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COALITION INTEROPERABLE ISTAR SYSTEM CONCEPT OF EMPLOYMENT

MAJIIC Operations Working Group (OWG)

Reference Document CCSD-MAJIIC

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THE COALITION INTEROPERABLE ISTAR SYSTEM CONCEPT OF EMPLOYMENT
WORKING PAPER VERSION 1.0

MAJIIC Operations Working Group (OWG)

Command and Control Systems

Abstract

This document represents the current Concept of Employment (CONEMP) coaltion interoperable intelligence, surveillance, target acquisition and reconnaissance (ISTAR) system. It provides information for commanders and their staffs on the operational employment of participating network enabled ISTAR systems during coalition operations.

The work described in this report was carried out under the provisions of the MAJIIC project Technical Arrangement.

This document is a working paper that may not be cited as representing formally approved NC3A opinions, conclusions or recommendations.

NATO Consultation, Command and Control Agency
The Hague
July 2007

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of **iv** + **28** pages
(excluding covers)

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SUMMARY

The MAJIIC project is dedicated to developing coalition capabilities for the interoperability and integration of intelligence, surveillance, target acquisition and reconnaissance (ISTAR) systems within a network enabled environment. The ISTAR products considered under the auspices of the MAJIIC project include Ground Moving Target Indicator (GMTI) data, Synthetic Aperture Radar (SAR) and Electro-Optical/Thermal Imaging (EO/TI) imagery/motion imagery, weapon locating information, Electronic Warfare Support Measures (ESM) and various exploited products derived from the aforementioned ISTAR data. Of note: this data, imagery and information may include products from other traditional and non-traditional ISTAR systems, that are present both within and outside of the ISTAR network. This data, imagery and information may be provided as streaming video, still imagery, tactical data link, metadata and in textual format. Further, ISTAR data and information will be available to supported and supporting commanders in near real time (NRT) and/or archived for up to 96 hours. A concept of employment for the collaborative employment of multinational ISTAR systems is published separately under the MAJIIC project.

The ISTAR capabilities considered in this tactics, techniques and procedures (TTP) document include the ground, maritime and aerospace platforms that collect the aforementioned data and information products, and the related capabilities required for the processing and dissemination of the resulting ISTAR products. These related capabilities include those directly and indirectly associated with the management and exploitation of ISTAR system products as well as systems that benefit from the collection, exploitation and dissemination of ISTAR products within a network enabled environment.

The ISTAR systems described in this CONEMP are envisaged as offering support to multinational coalition operations such as those undertaken by the North Atlantic Treaty Organization (NATO) in situations ranging from Article V Operations to peace support operations.

1. INTRODUCTION

Commanders are faced with a variety of missions and operations ranging from low to high intensity situations at the tactical and operational levels. To operate effectively, commanders at all levels must see first and understand the battlespace in order to act quickly and decisively. The requirement for timeliness of information to plan and conduct these operations can vary from near-real-time (NRT) to several hours or days depending upon the level of command, type of unit, and the nature of the situation and operation. However, the acceptable time lag between collection of information and its exploitation has continued to shorten as operational tempo increases.

Coalition operations in the former Republic of Yugoslavia, particularly Kosovo, highlighted operational and technical interoperability difficulties in achieving timely dissemination and effective exploitation of ISTAR data. Based on the findings from these operations, seven nations, Canada, France, Germany, Italy, Netherlands, Norway, Spain, the United Kingdom and the United States of America together with the NATO Consultation, Command and Control Agency (NC3A) as technical manager, agreed to work together under Project Multisensor Aerospace ground Joint Interoperable ISR Coalition (MAJIIC) to maximize the military utility of each national ISTAR assets.

ISTAR assets provide surveillance and imagery of the battlespace employing multiple methods. These include radar surveillance and imagery (GMTI data and SAR imagery), electro-optical and thermal imagery (EO/TI) motion imagery, weapon locating infromation and electronic support measures (ESM). ISTAR systems may provide wide area surveillance via Radar and ESM systems or point surveillance via EO/TI and SAR) systems. ISTAR collection requirements include but are not limited to adversary, friendly and nuetral force disposition and movement, fixed objects and the electronic spectrum associated with land, maritime and aerospace forces. Of note: for the purpose of these concepts of employment (CONEMP), the term “ground” refers to the earth’s surface, including land, inland and littoral waterways, and the airspace immediately above the ground (generally below 1000 feet above ground level (AGL)).

ISTAR system data, imagery and information are often a critical component in the successful detection, identification and engagement of adversary forces throughout the AOR, and as a consequence they are generally classified as high demand/low density (HD/LD) assets. This is especially true in support of time sensitive operations against emerging targets. As HD/LD assets, ISTAR system requirements generally exceed the number of systems available to any given commander. In order to achieve optimum results from these HD/LD systems, it is essential that the data, imagery and information gathered and exploited by them is effectively and efficiently disseminated and exploited by all coalition supported and supporting commanders.

This document describes a network enabled ISTAR system of multiple aerospace ground surveillance and reconnaissance (AGS&R) systems, ground based sensors, ground based exploitation systems and associated command and control information systems (C2IS) integrated with national collection, management, exploitation capabilities and systems that benefit from the employment of both pre-exploited (raw) and exploited system data, imagery and information.

The ISTAR system provides optimal support to commanders by supplying information on adversary, friendly and neutral forces as well as the environment in which operations are to be

conducted. Elements of the network enabled ISTAR system include the sensor platforms (i.e. satellites, fixed and rotary wing, manned and unmanned aircraft, ground and sea based sensors), their associated ground and exploitation workstations as well as network enabled remote workstations and C2IS that are not directly associated with an ISTAR system or sensor.

