Observations in allocation and tasking of Joint level Intelligence Surveillance and Reconnaissance (ISR) systems in support of Coalition Operations.

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If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither yourself nor your enemy, you will succumb in every battle

Sun Tzu
The Art of War

Abstract

Intelligence Surveillance and Reconnaissance (ISR) systems provide key capabilities to the Joint Forces/Combined Joint Task Force Commander (JFC/CJTF) for intelligence collection and battle management. ISR systems cover the full range of joint operations, supporting multiple commanders simultaneously with planned and dynamic collection and exploitation requirements.

Because ISR systems are limited in numbers, collection requirements often exceed the available capability. The management of ISR systems and the data, information and intelligence they provide is a high priority for the commander. The challenge then, is to efficiently allocate and task nationally owned ISR systems within a coalition environment in accordance with the supported commander's requirements.

The Coalition Aerial Surveillance and Reconnaissance (CAESAR) project is providing interoperable solutions to these problems based upon an integrated system of nationally owned and operated ISR systems.

This paper addresses issues regarding the planned and dynamic tasking of ISR systems in a coalition. The paper further illustrates procedural solutions that have been developed and implemented by NC3A and CAESAR as well as options for transition into operational NATO Commands, thereby improving the efficiency of both pre-planned and dynamic collection tasking for ISR systems.

Keywords

Intelligence Surveillance and Reconnaissance (ISR), Collection Management, Dynamic Tasking, Coalition, Integration, Time Sensitive Targeting (TST)

Introduction

Along a southern European road, a Colonel from the 39th Regiment Royal Artillery (RA) is preparing his unit for a fire mission in support of a planned assault on an enemy force blocking a bridge along the line of approach to an enemy held village. Using the Phoenix Unmanned Aerial Vehicle (UAV), the 32nd Regiment RA is providing detailed imagery of the bridge and its defences to a detachment of the 5th Regiment RA collocated with the 39th RA Headquarters. At an airbase 500 miles away, a Royal Netherlands Air Force F-16 flight lead is reviewing enemy dispositions near the bridge in support of the planned assault. On board the USS Carl Vinson, a US Navy EA-6B crew is planning a suppression of enemy air defence (SEAD) mission in support of the Dutch led F-16 strike. Their mission is to suppress a battery of SA-8 surface to air missiles believed to be hidden somewhere in hilly terrain between the bridge and the village. Over the battlefield, a 116th Air Control Wing E-8C Joint Surveillance Target Attack Radar System (JSTARS) has been providing ground surveillance area surrounding the village for the last eight hours.

At the Joint Operations Centre, the Land Component Commander has received information that a SCUD missile battery has been sighted by Special Forces entering an industrial complex to the south of the village and has disappeared. In an instant, the F-16 flight lead and the EA-6B crew are re-tasked. Their new mission; take out that SCUD battery as soon at it is located and identified. This is the Joint Forces Commander's number one priority. This mission is to be given the maximum support; all other priorities are rescinded.

The war fighters begin their planning; the mission will depart as soon as possible. What will these warriors need to accomplish their mission? Material support such as weapons and fuel are handled in due course. Planning for navigation routes, weapons employment, aerial refuelling and command and control move quickly through standard, well-established processes. However, the last and perhaps the most important piece that is needed is the capability required to detect, identify and target the SCUD missile battery among the many potential targets in the area of the village. Without this, the strike forces will be wasted, the target will not be detected or engaged and the strike mission will be placed in jeopardy over a hostile area.

So how do these units get the information they need? There are many ways; first and foremost, it may already exist. The Combined Joint Task Force (CJTF) commander may have already covered this area with surveillance and reconnaissance forces. Collection tasking among Intelligence Surveillance and Reconnaissance (ISR) systems may already be providing current and archived data and imagery of the area. In this case, the intelligence is simply passed to the operators in the field for their planning and employment. In those frequent cases when the enemy has emerged unexpectedly, this information must be rapidly and efficiently collected, exploited and disseminated before the strike mission begins. In the scenario above this task falls on the Phoenix UAV and the JSTARS. Before the orders go out however, questions must be answered. Will these systems need to be re-tasked? If so, how will this be done and what are the ramifications associated with these changes? What about the assault on the bridge? Will it continue without ISR support or will the assault be put off until later? How will this affect the CJTF's overall battle plan?

Much like the F-16 and EA-6B strike mission, an ISR system can also be dynamically tasked to provide immediate support to the priority commander's objectives. The primary difference is in the known and unknown ramifications associated with the denial of planned collection requirements to the overall conduct of the conflict.

This paper addresses the issues regarding planned and dynamic tasking of ISR assets at the joint level. This paper will illustrate procedural solutions that were developed and implemented during exercise operations, improving the efficiency of the collection system for both planned and dynamic collection tasking overall. Finally, this paper will discuss advances in ISR dissemination and options for the transition of these solutions to operational commands.

Coalition ISR

The modern battle space is characterized by an extremely wide and complex set of factors. To operate effectively, Commanders at all levels must "see first" and understand the total battle space in order to act quickly and decisively in this dynamic environment. The requirements for the timeliness of intelligence information may vary from near real time (NRT) to several hours or days old, depending upon the level of command, the type of unit supported (i.e. combat commander, exploitation centre, targeting group, etc), and the nature of the operation (ground operations, air operations, special operations, etc) [Mahaffey et al, 2003]. Within this environment, ISR systems play a critical role as the eyes and ears of the commander, thereby allowing the proper allocation of forces against perceived threats.

The Coalition Aerial Surveillance and Reconnaissance (CAESAR) project was initiated by seven nations (Canada, France, Germany, Italy, Norway, the United Kingdom and the United States) to provide interoperable data and information based upon an integrated system of nationally owned ISR systems. CAESAR ISR systems provide Ground Moving Target Indicator (GMTI) data, Synthetic Aperture Radar (SAR) imagery and intelligence products derived from the exploitation of GMTI data and SAR imagery (e.g. textual reports, meta data overlays and Link 16 tracks and points).

