Combat-ISTAR; A New Philosophy on the Battle for Information in the Future Operating Environment

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This article is entitled 'Combat ISTAR; a new philosophy on the battle for information in the future operating environment'. The article examines how our ability to maintain the significant contribution that air and space power make to the delivery of intelligence is under threat from the challenges inherent in the future operating environment and the likely fiscal constraints under which the Services must develop and operate joint combat capabilities. Meeting such challenges will require innovative thinking and new concepts that focus on the necessary future force structures, equipment and personnel that can deliver greater synchronicity in the delivery of intelligence and combat effect. Taking a platform agnostic approach, the article considers a range of options of how the development of Combat ISTAR may contribute to the part that air and space power play in supporting the joint force.

Introduction

Studies by the Development, Concepts and Doctrine Centre (DCDC) into the future strategic environment identify important trends for the character of future conflict. The future battlespace will be increasingly *contested, congested, cluttered, connected and constrained* and the battle for information will become increasingly critical to operations.[1] Recent doctrine on the importance of intelligence and understanding to future national decision-making also highlights the need to dominate in the information arena. The UK must, therefore, be prepared to fight for information access and superiority in the battle for ideas and influence that will define tomorrow's operations.[2] This will present significant challenges given the difficulties we face today in meeting the demand for information, even in the relatively permissive environment in which many of our current capabilities and expectations have evolved.

Extensive studies by the MOD Air Staff in support of RAF Strategy development underpinned the DCDC futures work. The studies identified that the more complex future operating environment might necessitate a shift in emphasis, in terms of weight of effort and investment, between the 4 air power roles: Control of the Air and Space; Air Mobility; Intelligence and Situational Awareness (ISA); and Attack.[3] They confirmed the enduring necessity for Control of the Air as an essential pre-requisite for all operations, but highlighted the increasingly critical inter-dependencies between the ISA role and the other air power roles, and the potential for an expansion of doctrinal thinking on space power. The studies also reflected that fiscal constraints and rising technology costs will potentially see a reduction in the number of air platforms available and in the ability to address growing challenges to space access.

Together these issues pointed to a pressing need for a new approach to the delivery of air and space power. This approach must seek a more holistic view on how to integrate and synchronise the contribution that all air and space capabilities make to the ISA role and how to **exploit** more effectively the vital intelligence they provide. Initial consideration of how to proceed focused on adoption of a more platform-agnostic philosophy that looks beyond traditional tenets such as fast jet, dual-role or multi-role aircraft and seeks more innovative solutions spanning the physical and virtual domains. It also reflected the shift away from a predominantly counter force mentality and kinetic targeting towards operations more reliant on greater shared situational awareness and the achievement of decisive effects. In a number of keynote speeches ahead of the Strategic Defence and Security Review (SDSR) the Chief of the Air Staff outlined how the RAF would take forward this new approach under the banner of *Combat-ISTAR*.

This article intends to expose further the thinking behind this new approach to the wider air and space power audience, and the joint community. It examines some of the conceptual ideas being considered in an effort to stimulate debate and challenge perceptions on Combat-ISTAR ahead of the next iteration of the Future Air and Space Operational Concept (FASOC) and

to inform emerging space doctrine.

Air and Space Power – A Vital Contribution to Assured Intelligence

The advantages of being able to **secure, dominate** and **exploit** the high ground has been understood since the dawn of warfare and the elevated vantage point afforded by the advent of air and space power offers a unique ability in this regard. The resulting view *over the hill* and across the electro-magnetic spectrum supports the delivery of intelligence at all command levels. This intelligence acts as a force multiplier, allowing more effective decision-making and the ability to gain the initiative, including at the strategic and operational levels. Examples from history include the contribution made by airborne assets to locating the German V-weapons production and launch facilities during World War II, and the satellite and airborne imagery critical to resolution of the Cuban Missile Crisis. Exploiting the inherent characteristics of air and space power enables rapid sensor coverage of a wide area and, to a certain extent, without the access problems experienced in the surface environments. Air and space sensors can provide concentrated, detailed, multi-band coverage of an area of particular interest, with airborne sensors also able to reposition rapidly from one area of the battlespace to another. British Air Power Doctrine describes how wide-area sensors, such as airborne stand-off radar, can cue higher resolution sensors with narrower fields of view, such as electro-optic reconnaissance pods and even fast jet targeting pods, on to the point of interest; the analogy is *floodlight* to *searchlight to spotlight*.[4]