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2. SCOPE

This CONEMP provides commanders and their staffs with information on network enabled ISTAR system implementation and operational employment in coalition operations. This includes guidance on maximizing the utility and complementary use of the various national radar assets involved. Commander's benefit from enhanced SA as a result of a network enabled ability to receive, share, exploit, archive and disseminate information within a coalition of nations which adopt the protocols and structures established to form the ISTAR System. This facilitates the creation and sharing of common ground surveillance data and exploited information and other intelligence among the various echelons of command.

This CONEMP focuses on the combined efforts of the nine MAJIIC coalition nations and their ISTAR and C2IS systems. These systems include the following assets (in alphabetical order) from the nine MAJIIC nations and the NATO surveillance and reconnaissance communities:

- Airborne Stand-off Radar system (ASTOR) (UK)
- Artillery Hunting Radar (ARTHUR) (NO)
- Coyote (CA)
- Distributed Common Ground Station (US)
- Exploitation Station Test Bed (ESTB) (UK)
- Hunter Unmanned Aircraft System (UAS) (US)
- Global Hawk unmanned aerial vehicle (UAV) (US)
- Hélicoptère d'Observation Radar et d'Investigation sur Zone (HORIZON) (FR)
- Italian Common Ground Station (ICGS) (IT)
- Interoperable Imagery Exploitation System (IIES) (GE)
- Integrated Staff Information System (ISIS) C2 Information System (NL)
- Italian Sensor Simulation (ISS) (IT)
- Joint Surveillance Target Attack Radar System (JSTARS) (US)
- JSTARS transportable mission support system (TMSS) (US)
- LUNA Tactical UAV (TUAV) system (GE)
- Maritime Command and Control Information System (MCCIS) (IT)
- Kongsberg Exploitation System (KES) (NO)
- Land Forces Command, Control and Information system (LFC2IS) (CA)
- Luftgestützte Unbemannte Nahaufklärungs Ausstattung (LUNA) (GE)
- Norwegian Command and Control Information System (NORCCIS) (NO)
- Predator medium altitude long endurance (MALE) UAV system (US)
- RADARSAT II (CA)
- SPERWER TUAVsystem (NL/CA)
- Shadow Unmanned Aircraft System (UAS) (US)
- Système d'Aide a l'Interprétation Multi-capteur (SAIM) (FR)
- Système Intérimaire de Drone Male (SIDM) (FR)
- U2 advanced synthetic aperture radar system (ASARS-2) (US)
- Watchkeeper TUAVsystem (UK)
- SAR and GMTI Workstation (SGW) (SP)
- NATO Airborne Early Warning and Control (NAEW&C) (NATO)

(Full details are at Appendix F to the associated tactics, techniques and procedures [TTP]).

This document is complements current and future Coalition Interoperable ISTAR Tactics Techniques and Procedures (TTPs) and the system architecture design principles (SADP)as developed, evaluated and published by the MAJIIC project and its participants.

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3. OBJECTIVES

The objectives of this document are to provide:

- A CONEMP for commanders and their staff involved in the planning, tasking and exploitation of network enabled ISTAR system.
- A high level description of planning and employment considerations for staff directly involved in the co-ordination of interoperable coaltion ISTAR systems (platforms, sensors and exploitation stations).

A foundation for coalition tasking, collection, exploitation and sharing of ISTAR data, imagery and information in support of the full range of information requirements management (IRM), intelligence preparation of the battlespace (IPB) and a the provision of SA and targeting processes over the full spectrum of operations.

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4. THE NETWORK ENABLED ISTAR SYSTEM CHARACTERISTICS

4.1 THE SYSTEM DESCRIPTION

The interoperable and integrated ISTAR system assets can be characterised by the automated (i.e. network enabled) tasking, collection, processing, exploitation and dissemination of ISTAR pre-exploited (raw) and exploited, data, imagery and information. Processing and exploitation may occur on board the platform or at GS. The integrated System, as described herein is not a physical system; it consists of the protocols needed to integrate multiple national and NATO ISTAR systems so that their effectiveness is optimised. These include the operational concepts, architecture and interoperability framework, key interfaces and formats needed to support coalition operations. Integration is achieved at the ground station (GS) level using existing communications and thus does not require nations to adhere to common platform-to-GS data-link standards. Interoperability is achieved by the implementation of a common data format that enables the transmission of ISTAR data throughout the network.

The integrted ISTAR system further includes the capability to store and share ISTAR data, imagery and information which adheres to established technical and operational standards. These standards are based first on NATO accepted formats and procedures. When NATO direction is not available, employment of NATO releasable national standards and procedures will be used. In the event that neither NATO nor releasable national standards and procedures are available, the MAJIIC project will create new standards and procedures and will provide detailed accounting of such to appropriate commands, agencies, working groups in order to facilitate adoption NATO wide. The data and information may be distributed amongst national GS or archived on central servers. The System configuration will be highly dependent on the operational situation in which coalition ISTAR assets will be employed and needs to be tailored to suit specific coalition structures and requirements. Figure 1 illustrates the concept of integrating national ISTAR assets into network enabled ISTAR system.