The objective of the CAESAR project is to maximize the military utility of GMTI and SAR resources through the development of technical and operational means that enhance interoperability among participating coalition nations [CAESAR SIMEX 2003].

In October 2003, the CAESAR project conducted a multinational exercise in which CAESAR Aerospace Ground Surveillance and Reconnaissance (AGS&R) systems and their associated exploitation capabilities were evaluated in an operational setting using current NATO operational directives, processes and procedures. The results of this experiment exposed problems associated with the planned and dynamic use of ISR systems within a coalition environment. In order to evaluate CAESAR against operational requirements, military subject matter experts (SME) from NATO and national commands were employed to develop and integrate operational processes in accordance with operational directives.

Because the CAESAR project is a coalition of NATO nations, all planning and tasking processes have been implemented in accordance with NATO published directives and procedures. However, anecdotal evidence from discussions with US and other national ISR staff officers and operators reveals that while NATO procedures may vary in the details, the concepts remain largely the same. For this reason, NATO procedures and processes have been chosen to provide a common baseline for the tasking and management of coalition ISR operations.

The ISR Mission

ISR as a mission can trace its history to the scouts, spies and informers that provided information for armies in the field from the beginning of written history. One thousand years before Sun Tzu wrote the Art of War, the army of Egyptian Pharaoh Thutmose III used agents and reconnaissance techniques to gather tactical intelligence. He was the first to formally recognize the five elements of ISR: Observe, Locate, Process, Decide and Disseminate [Defender 2003]. Today, ISR is most often associated with aerospace and ground based systems providing real time and NRT data and information on the movement of enemy and non-combatant forces in an area of interest (AOI). For aerospace systems, ISR is arguably their oldest mission, dating back to the use of balloons to observe opposing forces during the French Revolution. Additionally, prior to and during World War I, the first missions assigned to the fixed wing "aeroplane" were observation and reconnaissance of enemy forces.

The primary objective of ISR is the support of commanders and their units across the full range of military operations. ISR systems support the commander through the detection, tracking, and identification of specific objects (targets) or events (movement) within the commander's area of interest [Joint Encyclopaedia 1997]. Using ISR information, the commander and staff observe and analyze the meaning and impact of a wide variety of events. The commander's staff then convey useful, timely intelligence, adversary capabilities and intentions to supported commanders at all strategic, operational and tactical levels of command [AFDD-2.5.2 1999].

At the Joint level, ISR systems may support multiple commanders simultaneously with planned collection and exploitation requirements. However, as the kill chain associated with Time Sensitive Targeting (TST), Combat Search and Rescue (CSAR), Theatre Missile Defence (TMD) and Suppression of Enemy Air Defence (SEAD) continues to be compressed, ISR systems, like combat forces, are now required to respond to dynamic changes to collection and exploitation requirements within minutes of notification. Moreover, the supported commanders may include any number of Air, Ground, Maritime and Special Forces and may reside at all levels of command, strategic, operational and tactical.

A Revolution in ISR Information

Within the last 20 years there has been a marked increase in the number and type of ISR systems available to the commander. These systems have brought new capabilities for application of a wide range of operations and missions. These new capabilities may include ground radar surveillance using GMTI data and SAR imagery, as well electro-optical and infrared (EO/IR) imagery, electronic intelligence (ELINT), and passive acoustic sensors.

Within a coalition, ISR systems are generally classified as High Demand/Low Density (HD/LD) assets. Their data and information is often a critical component in the successful detection, identification and engagement of opposing forces throughout the AOR. Unfortunately, because they are HD/LD assets, ISR system requirements often exceed the number of systems available to any given commander.

Further ISR systems, by their nature are highly secure systems. The nations owning and maintaining ISR systems provide limited access to these capabilities at the unit level. As a result, the management of these ISR systems and their associated data, information and intelligence is a high priority to the CJTF and subordinate commanders dependent upon them for the successful completion of their mission.

ISR collection tasking requirements are based upon the system's product. These products are as diverse as the systems themselves. Some systems provide a detailed product based on a narrow requirement such as imagery of a bridge or other fixed target. Others may provide a product based upon surveillance of a wider area detailing movement within an area of operations (AOR). Additionally, much of the data and information processed by an ISR system is perishable (i.e. GMTI, EO/IR and ELINT). As a result, an ISR system may be tasked to support both planned and dynamic collection and targeting requirements in order to exploit time critical information.

The ISR Tasking Challenge in the Coalition Environment

The tasking of ISR systems within a coalition remains problematic for a number of reasons; chief among these is the ownership of the systems themselves. NATO as a coalition does not currently own an organic ISR capability. Some ISR capability is provided through the NATO Airborne Early Warning and Control (NAEW&C) system and its integral Electronic Support Measures (ESM) system. However, until the planned procurement of the NATO owned Alliance Ground Surveillance system, all ISR systems participating in NATO operations will remain nationally owned and allocated. As a result, the number, capability and composition of the ISR systems supporting the CJTF will vary from operation to operation.

Geography also provides tasking challenges for the joint commander. Often a joint commander's Area of Intelligence Interest (AOII) may not be entirely within his control and may be beyond the integral collection capability of those units assigned to the command. In order to adequately support the commander's mission, it will be necessary to obtain information and intelligence from sources other than those under the commander's control.

Within a single nation, the challenge is only moderately reduced. Service owned and operated ISR systems provide support for their dedicated commanders. Their design, capabilities and limitations are an outgrowth of their services' specific requirements. For example, if a joint commander requires support of an ISR system integral to a division, the commander may need to work through several layers of command before the unit and its command are located and tasked.

Operations in a joint environment may require substantial changes to tactics, techniques and procedures in support of a joint commander. Solutions must then be prepared with a CJTF mindset, leading to support for the full range of ISR operations. To do this one must first find common ground. Essentially, where do ISR systems and their commanders' requirements intersect? The answer is in the ISR systems' products. These products are the common denominator for tasking, both for the ISR system and by the commander.