Traditionally, air and space capabilities support the intelligence process in 2 mission areas; surveillance and reconnaissance.[5] Surveillance is the *continuing and systematic* observation of air, space, surface or sub-surface areas, places, persons or things, by visual, aural, electronic, photographic or other means. Reconnaissance complements surveillance by using visual or other detection methods to obtain *specific information* about the activities and resources of an enemy or potential enemy; it may also secure data concerning the meteorological, hydrographical or geographic characteristics of a particular area. More recent adoption of the term ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) reflects the prominent role that air and space sensors also play in 4 of the 6 steps of the targeting process: *detection; location; identification; decision; execution;* and assessment.[6] ISTAR is defined as:

> *The coordinated acquisition, processing and dissemination of timely, accurate, relevant and assured information and Intelligence which supports the planning and conduct of operations, targeting and the integration of effects…throughout the Spectrum of Conflict.*[7]

Regardless of the sensor or platform involved, the provision of intelligence is the vital contribution to reducing uncertainty in decision-making processes at all levels of command.[8] The increasingly critical nature of air and space ISTAR capabilities to modern operations has once again been highlighted by UK involvement in operations over Libya. But the intelligence gathering conducted during the early stages of the conflict was very different to such activity

in Afghanistan. The latter benefits from a mature ground disposition that allows the fielding of fixed surface intelligence architecture such as masts, aerostats and unmanned ground sensors, allied to a relatively uncontested air environment enabling the forward basing and operation of relatively vulnerable air platforms with line-of-sight data-transfer. In contrast, early operations over Libya required long-range ISTAR platforms capable of operating near or within contested airspace. The Coalition's relative paucity of such assets resulted in a lack of accurate intelligence on Libyan force dispositions, with operational decision-making taking place in a vacuum of situational awareness. As the operation evolved, the UK was one of the few coalition partners able to employ much-needed, wide-area ISTAR capability including E-3D Sentry, Sentinel R1, Nimrod R1 and RAPTOR-equipped Tornado GR4s. Undoubtedly, had the UK retained a Maritime Patrol Aircraft capability or had a contingent Unmanned Air System to provide persistent surveillance, these capabilities would also have been used. Nevertheless, to overcome ISTAR shortfalls in Coalition inventories and provide sufficient weight of effort for intelligence gathering the Coalition was forced to place heavy reliance on US platforms. Given the demand on such US assets and Secretary Gates' recent comments on NATO this reliance could carry increasing risk, particularly given the UK Strategic Defence and Security Review (SDSR) decision to reduce, gap or remove some ISTAR capabilities, with other European NATO partners potentially following suit. This will require radical new thought to address the lessons arising from Libya and to maintain the ability to conduct and support expeditionary operations in the future operating environment. However, it remains to be seen whether innovative thought and concepts such as Combat-ISTAR can gain sufficient traction to influence the difficult decisions that will need to be taken concerning existing procurement plans.

A New Approach: Combat- ISTAR

The need to redefine current thinking on the future delivery of the ISA role is seen as an essential part of an innovative approach to the delivery of effective air and space power effects to the joint force. The increasingly complex nature of warfare and the growing ability of our opponents to contest our ability to **secure** access and **dominate** in the high ground of the air and space will challenge our ability to develop the necessary situational understanding to support joint operations. In the battle for ideas and influence that may mark future operations, information itself will be seen as an emerging area of *combat* in light of adversary challenges to information dominance.[9] The fight for information may itself become the driving rationale for control of the air and potentially space, rather than the ability to secure such control for other offensive activity. Furthermore, the ability to source information in cyberspace will increasingly pervade modern operations and augment other collection methods, placing increasing importance on our ability to **secure, dominate** and **exploit** in this new environment. And we must also recognise and where possible mitigate the vulnerabilities inherent in our dependence on space.

The adoption by the RAF of the Combat-ISTAR approach aims to provide a springboard for such innovation, building on complementary efforts across a number of the MOD's sub-strategies,

including development of the Single Intelligence Environment:

> *Combat ISTAR is the provision of assured Intelligence and Situational Awareness derived from the synergistic employment of networked **air, space** and **cyber** systems in complex and often **contested** operating environments **in tandem with responsive influence effects**.*

Combat-ISTAR is, therefore, seen as a composite effect that aims to provide ISA through the achievement of battle-space dominance across the physical, information and virtual domains, within defined geographical bounds. Air and space power support to joint action will normally be achieved through the simultaneous execution of the ISA role with one or more of the other core air and space power roles synchronised, where necessary, with activities in the other environments. The adoption of a platform-agnostic approach to delivery of the ISA role intends to place precedence on every air and space platform contributing towards delivery of combat effect in the information domain. It also recognises that the ability to deliver effective ISA using air and space capabilities will demand greater emphasis on the rapid processing, fusion and exploitation of information from a wider variety of available sensors, together with an ability to deliver immediate effects.