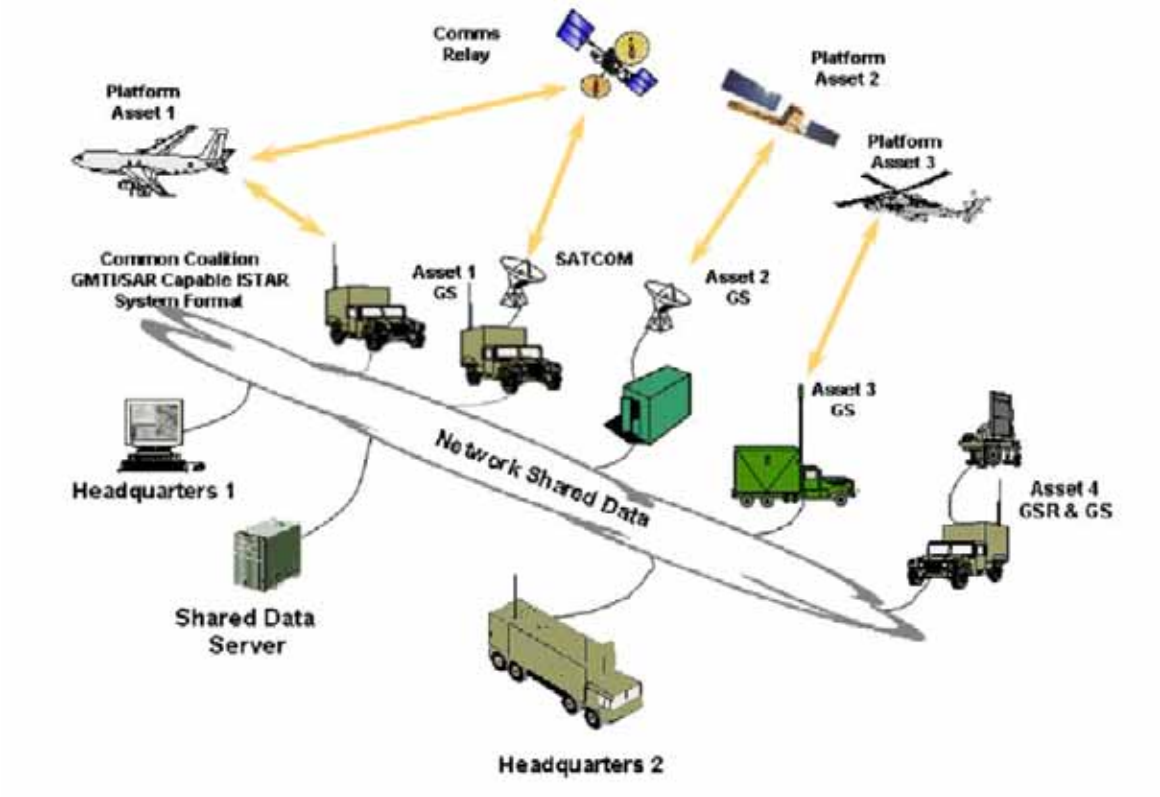

Figure 1 Concept of integration the GMTI/SAR-capable ISTAR system

4.2 THE SYSTEM COVERAGE

The types of national ISTAR assets that might support coalition commanders and the areas they typically cover during military operations are illustrated in the Figure 2 below:

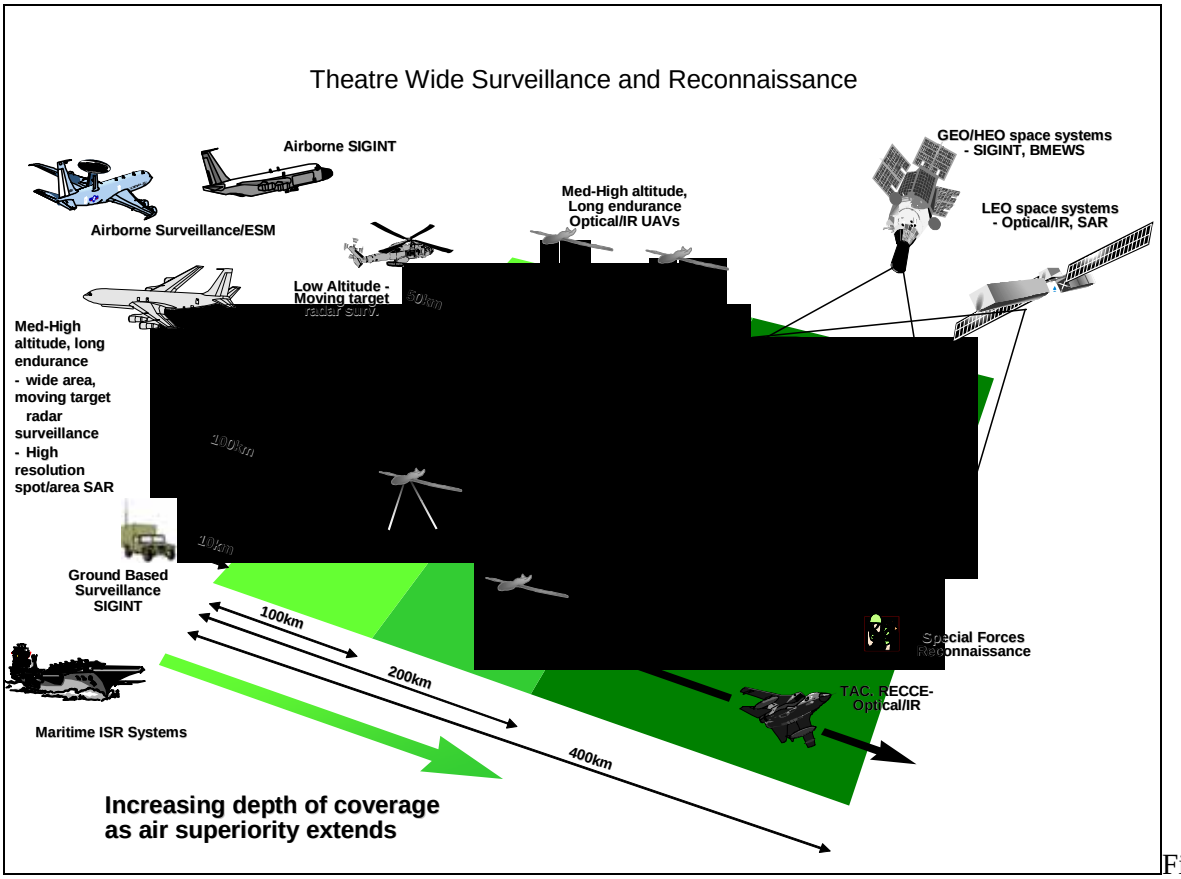

Figure 2 Selected radar sensor notional coverages within the system

4.3 CHARACTERISTICS OF THE SYSTEM

4.3.1 GMTI

GMTI is able to provide detection, location and tracking of moving vehicles and relatively slow moving, low flying air vehicles such as helicopters. Some national radar assets also provide classification of vehicles into tracked, wheeled and helicopter categories. Wide area coverage can be achieved at moderate refresh rates, whilst higher rates can be achieved over smaller areas to facilitate detailed tracking, particularly for targeting. GMTI is capable of supporting IPB, indication and warning (I&W) of preparations for combat by military forces, attack and battle damage assessment (BDA). It can also reveal the movement of refugees using motor vehicles, their rate of movement, and gathering points. Groups of people moving on foot are not likely to be detected by aerospace assets, but many GSRs can detect moving personnel.

4.3.2 SAR

The SAR imaging technique generates a photograph-like image of the surface which will include static or stationary objects which appear as if they were imaged from overhead. Discrete moving objects, such as individual vehicles are, in general, not detectable by current airborne systems. However, techniques are available to some national assets which do enable moving targets to be detected and correctly located. Large areas can be covered at moderate resolution, called “swath” mode, whilst higher resolution, in some cases sufficient for Recognition of targets, can be achieved over small areas, called “spot” mode.

4.3.3 Electro Optical (EO)

Electro-optic imaging systems operate in the visual range of the electromagnetic spectrum and are able to capture black and white or coloured still images and video of its environment. The sensors employed comprise of a lens system that focuses light on to photosensitive electronic devices, such as charge couple deveices (CCD) or Complementary-symmetry/metal-oxide semiconductor (CMOS) sensors. The resulting image or video produced will be contained in an electronic geo-referenced file that can be electronically viewed and exploited on a ground or exploitation workstation. The resolution of the sensor system is dependent on a number of factors, such as the distance from the object under investigation, amount of available light, optical resolution of the lens, resolution of the photosensitive electronic sensor, etc., and will determine whether an imagery analyst can identify and recognise objects and activities under investigation.

4.3.4 Thermal Imaging (includes Infrared) (TI/IR)

Infrared thermography is the technique that uses an infrared imaging and measurement camera to see and measure invisible infrared energy being emitted from an object. Thermal, or infrared energy, is energy is not visible to the naked eye because its wavelength is too long. It is the part of the electromagnetic spectrum that we perceive as heat. Unlike visible light, in the infrared spectrum, everything with a temperature above absolute zero emits infrared electromagnetic energy. Even cold objects, such as ice cubes, emit infrared radiation, but depends on the environmental conditions. The higher the temperature of the object, the greater the infrared radiation emitted. The infrared sensor can detect infrared energy and converts this invisible infrared energy into a two-dimensional visual image. What the image shows are the hot and cold areas that are contrasted in different colours or shades of grey. In order to identify objects of interest, the objects must possess a temperature differential to its environment, otherwise the collected image does not provide the thermal imagery analyst enough image contrast to detect, identify and recognise the objects under observation.

4.3.5 Electronic Support Measures (ESM) and Electronic intelligence (ELINT)

There are significant differences between electronic intelligence (ELINT) and electronic support measures capable systems. While both systems receive, process and report data based on various electronic emissions, only ELINT systems are specifically designed to detect, classify, and identify threat systems within the electronic order of battle (EOB). ESM systems are most often used for threat warning and are not designed to provide the data and information required for ELINT operations. Operators using ESM data and information must be aware of the limitations of this data and information when employing it for operations that require a high degree of accuracy such as targeting. ESM systems may however, support IPB and I&W for commanders providing opportunities for cueing of other more accurate ISTAR systems.

4.3.6 Cueing and cross-cueing of other assets

The System can be cued and cross-cued with other ISTAR assets to provide a more accurate and complete operational picture. The information generated by radar sensors can be used to cue surveillance and reconnaissance assets equipped with other sensors such as EO/IR imagery and ESM assets. These assets can provide identification – quality information, thus complementing network enabled ISTAR system capability and meeting the requirements of strict rules of engagement (RoE). An example of cross-cueing is given in Figure 3.