ISR System Classes

ISR systems can be organized into "classes" based upon the products or data they provide. These include GMTI data, EO/IR and SAR imagery as well as ELINT information just to name just a few. When tasking a system to fulfil a collection requirement, the commander's intelligence staff must take into account the class or type of ISR system to be utilized. For example, a GMTI system may not be well placed to provide details on the current disposition of an airfield. Similarly, an ELINT system is not the best option for the detection and reporting of vehicle movement within an AOR.

Within ISR classes, individual system capabilities and limitations are widely diverse as well. This may in turn affect the commander's required level of support. Using AGS&R systems as an example, the USAF JSTARS provides ISR capabilities significantly different than the French Army Hélicoptère d'Observation Radar et d'Investigation sur Zone (HORIZON) system. Both systems are currently operational and both provide GMTI data to networked ground stations to support ground based analysis and command and control (C2). The JSTARS however, is also capable of providing SAR imagery in addition to on-board and analysis and C2 capabilities. As a result, tasking a HORIZON to provide imagery of a ground target would not be successful. Both systems were created with their primary commanders in mind. In the case of JSTARS and HORIZON, each system was designed to support a different level of command. While both ultimately support the CJTF or corps commander, the JSTARS system was designed to support both the Air Component Commander and the Corps Commander while the HORIZON system was designed to support a Division Level Commander. While this command arrangement best supports national employment doctrine and planning, it complicates CJTF level tasking and allocation of these assets.

These problems also exist for EO/IR systems such as the US Army Hunter UAV and the French Eagle UAV as well as ELINT collection and analysis systems such as the US Navy EP-3 Aries III and the Royal Air Force Nimrod R-1. The key to efficient tasking and allocation is both a thorough understanding of each system's capabilities and limitations and the ability to effectively task these systems at multiple levels of command in a joint coalition environment.

Planned vs. Dynamic ISR Tasking

Requirements for the centralized tasking of ISR systems have precedent. During World War II, the following statement was issued in US Army Field Manual 100–20, Command and Employment of Air Power, 1943: "Experience in combat theatres has proved the requirement for centralized control, by the air commander, of reconnaissance aviation". This concept remains valid today though centralized control of these assets now resides with the CJTF.

Within NATO, directives and regulations exist to provide processes and procedures to allocate and task ISR systems provided to the JFC/CJTF. These procedures provide direction for the full range of jointly held ISR assets provided to the various component commanders. These procedures are known collectively as the Collection Coordination and Intelligence Requirements Management (CCIRM) process. CCIRM duties involve; developing a daily collection plan, validating, prioritizing, and disseminating Requests for Information (RFI) from subordinate elements as well as adjacent staffs and monitoring and ensuring all collection requirements are identified in minimum time to satisfy the Commander direction and guidance [AJP-1 2002]. This is coordinated through the joint intelligence staff, the component commanders and their liaison officers (LOs). This process is well defined and is an essential requirement for the efficient management of Joint ISR systems.

While the CCIRM process provides an efficient method of managing ISR systems through planned collection requirements, the directives fall short on the allocation and tasking of individual systems in the dynamic environment. There are many reasons for this, including problems associated with communications, competing priorities between supported commanders as well as inappropriate system tasking and resource management.

Dynamic collection requirements are described as those collection requirements that fall outside of the normal collection cycle. Essentially, they are unique requirements not listed or specifically stated as a standing requirement [BI-SC 65-5 2002]. These requirements may be forwarded just before or during the ISR mission. Through experimentation and analysis of ISR operations in coalition exercise operations, the CAESAR project has identified two types of dynamic tasks for ISR systems, platform space and time, and platform surveillance area.

Platform Space and Time

Platform space and time requires movement of the platform in space or time to support an updated objective. As a result, the ISR system's collection tasks will be interrupted, which in turn will further interrupt the joint commander's daily collection plan. Problems caused by these interruptions may cascade for several days as combat missions must be cancelled or rescheduled because collection requirement are not fulfilled.

A change in platform space and time also requires a high degree of coordination outside of the intelligence community. During execution, any changes in coverage area, station times, or radar priorities which require changes in the ISR platform's orbit/working area must be coordinated with the current operations cell of the Combined Air Operations Centre (CAOC) for Air Component Commander allocated assets and the appropriate operations/intelligence cell of the supported commander's headquarters. Coordination must also be accomplished with the ISR system (aircrew and/or ground station operator) to ensure that new tasking is both feasible and within the bounds of supportable risk management [CAESAR TTP 2003].

Platform Surveillance Area

The second category of tasking, platform surveillance area, also requires re-tasking the ISR system to support new or modified collection requirements. However, this may be as simple as adding collection requirements in an area already covered by the sensor. In this case the dynamic tasks can be handled with no degradation to the overall plan. This is especially true for systems that provide wide area surveillance such as JSTARS and HORIZON. Conversely, if the dynamic task requires a change in the sensor surveillance area, the system may lose the ability to support the original collection task. In essence, the effect may be just as significant as a change in platform space and time on the degradation of the original mission.

Supported commanders and their subordinate units may make sensor service requests (SSR) through direct communication with the ISR platform or with the ground station operator as authorized by the supported commander. Other agencies' and commander's SSRs may be supported in accordance with established procedures and priorities. When required, the ground stations are generally the focus for dynamic tasking and the submission of dynamic requests (system dependant) [CAESAR TTP 2003].

One of the primary problems associated with both planned and dynamic collection management is the translation of joint level collection requirements into effective collection tasking for individual ISR systems. As stated earlier, each requirement requires a certain type or types of ISR data and information to be collected. These collection requirements must be tasked to the correct product or class of ISR system. To complicate matters further, within these classes, each system has specific capabilities and limitations that may significantly affect the quality of the ISR data and information being passed to the requesting commander. For example, the RC-135 RIVET JOINT may have slightly different capabilities than the RAF NIMROD R-1. Since both provide the same class of ISR data, either can be tasked to perform the same collection requirement. This information is both sensitive and detailed enough that specialized staff augmentation is required. For this reason, the ISR system Liaison Officers (LO) plays a critical role in the employment of their systems.