Combat ISTAR – From Intelligence to Influence

The military aircraft inventory is under increasing financial pressure, an issue compounded by the growing cost of platforms and technology in general. New concepts must, therefore, consider how a smaller number of existing and future platforms will contribute across the spectrum of the air and space power roles. The currently understood limits of materials and engineering techniques suggest that any one platform is unlikely to be able successfully to conduct all 4 of these roles. Combat-ISTAR should, therefore, seek to focus capability development so that **all** air and space platforms can contribute to combat in the information arena while providing other offensive or enabling capabilities. This approach will seek to exploit emerging technological solutions to some of the traditional limitations inherent in air and space sensors.

For air breathing platforms, this approach builds on the continual innovation evident since the advent of aircraft, which began with reconnaissance and then armed reconnaissance platforms. As fighter aircraft developed to counter this threat, further evolutions differentiated between fighter and bomber aircraft, which developed independently in response to their payload, manoeuvrability and range. Later evolutions, particularly in the era of jet-powered aircraft, saw an increasing design focus on multi-role capabilities, combining the roles of fighter, bomber and reconnaissance aircraft wherever possible. More recently, the addition of role-specific equipment to existing platforms has seen a further expansion of their capabilities and roles. This trend is apparent today in the multiple capabilities offered by the Tornado and the Typhoon over Afghanistan and Libya.

It is important to recognise, however, that the trend towards greater role diversity was not

solely the preserve of bomber and fighter aircraft. Larger platforms, including maritime and transport aircraft also made a considerable contribution to offensive and reconnaissance capabilities. Aircraft such as the Shorts Sunderland operating in the maritime environment outside of the short-range fighter threat were not so reliant on securing control of the air; they were therefore able to combine a long range and persistent reconnaissance capability with the ability to carry weapons effective against the U-boat threat in the Atlantic. The utility of long-range Maritime Patrol Aircraft was again demonstrated during the Falklands campaign, where persistent surveillance by Nimrod aircraft deterred the Argentines from using their maritime assets after the sinking of the *Belgrano*. Modern day equivalents include the installation of a range of offensive weaponry on the Hercules C-130 Gunship variants, the addition of a variety of sensors such as WESCAM cameras on the King Air and SIGINT packages and data-link rebroadcast capabilities on tanker and transport aircraft. This role diversity and the increasing trend towards all platforms contributing to the ISA role is the driving factor behind the platform-agnostic approach within the Combat-ISTAR philosophy.

In addition to a focus on the ISA role, Combat-ISTAR will seek to exploit the increasing interdependence between the air power roles in terms of rapid and agile offensive action against fleeting adversaries. As an important element of Joint Fires, air assets operating in the ISA, Attack and Control of the Air roles can operate seamlessly across all elements of the targeting process, **exploiting** the intelligence they gather through the *execution* and *assessment* functions. The synchronicity offered by a single platform conducting all of these discrete functions reduces the friction inherent in handing off tasks between separate assets and offers more effective prosecution of time-sensitive targets. This will be particularly relevant to the *congested* urban and littoral environments of the future where likely targets will be difficult to find, opportunities for prosecution will be fleeting and the risk of collateral damage high. It will also be critical if the future operating environment is being *contested* and platforms must fight to gain and **secure** access to the information required. Such aspirations are already becoming reality, with platforms such as Typhoon offering capabilities in the required 3 air power roles; further exploitation of the synergies offered by this platform is under consideration. Looking to the future, the integrated suite of highly capable sensors on the F35 Lightning II, Joint Combat Aircraft (JCA) and its ability to fuse and distribute information suggests that its introduction to service will offer a physical manifestation of the Combat-ISTAR principles.

However, while future capabilities such as JCA represent the embodiment of Combat-ISTAR, it is important to stress that in a holistic approach to delivery of air power they are not the sole answer to the assured delivery of intelligence or engagement of fleeting targets. Priority must be given to the need for seamless interconnectivity between all other 'sensors' and 'shooters' to enable rapid engagement of any target during the *execution* phase, including joint fires assets operating in the other domains. Indeed, one vision of the future suggests merit in delivering an *effects cloud* that represents the full range of joint fires assets available to a commander. This could potentially allow commanders to select assets, from all environments, including cyber,

resident on the network with the required information, capacity and capability to engage the identified target. As the foundation of the Combat-ISTAR approach, an *every platform a sensor* approach could be compared to a further evolution of the USAF's catchy *every sensor a shooter* strap-line that extends beyond a historic focus on fast-jet platforms. It also serves to refocus efforts on effective delivery of the required outputs; intelligence and influence.