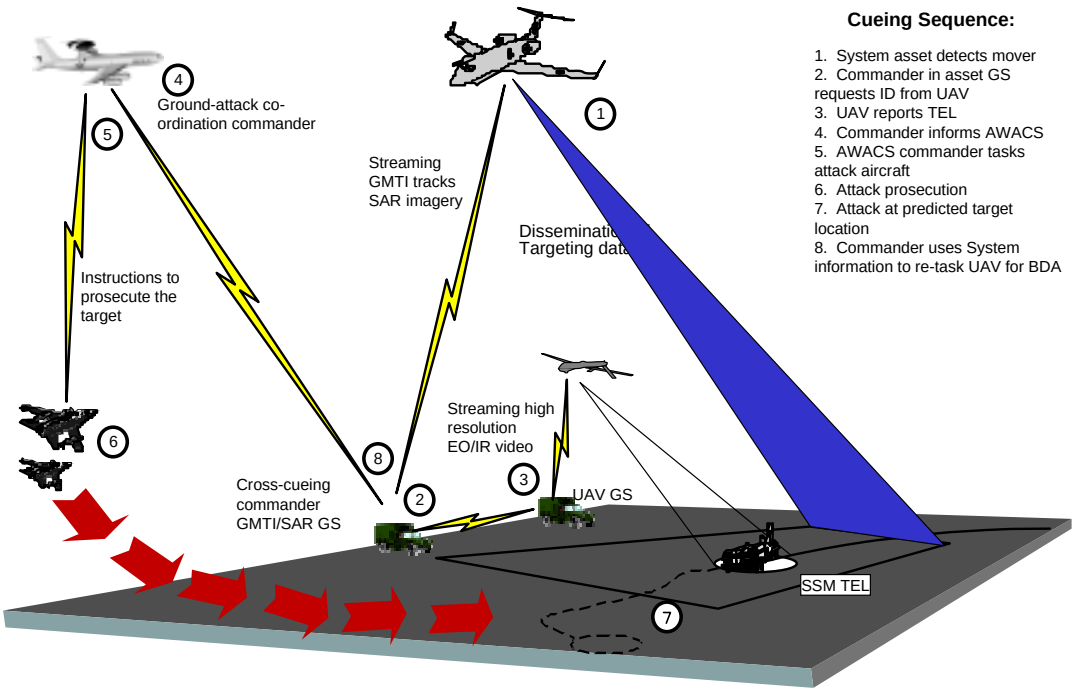

Figure 3 Illustration of cross-cueing in support of time sensitive targeting (TST)

4.4 THE BENEFITS PROVIDED BY THE SYSTEM

The System enables the output of all neotwork enabled ISTAR assets to be viewed and analysed by all exploitation workstations within the coalition. By so doing, the following can be achieved:

4.4.1 Sharing of data

By sharing data in NRT, the following can be provided:

- Redundancy; any GS or exploitation workstation could take over the mission from any other.
- Improved efficiency: any GS could be tasked to carry out exploitation irrespective of the area of coverage of its associated national AGS&R asset.
- Work sharing federated exploitation can be achieved by co-opting exploitation assets to meet higher workloads as they develop.

4.4.2 Access to shared data and information

By archiving data on a distributed database, GS can retrieve all historical data and thus ensure the:

- Provision of background information when a GS comes into action.
- Ability to complete data if a GS undergoes intermittent outage.
- Ability to access relevant data, for example an image chip from a SAR data-set for enhancing exploitation (e.g. change detection).

4.4.3 Integration of assets

By integration of multiple national ISTAR assets the following can be provided:

- Improved asset allocation and tasking.

- Enhanced exploitation of specific sensor capabilities; (e.g. assets which provide the best MTI can be complemented by those which can provide the best SAR imagery).
- Reduced loss of coverage when, for example, operations is suspended during platform manoeuvres to meet operational requirements such as orbit restraints.
- Ability to minimise area screening due to terrain masking by use of different observation angles.
- Ability to leverage ISTAR assets across components and at all levels heretofore unavailable to operational commanders

4.4.4 Exploitation of multiple asset outputs

By the ability to display multiple asset data, the following can be achieved:

- Improved quality of the ground picture leading to enhanced SA.
- Improved ground tracking
- Aids to identification
- Cross cueing
- Enhanced exploitation by reduction in false alarms.

4.4.5 Assistance to collection management

- Development of the capability of priority commanders to task their allocated ISTAR assets.

The System includes collection management tools which enhance the employment of ISTAR assets, both pre-planned and ad hoc.

5. EMPLOYMENT

5.1 COMMAND RELATIONSHIP

The command structure for planning, tasking and employment of ISTAR assets must be defined. Coalition staffs prioritise, co-ordinate and task employment of AGS&R radar resources in accordance with the overall process, function, and operational priorities laid down in the existing joint forces commander/combined joint forces command (JFC/CJFC) joint co-ordination order (JCO).

5.2 COLLECTION MANAGEMENT PROCESS

The collection mangement process at its origin is based upon campaign objectives and the targeting cycle, and is guided by command regulations and directives. The six elements in the collection management process include requirements development, collection plan development, collection tasking, dissemination, evaluation of reporting and update of the collection plan.

The effective employment of the ISTAR system is dependent upon effective, co-ordinated planning and exploitation, which must be integrated into the coalition command and control structure and in accordance with the applicable headquarters' collection and targeting processes. This ensures that the cohesive employment and tasking of network enabled ISTAR system will be flexible enough to enable the optimal employment of ISTAR assets within a coalition while maintaining the coverage and priorities specified to meet the Commanders' requirements. An illustration of collection, coordination and intelligence requirements management (CCIRM) process within the context of employing ISTAR assets is shown at Figure 4. (Red triangles indicate where the system interacts).