ISR Management – The Focal Point

Results from CAESAR participation in CJTF exercises have identified a need for an overall point of contact for the management of ISR systems. In early iterations of the CAESAR TTPs, this position was described as the ISR manager. The ISR manager is responsible to the CCIRM staff for the effective employment of ISR assets to meet commanders' information requirements. The ISR manager provides the theatre CCIRM staff with advice, training, de-confliction and analysis of ISR operations and products [CAESAR TTP 2003]. In addition, the ISR manager operates with LOs from each participating system. Within NATO, this position is identified as the Theatre Collection Manager (TCM).

As the command point of contact (POC) for ISR management, the TCM must be familiar with the basic requirements, capabilities and limitations of each of the assigned ISR systems. The TCM is also the primary POC for the integration of ISR systems into the commander's CCIRM and targeting processes.

Figure 1
TCM and LOs Meeting for Allocation and Tasking of ISR Assets

During CAESAR SIMEX 2003, ISR management functions were tested using current NATO collection management directives. As a result, certain shortfalls were identified in ISR management. The following paragraphs detail some of these findings and potential solutions.

TCM System Management

There is at present, no automated means for the TCM or others within the network to be notified when a sensor or an exploitation system makes an unscheduled departure from and/or return to the network. As a result, end users and others who depend on the "down" system may incorrectly assume it is capable of providing service.

Without automated options for system management within the network, the SIMEX TCM was required to create and disseminate operational procedures for reporting and management within the network. The following formats were the result of those operational ISR management procedures. Note: the following figures were produced to support operations during the CAESAR SIMEX, 21 Oct 2003.

Common Collection Formats

During the exercise, the TCM oversaw the development of collection requirements into collection tasks such as Named Areas of Interest (NAI), Target Areas of Interest (TAI) and Engagement Areas (EA). However, there was initially no common method for forwarding and displaying collection tasking. In most cases the TCM, through voice and e-mail, provided manual data inputs.

The CAESAR collection-tasking format was designed to provide the capability to task a broad variety of systems independent of the product. While this format was tested using GMTI and SAR ISR systems, it can easily be formatted to provide planned tasking for other ISR systems as well. The final iteration of the collection task is shown in Figure 2.

Collection Plan

*Index	Area of Interest	RQSTR	BE#	AOI Coords Latitude/Longitude Degrees/Decimal	AOI Coords Latitude/Longitude Degrees/Minutes/Seconds	Radius	Time	CRITERIA	AMPN	REPORT FREQ	OBSR	REM	XCUE	SCRND
1	NAI 1	J2		44.7425000 020.3688889 44.7900000 020.5972214 44.0097237 021.0230560 43.9750000 020.8433342	44 ' 44 ' 33N 020 ' 22 ' 08E 44 ' 47 ' 24N 020 ' 35 ' 50E 44 ' 00 ' 35N 021 ' 01 ' 23E 43 ' 58 ' 30N 020 ' 50 ' 36E		700 1800	MTI_p20	Logistics movement into and out of assembly areas	1 MINUTES	Rail Road Traffic LOCs from Beograde to Kargujevak			
3	NAI 3	J2		43.8088875 021.4691658 43.8938900 021.4827785 43.8675000 022.0613880 43.7613900 022.0497227	43 ' 48 ' 32N 021 ' 28 ' 09E 43 ' 53 ' 38N 021 ' 28 ' 58E 43 ' 52 ' 03N 022 ' 03 ' 41E 43 ' 45 ' 41N 022 ' 02 ' 59E		700 1800	MTI_p20	Logistics movement into and out of assembly areas	1 MINUTES	Locs from Beograde, Kargujevak, Paracin to crossroads at 43'45N 021'57E			
5	NAI VRANJE	J2		42.5500000 021.9333324	42 ' 32 ' 60N 021 ' 55 ' 60E	10KM	700 1800	MTI_p1	ADA OPERATIONS. Possible SA-6 site in vicinity	1 MINUTES	Significant movement into and out of area			
23	LCC 3	J2		43.1447220 021.4202785 43.3069458 021.4319439 43.3069458 020.9780560 42.8697200 021.1136112 43.0905571 021.3022213 43.1491661 021.4202785	43 ' 08 ' 41N 021 ' 25 ' 13E 43 ' 18 ' 25N 021 ' 25 ' 55E 43 ' 18 ' 25N 020 ' 58 ' 41E 42 ' 52 ' 11N 021 ' 06 ' 49E 43 ' 05 ' 26N 021 ' 18 ' 08E 43 ' 08 ' 57N 021 ' 25 ' 13E		700 1800	MTI_p20		1 MINUTES	Report convoys of 20 or more vehicles			
24	LCC 4	J2		43.3363876 021.8533325	43 ' 20 ' 11N 021 ' 51 ' 12E	10KM	700 1800	MTI_p5		1 MINUTES	Report increased activity at airfield for convoys of 10 or more vehicles.			

* for reference only

NC3A 2003 - Collection Plan xsl stylesheet version 1.1

Figure 2
ISR System Collection Task Format

Command Priorities and Dynamic Tasking

During Strong Resolve 2002, there was only one conflict in tasking between commanders attempting to use the same resource to satisfy two collection requirements. This conflict was for the use of HORIZON for a special operations mission at the same time the supported ground commander was planning a counter-attack. Both missions required real-time GMTI data. In this particular case the HORIZON ground surveillance area could not satisfy both requests simultaneously. Because the ground commander had tactical control of the resource, and the special forces mission was an "add on", outside the planned set of requirements, the conflict had to be settled through the CJTF chain of command. In this case the CJTF settled this conflict against the tactical unit because of overarching requirements for the special operations mission.