In space too, continuing evolution in orbital delivery systems and satellite capabilities has led to greater exploitation by an increasing number of states and commercial operators. Greater competition in space, together with the resulting increase in *congestion* and *clutter* serves to limit traditional western dominance of this environment. Space is also increasingly being *contested,* as indicated by recent demonstrations of credible anti-satellite capabilities, activity in the cyber domain and through jamming of the electro-magnetic spectrum. The potential for the future weaponisation of space could also have a significant impact on our joint dependence on space capabilities, particularly the ability to **exploit** the high ground for ISA.[10] This aspect should drive a joint requirement for improved space situational awareness, including novel solutions such as the use of small satellites to monitor and even protect more valuable assets. Further, the advent of a new range of hybrid platforms – so called space planes and hyper-velocity glide vehicles - that operate in near space and the air represent a blurring of the boundaries between these environments. They will therefore complicate traditional notions of sovereign airspace and the global common of space. These and other issues will likely feature in the developing National Space Security Policy, which will influence emerging concepts and doctrine, including a proposed Joint Doctrine Note on *Space Support to the Joint Warfighter*.

A Focus on the Product – The Intelligence Cycle Revisited

Combat-ISTAR intends to move beyond the contributions made by individual platforms and sensors to the ISA role and take a more holistic approach to more effective exploitation of the full DIRECT-COLLECT-PROCESS-DISTRIBUTE intelligence cycle.[11] The emerging concept must therefore look to exploit technological developments in areas such as cyber capabilities, computer processing and network connectivity. Returning to the analogy from Air Power Doctrine, the future inventory might therefore see fewer floodlights and even searchlights but a potentially greater number of flashlights. This places even greater priority on the ability to piece together all of these discrete, multi-spectral flashlight elements and to focus greater effort on the DIRECT-PROCESS-DISTRIBUTE elements of the intelligence cycle, rather than a platform-centric approach to the COLLECT function.

One suggested solution to overcoming the limitations inherent in having fewer dedicated ISTAR assets is to use a *mosaic* or *jigsaw* approach to deliver intelligence across the entire area of operations. The future battlespace will likely contain an increasing range of sensors able to deliver discrete information elements, including airborne radars, self-defence electronic surveillance equipment, electro-optical devices and even blue-force tracking systems. Contributors will additionally include air and space assets from other nations and commercial

operators, placing high priority on interoperability with such partners, together with assets operating in other domains, including cyberspace. The so-called Combat-Oriented Mosaic-Built Intelligence (COMBI) approach aims to deliver the ability to cross-cue or task directly and then harvest information from every air and space sensor available in the battlespace. Subsequent piecing together of each small element of information in the same way as a mosaic or jigsaw allows construction of a more comprehensive *picture* of the battlespace to support delivery of assured intelligence.[12]

The COMBI approach will clearly demand highly effective computing and communications capabilities, together with interactive networks that support high rates of data transfer and fusion. This may predicate placing greater investment in research and development into future computing and software evolution, building on expected future advances in computer chip capacity and cloud computing. Software areas such as data-mining, pattern-recognition and prediction algorithms also offer encouraging signs of potential, as do commercial advances in multi-purpose, multi-function and multi-layered information and volume distillation development. Furthermore, trends in miniaturisation could offer increasing utility from the intelligent use of airborne platforms of all types, including in space, to enhance the range and utility of deployable and flexible networks by providing airborne relay stations and mobile processing. This could assist the movement of information around the battle-space, particularly in environments that do not support the placement of suitable ground facilities.

Such innovative approaches to the DIRECT-PROCESS-DISTRIBUTE elements should also drive a fresh examination of COLLECT capability requirements. Developments in on-board sensor capabilities offering greater information feeds from individual platforms provide one area worthy of consideration; current attempts by the US to develop its GORGON STARE concept provides a useful example.[13] Other interesting developments include the US Army's Manned-Unmanned System Integration Capability (MUSIC), which will be trialled in late 2011.[14] The system aims to combine manned and unmanned operations to form a cohesive intelligence, surveillance and reconnaissance unit that collects and disseminates critical battlefield information, accessing all the information collectively and simultaneously; the principle is *what one can see, all can see*. The capability will introduce a universal ground station for a variety of unmanned systems and a 3-sensor payload dubbed *Triclops*. The latter innovation aims to provide external operators – either soldiers on the ground or crews of manned platforms – the ability to control directly part of the sensor payload without the need for voice communications with the operator.