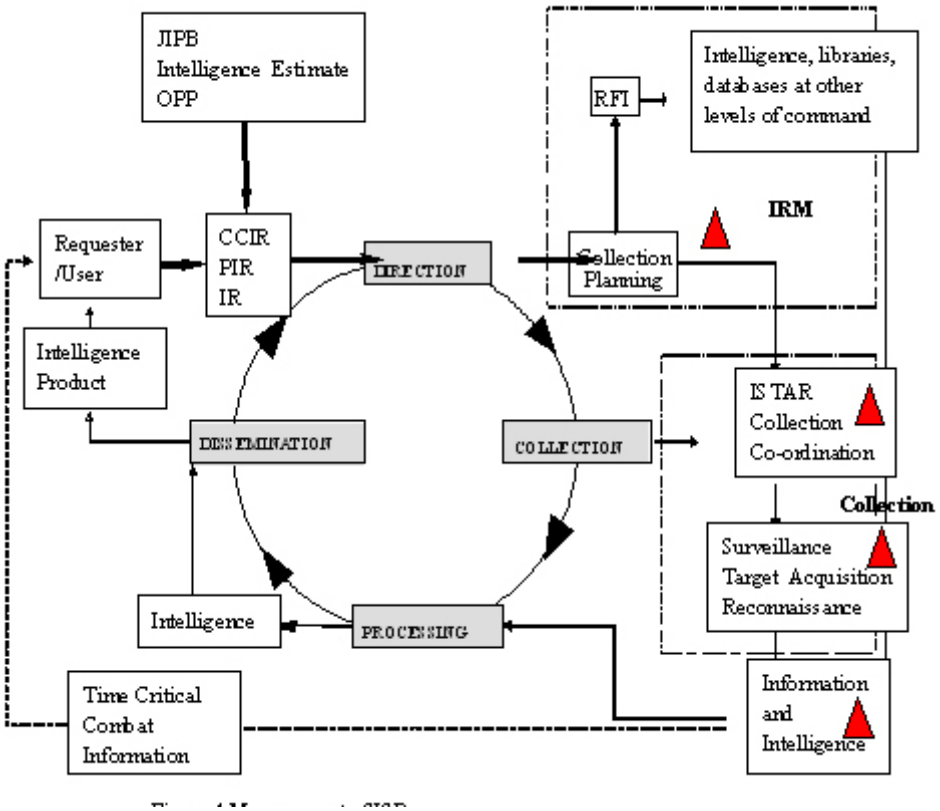

Figure 4 Management of ISR

Relationships between specified sensor platforms and GS will depend upon the command relationship under which national assets are assigned to the coalition commands. For the purpose of this CONEMP it is assumed that the commander of a coalition joint force will have operational control/tactical command (OPCON/TACOM) over some assets, while nations can retain operational command (OPCOM) over some others. The ISTAR management function is provided by the appropriate command level CCIRM and will be augmented and assisted by individual national AGS&R radar asset liaison officers (LO) as available. Together they develop the collection requirements for allocated assets. The key role of the LO is to assist in ISR management by providing the understanding and detailed advice of the capabilities and limitations of national assets and by providing knowledge of the wider coalition System. The communication staffs use the existing communication structure to meet the needs of the system.

5.3 THE SYSTEM TASKING SEQUENCE

The optimal employment of network enabled ISTAR system is dependent upon effective and realistic tasking and asset management. Personnel and staffs responsible for tasking national assets must be fully aware of each national AGS&R radar asset's unique capabilities and limitations. The employment and tasking of these assets must be flexible enough to ensure rapid re-tasking of elements of the system so that products can be made available to commanders as required. The focus of the system is to provide the right information, to the right people, at the right time.

The command intelligence staff, together with national ISTAR asset LOs, determine the most suitable means of meeting the commanders' information requirements based on CCIRs and

developed collection plans. Once tasked, the allocated assets execute the collection, exploitation and dissemination of the required data and information. The System enables separate tasking of exploitation assets, such as GS, and the sensors, thus optimising the capability of individual national assets. Co-ordination of the airborne assets within the system takes place as part of the air tasking cycle.

5.4 DYNAMIC TASKING

Dynamic tasking is the tasking that occurs outside of the pre-planned tasking process as defined by the approved CXP or target deck and must be accomplished within the current ATO cycle. This tasking denotes an air centric view. However, as the ATO cycle mirrors the collection cycle and since the assets most easily retasked are generally found in the air component, it is reasonable to work in parallel with the ATO cycle for planning purposes

5.4.1 Categories of dynamic tasking

Dynamic tasking of ISTAR assets generally fit into two categories: changes to platform location and time on station, and change of the platform surveillance area.

5.4.1.1 Platform, space and time

This first category of tasking requires movement of the platform in space or time to support an updated objective. This requires a change in mission, as the system's original collection tasking must be pre-empted to meet the new tasking. During execution, any changes in coverage area, station times or radar priorities which require changes in the ISTAR sensor platform's orbit/working area must be coordinated with the current operations cell of the 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 ISTAR system (aircrew and/or ground station operator) to ensure that the new tasking is both feasible and within the bounds of supportable risk management.

5.4.1.2 Platform surveillance area

The second category of tasking requires refocusing the sensor's priorities to support new or modified objectives or users. These changes may or may not pre-empt the system's original collection tasking. If the system is capable of providing the added collection with available resources, the supported commander will not experience degradation in support.

Supported commanders or units may make sensor service requests (SSR) through direct communication with the ISTAR platform or with the ground station operator as authorized by the supported commander. SSR requested by agencies and commands outside of the C/JTF command architecture (e.g. Joint Analysis Centre) may be supported in accordance with commander established procedures and priorities. ISTAR system operators (airborne and ground based) are generally the focus for dynamic tasking and the submission of dynamic requests.

5.5 DE-CONFLICTION

Conflicts in employment priorities for ISTAR resources should be resolved according to the following guidelines. In general, de-confliction will be attempted at the lowest level of authority (e.g. the ISTAR mission commander or operator). If the mission commander/operator is unable to resolve conflicts involving changes in mission tasking or priority, the supported commander's higher headquarters (e.g. CAOC or Land Headquarters) will be consulted for adjudication and resolution.