ISR Collection Tasking

Sensor planning tools are not currently available to the TCM for the coordinated planning of collection tasks. Problems associated with terrain screening and sensor maximum and minimum range required close coordination with system LOs. Further, placement of sensor orbits and collection requirements are not currently displayed against a graphical underlay. This limited the TCM's ability to dynamically task ISR assets when the LO was not physically present.

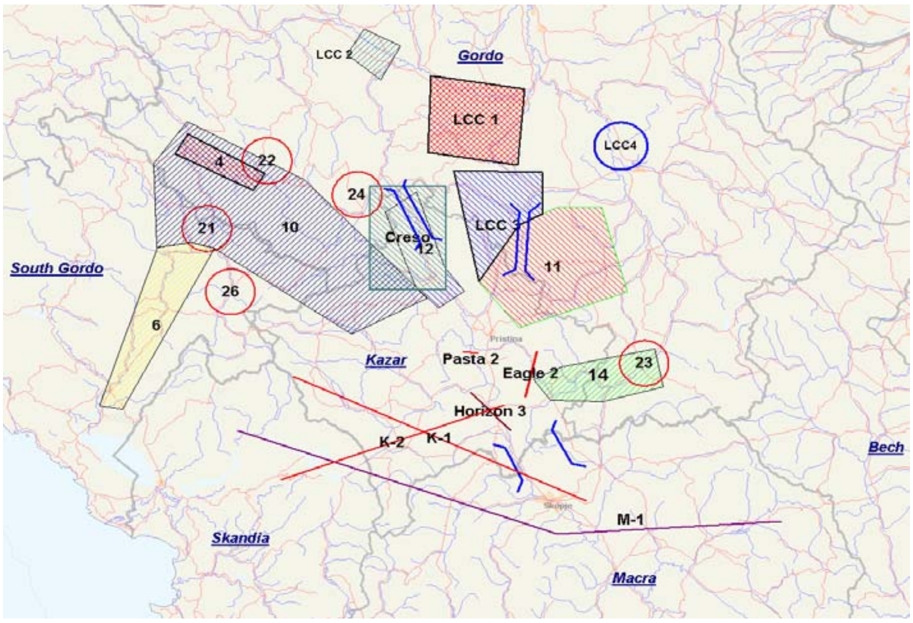

Figure 3.
ISR Asset Orbit and Collection Areas Overlaid on Geographic data

During the CAESAR SIMEX, the collection-tasking format was combined with a geographical underlay providing a visualization of both ISR system orbits and their associated collection requirements (see Figure 3). Using this tool, the TCM and other ISR team members were able to visualize the AOR and dynamically task ISR systems to pick up collection tasks when one or more systems fell out of the network. One drawback to this capability was the lack of real time information on the location and status of the ISR sensor platform. If for example, the JSTARS left station to refuel or was in the wrong part of its orbit to cover a dynamic task, the TCM may erroneously direct a dynamic task that could not be immediately filled.

Planning for the Unplanned

Predictive Battlespace Awareness (PBA)

A key-planning component to the war fighter's success is Predictive Battlespace Awareness (PBA). PBA requires in-depth study of an adversary well before hostilities begin. The TCM uses PBA to anticipate the adversary's actions to the maximum extent possible. This allows the TCM to utilize critical ISR assets for confirmation rather than pure discovery once hostilities begin [Roche and Jumper 2003]. According to General John Jumper, Chief of Staff USAF, PBA is a concept that draws upon the integration of target systems analysis, intelligence preparation of the battlespace, ISR strategy, planning, and execution. PBA enables the commander to conduct pre-emptive operations, seize and maintain the initiative, and influence enemy actions to achieve desired effects. PBA should be taken into account during the CCIRM process in order to achieve an effective collection task. Use of PBA is also important in contingency planning for ISR tasking. Prediction of opposing force dispositions allows planning for ISR system losses should they occur.

Contingency Planning for ISR Collection Tasks

The ISR collection task format does not provide contingency planning in the advent of an unplanned system departure from the network. During the exercise, evaluators noted the loss of coverage for specific collection requirements when systems dropped off line unexpectedly. This forced the TCM and staff to review priorities and reallocate systems quickly to meet command collection requirements. This required a great deal of coordination using voice and free text message between ISR systems that were required to pick up the lost system's planned collection requirements. This in turn provided opportunities for confusion between the TCM and the ISR LO as well as sensor system operators. Further, because these dynamic tasks were not planned, the TCM was required to work through priorities and placement issues that are normally completed during the CCIRM process.

In order to reduce coordination for dynamic tasking, an ISR tasking matrix was developed to ensure that each collection requirement was covered by at least two sensors whenever possible. This enabled the TCM to shift priorities immediately as the systems had already pre-planned the new requirements and were aware of their responsibilities. This matrix further allowed the TCM to prepare contingency plans for ISR system losses thereby reducing the amount of ad-hoc collection planning required to fulfil the collection requirements. The graphical display in figure 4 illustrates the responsibilities of multiple ISR systems for specific collection requirements operating in support of CAESAR SIMEX.

Sensor vs. Exploitation Management

Another drawback to the collection task not foreseen was the role of the exploitation station in the successful completion of the commander's collection plan. ISR data and information may be exploited by a diverse group of commanders and agencies. Generally, each command and agency has its own inherent analysis capability. Commanders using their analysis capability may use raw and exploited data from ISR systems as well as the exploited data and information from intelligence analysis centres to develop a more current view of the battlefield and opposition dispositions [Ross 2002].

