scheme of maneuver. A strategy-to-task hierarchy provides traceability between ISR tasks, objects, and outcomes to describe the causal relationships. This in turn allows ISR value to be measured in terms of Return-on-Investment for ISR value against resource costs. One of the critical aspects of this ISR value is that it considers ISR from planning to collection through analysis and production, and is not limited to asset utilization for a platform and sensor. This helps commanders understand capabilities, measure and report progress, identify opportunities, anticipate challenges, and adjust effort. Key factors or Dominant Indicators can be identified for specific ISR Roles to weight ISR capabilities and inform planning, employment and assessment. Although this assessment approach relies heavily

on identifying measurable elements and quantifiable data, it is not an end in-and-of itself. It supports systematic analysis to identify the drivers and variables affecting mission performance, and allow commanders to make operational decisions that improve effectiveness and risk management.

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APPENDIX A: ISR Roles

This section is excerpted from the draft *ISR Assessment Framework*, dated 20 September 2016:[15]

ISR ROLES: The roles described below are intended to categorize functions ISR assets execute. Objectives, tasks, and MoP/MoE should be developed for each role to facilitate ISR assessments.

These roles can be further tailored by sub-roles based upon operational environments as needed (examples below):

1. ISR SUPPORT TO FORCE PROTECTION: ISR support to force protection enables prevention or mitigation of hostile actions against friendly personnel, resources, facilities and critical information. It characterizes an adversary's capability, disposition, intent and willingness to act.

   Sub-Role Examples: Overwatch, Fixed Point Security

2. ISR SUPPORT TO TARGET DEVELOPMENT: ISR support to target development identifies and develops points, functions, areas-of-interest (AOI), and centers-of-gravity (COG) based on spatially- and temporally-referenced, object-based intelligence that establishes the relationships and values required to facilitate production and effects-based targeting options for commanders.

   Sub-Role Examples: Target Development of Facilities, High Value Individual (HVI) Target Development

3. ISR SUPPORT TO CURRENT OPERATIONS: ISR support to current operations is aligned and tailored to specific force objectives, and authorized to answer operational needs. It must provide multi-domain battlespace awareness for ongoing operations, empowering decision advantage to have measurable impact to operational objectives.

   Sub-Role Examples: Strike Support, Drug Interdiction, Troops-In-Contact (TIC) Support

4. INTELLIGENCE PREPARATION OF THE OPERATIONAL ENVIRONMENT (IPOE): The ISR Role of IPOE is the employment of ISR capabilities to conduct an initial and continuous look (monitor) at an operational environment to obtain overall awareness. IPOE is a baseline, all-source characterization of the battlespace to create awareness of psychological, political, geographic, economic, cultural, military, technological, and environmental terrain to support the commander's decision-making process. IPOE determines adversary intent and identifies networks, COGs and vulnerabilities.

   Sub-Role Examples: SRO, Foundational Intelligence, Treaty Verification

5. WARNING INTELLIGENCE: The ISR Role of warning intelligence is the observation, collection, processing, and analysis of unique, measurable, and reliable indicators, across all domains, in order to provide commanders with time-sensitive, decision-quality information regarding potential adversary actions, intents, and courses of action.

   Sub-Role Examples: Indications & Warning, Signature Development

[1] *Commander's Handbook for Assessment Planning and Execution*, viii.
[2] Ibid, ix.
[3] ACC, 4.
[4] For a description of ISR Roles, please refer to the ACC *ISR Assessment Framework* (Draft), Appendix B.
[5] Also referred to as a 'Mission Type Order'
[6] JP 2-01
[7] Ibid, 7.
[8] *Commander's Handbook for Assessment Planning and Execution*, ix.
[9] ACC, 5.
[10] ACC, 5.
[11] Ibid, 17.
[12] Discussion with RAND ISR Mission Measures of Effectiveness, 6 Dec 16.
[13] Rhodes, 14.
[14] Gartner, 26.
[15] ACC, 19.