During mission execution, supported commanders may require changes in their organic and/or assigned ISTAR mission tasking for operational reasons. Components with multiple ground stations (multiple supported commanders/units) should designate both master and secondary units/ground stations to filter dynamic sensor service requests (SSRs) and ad-hoc collection requirements for ISTAR support outside of the collection management cycle. This is done to avoid the possibility of over-tasking and confusion caused by the support of multiple users, as well as for the practical advantages in filtering requests at the applicable level of command.

6. OPERATIONS

6.1 OVERVIEW

This section illustrates how the system can be employed across a wide range of situations to support multiple commanders, for example crisis response and NATO Article V operations, and phases within these situations, such as crisis prevention, conflict and conflict resolution. It does not provide details on the use of any single national AGS&R radar asset. Full details of the national capabilities can be found in Appendix D of the TTPs.

6.2 CONTRIBUTION OF NETWORK ENABLED ISTAR SYSTEM IN OPERATIONS

6.2.1 Potential conflict operations (NATO Article V and UN Article VII)

6.2.1.1 Pre-conflict phase

During a crisis prevention phase, at any level of intensity, national assets would contribute to meeting the requirements for information primarily at the strategic and operational levels of command, although some, due to their characteristics, will remain allocated at tactical levels. By so doing, the scale and nature of the build up of all types of forces, including land, air and maritime, can be determined through the employment of ISTAR assets including the system. Surveillance can be carried out at long ranges (potentially global in the case of satellites) and will provide an element of force protection as their presence may suppress the activities of a potential adversary. ISTAR data, imagery and information can be very useful in this initial phase of operations to ensure maps are accurate and to provide the general status of forces. During this phase, by determining concentrations and direction of movement of vehicles and personnel, the system will contribute to IPB. The activities of non-combatant elements can also be monitored. As the crisis deepens and armed conflict appears more likely, the system can increasingly be used to support tactical commands, providing information on the deployment and activity of specific manoeuvre formations and units, associated command, control and communications, and key combat service support elements. Support would also be provided to decision-makers directly involved in preparations to engage surface targets.

Pre-exploited and exploited ISTAR products will provide support to the development of operational and contingency plans. It will provide a capability to retain awareness of the disposition, posture and readiness of the opponent's forces. The System will also provide required geographical information on their area of responsibility (AOR). It can contribute to other information requirements, in addition to those described above relating to intelligence, including IPB, I&W, target intelligence, increased SA and assistance in the creation of the commander's operational picture (includes the Regognized Air Picture [RAP], Recognized Surface Picture [RSP], Common Ground Picture [CGP] and Electronic Order of Battle [EOB]).

6.2.1.2 Conflict phase

During the conflict phase the system would provide NRT and archived ISTAR products and information at the operational and tactical levels of command. The System will provide information to enhance the development of intelligence and hence inform the Commander's decision-making process. Those directly involved in engaging targets may be provided with target acquisition

information in sufficient detail to allow effective cueing of high resolution ISTAR assets, employment of weapons and assist in subsequent BDA and combat assessment.

The System will provide a continuous capability to develop and maintain awareness of the disposition, posture and readiness of the opponent's forces. Furthermore, the area of interest (AOI will be focused on collection requirements derived from Commander's Critical Intelligence Requirments (CCIR), Priority Intelligence Requirements (PIR), Secondary Intelligence Requirements (SIR), Essential Elements of Intelligence (EEI) and Requests for Information (RFI). ISTAR systems supporting their designated AOIs with sufficient timeliness and accuracy to ensure effective engagement by a wide variety of offensive assets. The information provided includes but is not limited to the physical location, activity, size and status of forces and other targets. Such information can also be used to cue SAR imaging or other ISTAR assets in order to support target identification to the degree necessary to meet extant RoEs, and to improve understanding of the nature of static or stationary targets.

6.2.1.3 Post conflict phase

During conflict resolution phase, commanders will require information on the opponent's intentions along with the redeployment activity and status of the opponent's forces. Commanders may also have to address humanitarian and environmental problems which could have arisen from the conflict.

The System may be used to monitor, for example, lines of communication (LOC), assembly areas and airfields. Periodic SAR imaging can also support monitoring of these sites for changes of equipment quantities, reducing the burden on inspection forces. If indications have been received that the opposing parties may attempt to remove equipment, GMTI radar surveillance of these storage sites can be used to monitor movement into and out of the area while EO systems may locate and identify the types of vehicles on the move.

Information derived from the system may be used to provide an indication of humanitarian and environmental problems by monitoring general traffic flow with periodic GMTI radar and EO/TI surveillance of populated areas. Unusual traffic movement could indicate problems that might require military intervention. SAR imagery or other ISTAR assets could be cued to provide further clarification of these observations.

6.2.2 Crisis Response Operations (CRO)

Non-article V Crisis Response Operations range from support operations primarily associated with civil agencies through operations in support of peace1, to Alliance combat operations. In the framework of a NATO-led operation, Alliance forces could additionally conduct extraction operations, and tasks in support of disaster relief and humanitarian operations, search and rescue (SAR) or support to non-combatant evacuation operations (NEOs). Operations that involve the use of military force or the threat of force include military action ranging from sanction and embargo enforcement to military combat operations [AJP-3.4, 2004]. Recent examples of CRO operations include peace keeping (Bosnia) and peace enforcement (Kosovo) to disaster relief (Pakistani Earthquake). Note these operations may also be referred to as Peace Support Operations (PSO). For more details see Coalition Interoperable ISTAR Tactics, Techniques And Procedures (TTP) Version 1.8, July 2007. Basic examples of such operations are given in the table 1 below:

:

Table 1
Examples of ISTAR support to OOTW

No.	Scenario	Summary
1	Defense Against Terrorism (DAT)	NATO identifies four different roles for military operations in support of Defense against Terrorism (DAT). Of note, Force Protection (FP) is an essential consideration in each of the four roles. The 4 roles are: • Anti Terrorism, essentially defensive measures. • Consequence Management, which is dealing with, and reducing, the effects of a terrorist attack once it has taken place. • Counter Terrorism, primarily offensive measures. • Military Co-operation.
2	Search and rescue	Deployed ground troop search parties could use ISTAR applications and facilities to gain more situational awareness and information.
3	Disaster relief	ISTAR can be used to assist the commander to manage information collection and interpret the relevance of information from a large number of external sources. Management of information from external sources and the use of integral sensors to fill information gaps are critical in this type of operation. Interpretation and dissemination of mission critical information would be greatly enhanced by using ISTAR capabilities.
4	International humanitarian assistance	ISTAR could be used to support ISTAR monitoring activity in inaccessible or restricted areas.
5	Surveillance\control of territory and approaches	ISTAR could support ISTAR sensors used to assist civil authorities in monitoring approaches to territory.
6	Peace support/enforcement operations (UN Chapter 6 and 7)	ISTAR would be used by commanders throughout the full range of UN Chapter 6 and 7 operations to monitor a cease-fire agreements and separation of forces.
7	Environmental and Natural Resource Monitoring and Reporting	ISTAR may be used to monitor natural as well as man made environmental hazards and resource management (i.e. dumping of pollutants and illegal fishing within littoral waters). ISTAR products may be used to counter these operations or manage consequences.
8	Border Patrol and Surveillance	ISTAR may be used to monitor and report activity along international borders. ISTAR products may be used to locate routes of entry and individuals, groups and vehicles used in smuggling operations. Further, ISTAR products may be used to locate and rescue individuals and vehicles that have become lost or stalled in dangerous or restricted areas.

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7. SUMMARY

7.1 VALUE OF THE NETWORK ENABLED ISTAR SYSTEM

The System can improve SA by enhancing surveillance and reconnaissance capabilities for the supported and supporting commander. This is achieved by integrating various national ISTAR assets through the development of common communication architectures, standard formats and protocols. The System, established by these means, must be integrated into the coalition command and control structure and the ISTAR process. This will ensure that the employment and tasking of these assets will be flexible enough to meet the commander's objectives

7.2 APPLICABILITY

The System can be employed across a wide range of situations, from OOTW, crisis response operation (CRO) to NATO Article V operations, and through the phases of these situations, such as crisis prevention, conflict, and conflict prevention, supporting multiple commanders at all echelons. During each phase of an operation, the network enabled ISTAR system will contribute to varying degrees to development of operational and contingency plans, development and maintenance of SA, IPB contribution to the COP, targeting development and BDA.

7.3 BENEFITS

Through the employment of network enabled ISTAR system, commanders at all levels will be provided with enhanced intelligence which will enable them to meet their military objectives more effectively, efficiently, and in a timely manner to ensure mission success.

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ABBREVIATIONS

AGS&R	Aerospace ground surveillance and reconnaissance
AIP	Anti-surface warfare improvement program
AOR	Area of responsibility
ASARS-2	U2 advanced synthetic aperture radar system
ASTOR	Airborne stand-off radar
BDA	Battle damage assessment
CAESAR	Coalition Aerial Surveillance and Reconnaissance
CCIR	Commanders Critical Information Requirements
CCIRM	Collection, coordination and intelligence requirements management
CGS	Common ground station
CJFC	Combined joint forces command
CONEMP	Concept of Employment
COP	Common operational picture
CRO	Crisis response operation
DAT	Defense Against Terrorism
EEI	Essential Elements of Information
ELINT	Electronic Intelligence
EO	Electro-optical
ESM	Electronic support measures
GMTI	Ground moving target indicator
GS	Ground stations
GSR	Ground surveillance radar
HORIZON	Hélicoptère d'Observation Radar et d'Investigation sur Zone
I&W	Indication and warning
IIES	Interoperable imagery exploitation system
IPB	Intelligence preparation of the battlespace
IR	Infra-red
IRM	Information requirements management
ISTAR	Intelligence, surveillance, target acquisition and reconnaissance
JCO	Joint co-ordination order
JFC	Joint forces commander
JSTARS	Joint Surveillance Target Attack Radar System
JSWS	Joint services work station
LO	Liaison officer
LOC	Lines of communication
MAS	Multi-asset synchronizer
MAJIIC	Multisensor Aerospace-ground Joint Interoperable ISR Coalition
MATrEx	Motion analysis, tracking and exploitation

MOU	Memorandum of Understanding

ABBREVIATIONS *(continued)*

NATO	North Atlantic Treaty Organization
NC3A	NATO Consultation, Command and Control Agency
NRT	Near-real-time
OOTW	Operations other than war
OPCOM	Operational command
OPCON	Operational control
PA	Project arrangement
PIR	Priority Intelligence Requirements
RADARSAT	Radar satellite
RFI	Request for Information
RoE	Rules of engagement
SA	Situational awareness
SADP	System architecture design principles
SAIM	Système d'Aide a l'Interprétation Multi-capteur
SAR	Synthetic aperture radar
SIR	Secondary Intelligence Requirements
TA	Technical Arrangement
TACOM	Tactical command
TAI	Target areas of interest
TI	Thermal Imaging
TST	Time sensitive targeting
TTP	Tactics, techniques and procedures
UAV	Unmanned aerial vehicle
UN	United Nations

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