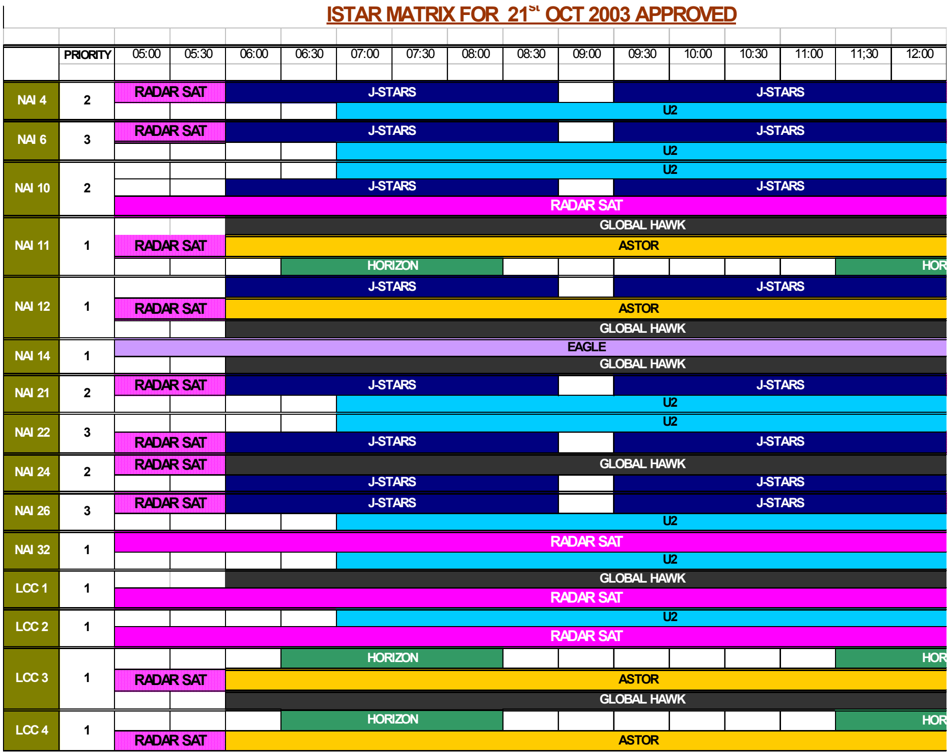

Figure 4
ISR Tasking Matrix

Heretofore, ISR ground stations were treated as a part of a single ISR system. HORIZON data was used exclusively through its integral ground station, U2 imagery through their ground exploitation station and so forth. Any data or information that HORIZON or U2 passed on to other commands was in the form of annotated imagery or textual reports. With the advent of CAESAR, these exploitation and ground stations became network enabled in local and wide area networks. As a result, exploitation stations from several systems may now employ data from multiple sensors to provide detection, tracking, and identification of targets within an AOR.

Further, exploitation stations may be independent of ISR systems. For example, a suitably equipped exploitation station on the CAESAR wide area network may collect and exploit GMTI data and SAR imagery from all AGS&R systems on the network. The exploitation station may also receive imagery from EO/IR systems as well as ELINT or ESM data through broadcast intelligence. As a result, the system may provide identification and targeting for the commander. Because these exploitation stations had up until this time not been tasked independently of the sensor, their capabilities may not have been employed efficiently by the TCM within a coalition.

During the SIMEX, exploitation tasking was initially focused on the sensor. Because exploitation stations were left without tasking, duplication of effort and confusion in tracking and surveillance responsibilities ensued. In order to alleviate this problem, an ISR Exploitation Matrix was created (see Figure 5). This matrix allowed the TCM and other members of the ISR staff to view tasks that had been allocated to exploitation stations within the network. Using this matrix, the TCM was able to dynamically task exploitation stations independent of ISR sensors providing increased capabilities to fulfil the joint commander's collection plan.

	NAI 4	NAI 6	NAI 10	NAI 11	NAI 12	NAI 14	NAI 22	NAI 24	NAI 26	NAI 21	NAI 32	NAI L1	NAI L2	NAI L3	NAI L4	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI	NAI
ASTOR				P	S	S						S	S	P																				
CRESO					BDE																													
HORIZON				S										S			SECONDARY COVERAGE ONLY																	
IES1											P																							
IES2															P																			
JSWS																																		
MTIX	P	S	P						S	S																								
MATREX											S	P	P		S																			
MTOC		P							P																									
N2							P	S		P																								
SAIM						P																												
TMSS	S		S		P		S	P																										
REMARKS	(P)RIMARY / (S)ECONDARY JAC Request -- Location and activity of GORDO's most combat capable units from 1st Corp - 43 Tank BDE/5 Mech/ARTY BDE. 2nd Corp - 34 Tank BDE/ARTY BDE. REPORTING CRITERIA According to collection plan dated 21 Oct 03. TRACKING CRITTERIA If any reporting criteria is met																																	

Figure 5
ISR Exploitation Matrix

Tools for a Rapid Response

Field Marshal Helmut von Moltke stated "No plan survives contact with the enemy." During contingency operations, ISR systems are affected by many factors. The loss of a system for operational or technical reasons, the detection of a time sensitive target and dynamic changes on and over the battlefield may require dramatic changes in ISR tasking and allocation. When this happens, the TCM and staff, the LOs and indeed the sensor operators themselves may be called upon to dynamically shift their operations in a very short period of time. TST operations in particular provide an excellent model for this rapid tasking.

During the SIMEX, the SHAPE TST working group developed and implemented a common reference system for the rapid tasking of ISR systems. In order to reduce coordination and standardization problems, the Common Grid Reference System (CGRS) was adopted by both combat operations for tactical operations and by collection management. This action significantly reduced coordination problems between the ISR system operators and combat forces at the operations centre and in the field.

The LO – The commander's bridge to the system

The LO is the commander's expert for the employment of their system. The commander and staff rely on the LO to ensure their systems are integrated, tasked and employed properly within the AOR. The LO's mission is to coordinate the full range of operations for their specific system.

As a member of the planning team, the LO supports the CJTF and the intelligence/operations staff through the processing of daily collection tasking, de-confliction of collection asset shortfalls and ATO entries and airspace management for airborne systems. The LO will also coordinate operational employment factors including the supported commander's collection priorities, represent asset availability/status at synchronization planning meetings and participate in daily intelligence and targeting working groups as appropriate [CAESAR TTP 2003]. Ideally the LO will be physically present at the allocation meeting. In reality, the limited numbers of LOs and the level at which their systems operate generally dictate the location

During execution the LO will monitor ISR system operations and coordinate airspace and ATO changes as required, monitor accomplishment of system collection and targeting tasks from supported and supporting commanders, and coordinate operational aspects of dynamic tasking of ISR systems. The LO will maintain sufficient familiarity with similar and dissimilar ISR platform capabilities in order to assist in coordinating and resolving issues, such as cross-cueing and system coverage. Throughout the operation, one of the most important functions of the LO is the education of command personnel and their staffs on ISR system capabilities and limitations [CAESAR TTP 2003].

During the CAESAR SIMEX, the importance of the LO was evident in the daily management of the ISR systems through the CCIRM process. The LO provided the TCM with mission timing and location for assigned ISR systems, reviewed collection requirements for applicability to specific systems and recommended mission location and timing changes to meet the commander's objectives. Using the collection requirements and commander's priorities, the LOs assisted the TCM in the development of system specific collection tasks. These collection tasks were then forwarded to their specific ISR system mission crews and exploitation teams prior to system mission planning.

One problem identified during SIMEX employment was that system LOs did not fully use established procedures for system management during the exercise. This was partly due to the need to perform actions very quickly, with the intention of "catching up" later [CAESAR SIMEX 2003].

Individual systems currently provide LO requirements and procedures in accordance with national directives. Standardization of LO requirements could provide a baseline from which all ISR system LOs could operate. The CAESAR project has developed and published a basic set of ISR LO requirements within the CAESAR TTPs.

Advances in ISR Distribution

Intelligence products, including those provided by ISR systems, should be disseminated using all available information communication systems and made available to users in directed dissemination (push) and web-style bulletin boards (pull) systems. Dissemination of intelligence in hard copy should be the exception [AJP-1 2002].

The advent of the Internet and web based services has provided new capabilities for the distribution and exploitation of ISR data and information. Commanders and units previously incapable of receiving and exploitating ISR data may now employ data from these systems as soon as it is available on the web. Employing this new capability can require as little as a networked personal computer (PC) and the tools required to search and collect this data.

The CAESAR project has developed the capability to provide persistent storage and retrieval of AGS&R data on the web using the CAESAR Shared Database (CSD). This database acts as a library for the collection of archived and NRT AGS&R data and information. This data and information is available to commanders and units through the use of a web browser on a secure network. Figure 6 provides an example of the information that is available in the CSD. This data can be used by a commander to realign forces, change targeting priorities and direct new collection requirements for future ISR missions. In the example shown, a German prototype exploitation station has provided tracking data from multiple GMTI sensors on the Internet. Using a web browser coupled with the CSD thin client interface, any PC on the appropriate network could copy and employ this information at will.

While net enabled databases provide an alternate method of ISR data dissemination and exploitation, the ramifications for ISR system management may be significant. Heretofore, only those units directly in contact with the priority commander and the sensor were capable of requesting dynamic collection requirements. The CSD, as a “network enabled” database, allows a wider population of commands and units to receive and employ both exploited and “raw” ISR information. This could result in an unmanageable number of changes routing directly from multiple requesting units to the sensor. For this reason, a clear chain of command and well-defined priorities are essential to the efficient management of ISR systems.

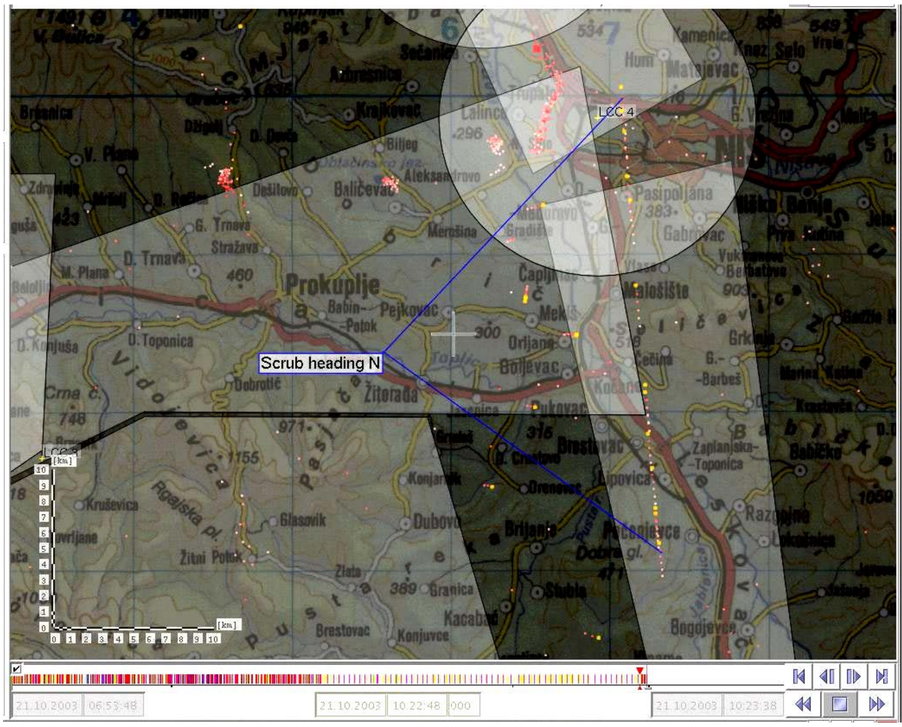

Figure 6
GMTI Data Downloaded from the CAESAR Shared Database

Concurrent Transition – The Way Ahead

The development of integrated and interoperable ISR systems is incomplete without a plan to transition the capabilities into the active force. The CAESAR Project has begun the process of “concurrent transition” through close coordination with NATO Commands and their staffs even as the project concludes. There are two driving factors for this transition strategy. First, the rapid increase in ISR capabilities requires the coalition to adopt a proactive concept in system integration. Second, the CAESAR project ensures that its Concept of Employment and TTP documents are in line with current NATO directives and procedures through participation in the development of NATO command level directives and regulations. These directives and regulations include those covering ISR operations (e.g. BI-SC Directive 65-5 Collection Management), testing of developmental capabilities and procedures during live and simulated exercises (e.g. ISR management during Strong Resolve 2002), and the validation of system capabilities in operational environments (e.g. Link 16 operational testing during the JTIDS Operators Tactics Meet [JOTM] 2004). Figure 7 details transition efforts by CAESAR within NATO to ensure the proper integration of this integrated ISR capability.

Figure 7
CAESAR-NATO Transition

The publication of CAESAR operational documents for the employment of these systems (e.g. CAESAR TTPs) as well as technical recommendations and findings from the CAESAR Project will be continue to be forwarded to appropriate national and coalition commands and agencies for evaluation and integration into current and future systems and directives. Further, CAESAR project results are already being used in the development and implementation of ISR exploitation capabilities for national systems for use in the coalition environment.

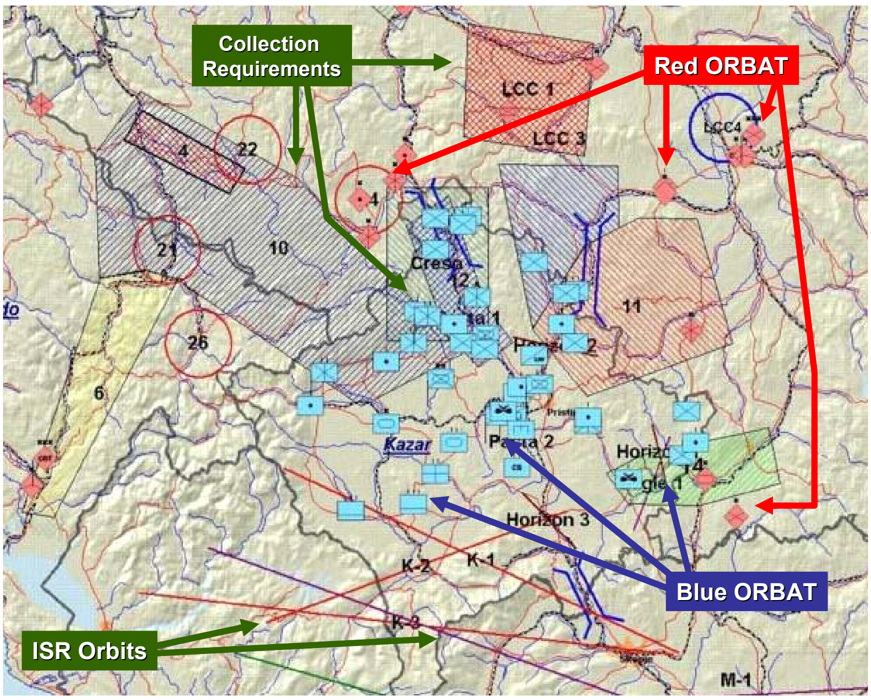

Figure 8
NORCCIS II Integration of CAESAR Products

During the SIMEX the Norwegian Command and Control Information System II (NORCCIS II) integrated retrieval of data from the CSD and use of the ISR planning tools developed for the exercise. This information was correlated to Link 16 track data and blue/red force tracking information from the intelligence staff to provide a more accurate view of intelligence operations in the common operating picture (COP). Figure 8 illustrates the view provided by NORCCIS II.

In the near future, the Multi-sensor Aerospace Joint Interoperable ISR Coalition (MAJIIC) project will build upon CAESAR results, findings and recommendations integrating further ISR capabilities including EO/IR, Streaming Video and ESM. This in turn will integrate a larger number of components and commands leading to more information and increased need for efficient and effective ISR tasking.

Conclusion

Rapid, responsive and accurate ISR data and information is critical to commanders at all levels. However, in order to be effective, the ISR sensors and their associated exploitation network must first be looking in the correct area and for the correct data or information. This is the essential requirement for effective, efficient and accurate tasking of the systems. The TCM, the LO and the supported commander must first, provide correct planning and second, prepare contingency plans for the changes that are inevitable in conflict. Given the proper planning, the scenario referenced in the introduction should continue as follows:

The TCM, having been notified of the dynamic request for ISR information in the vicinity of the village, reviews current capabilities and available information. It is determined that JSTARS GMTI from the past eight hours will be used to detect likely vehicle movement into the village. JSTARS will further be tasked to provide SAR imagery of the industrial area to the south of the village every 15 minutes leading up to and immediately after the air strike. Movement of the JSTARS orbit will not be necessary as it is already providing surveillance for the target area. The additional SAR imagery tasking will be handled in due course with no degradation to planned JSTARS collection tasks.

The Phoenix will provide EO/IR surveillance of potential targets that have been detected by JSTARS. To accomplish this task, the Phoenix will be required to move to a new working area. As a result, Phoenix collection tasks will go unfulfilled leaving the coalition without imagery for the assault on the bridge. To remedy this situation, the TCM has already planned for an RQ-4 Global Hawk operating in the area to extend its orbit 20 miles east in order to pick up the Phoenix's planned collection tasks. As a result, the 39th Regiment RA Commander completes the fire support mission on the bridge as planned while the SCUD missile battery, having been first been detected by JSTARS, then identified by Phoenix, is neutralized by the Dutch F-16 strike mission.

The interaction described in the above scenario is available as a real capability. Through the current CAESAR and future MAJIIC projects, the technical integration of coalition ISR systems is a reality for the commander today. It is now up to the commanders and their staffs to devise the proper operational methods in which it can be employed.

Proper tasking, both planned and dynamic, is the critical first step to successful ISR operations. In order to be effective, continued development of interoperable and integrated systems must be based on operational processes. This requires a partnership between the end user (National and Coalition Commands) and the agencies charged with the development of these programs. Without this partnership, the scenario above could have ended with quite the opposite result. If multiple commanders fight to retain or take control of ISR assets, both planned and time sensitive missions will be left without their “eyes and ears”.

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Biography

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