Combat-ISTAR might also usefully seek to exploit emerging platform technologies that could offer complementary utility in this regard. Novel platforms such as airships or hybrid air vehicles might offer interesting opportunities in the future and unmanned systems will doubtless offer increasing versatility and utility beyond their current armed ISA capabilities, to include Unmanned Combat Air Systems that can operate at less risk in non-permissive environments. Such platforms may offer significant advantages in terms of persistence

and even a modular approach to capability delivery. However, they do not yet obviate the personnel burden inherent in operating complex air systems. One of the reasons for the adoption into doctrine of the term Remotely Piloted Air Systems (RPAS), as an alternative to Unmanned Aircraft Systems (UAS), is to reflect the essential role of the crew operating the system and emphasises that the system as a whole is not unmanned.[15] Moreover, persistent surveillance, either manned or unmanned, requires a large number of personnel to both generate and maintain the activity and to manage the significant amount of data it generates.

The capability areas mentioned provide only a highlight of some of the areas that might be considered under the Combat-ISTAR approach. One other important consideration, however, is the impact that any significant shift in how air and space power contributes to the ISA role will have on how we attract and cultivate the right personnel to deliver the required product. Early work under the Combat-ISTAR approach should, therefore, investigate what new skills may be required for such an approach, the command and control arrangements and systems necessary for the tasking of more interdependent air and space operations, and the agile force structures required to deliver assured intelligence to the end user, at whatever level of command. It must also identify how the continuing increase in volumes of information delivered by modern air and space sensors, and increasingly from cyberspace, will impact on the capacity required within the analysis and processing areas. This area could potentially become a bottleneck in the intelligence cycle if insufficient resources, both personnel and technological solutions to information management and processing, are allocated to these critical functions. Fortunately, the RAF's long association with technological innovation and its highly skilled workforce make it particularly well placed to take the necessary leap of faith to deliver such outcomes for the joint force.

Conclusion

Combat-ISTAR intends to drive a new approach to the integrated employment of air, space and cyber systems to deliver assured intelligence and situational awareness, in conjunction with agile offensive action against potentially fleeting adversaries. Underpinning this approach is the need to maximise the advantages of being able to **secure**, **dominate** and **exploit** the high ground to deliver effective intelligence, a critical element of developing the necessary understanding to support decision-making at all levels. However, our ability to maintain the significant contribution that air and space power make to the delivery of intelligence is under threat from the challenges inherent in the future operating environment and the likely fiscal constraints under which the Services must develop and operate joint combat capabilities.

Meeting such challenges will require innovative thinking and new concepts that focus on the necessary future force structures, equipment and personnel that can deliver greater synchronicity in the delivery of intelligence and combat effect. Such thinking must overcome legacy, platform-centric approaches and move to consideration of how to more effectively harvest, process, manage and exchange information collected by a wider variety of sensors. It must also consider how to meet the requirement for coincident support to joint action,

including fires against fleeting targets in difficult environments.

Early thoughts are considering the increasing inter-dependencies between the 4 air and space power roles, with an increasing focus on the centrality of the ISA role. This work recognises the growing importance of being able to challenge for dominance in the information arena within congested and contested environments. Initial consideration is being given to enhancing the utility that combat capabilities operating in the Control of the Air and Attack roles may offer to the ISA role, but the aspiration is for all platforms, including those operating in roles not traditionally considered as combat functions to contribute to the holistic delivery of information and intelligence. This platform-agnostic approach to the air and space contribution to the intelligence cycle brings with it a new paradigm for the command and control of a wider variety of other information contributors. It will also build on existing proposals seeking to enhance our abilities to process and share information across common networks and with our future coalition partners. The Combat-ISTAR approach will therefore have a marked influence on the future development of air and space power to support the joint force.

Notes

[1] DCDC: Future Character of Conflict Paper.
[2] Joint Doctrine Publication 04: Understanding.
[3] AP3000 British Air and Space Power Doctrine – Fourth Edition, Chapter 3.
[4] *Ibid* p47
[5] *Ibid*, p46.
[6] The term F3EA (Find, Fix, Finish, Exploit and Analyse) is also gaining popularity.
[7] JDP 0-01.1. United Kingdom Glossary of Joint and Multinational Terms and Definitions, (7th Edition).
[8] Intelligence is the product from the collection, processing, integration, analysis, evaluation and interpretation of available information.
Described in the Intelligence process (DCPD - Direct, Collect, Process, Distribute).
[9] OED, Combat: to fight or contend against; oppose vigorously; a fight, struggle or controversy, including between ideas.
[10] It is estimated that up to 90% of our current military capabilities are in some way reliant on space; FASOC 09, p1-2.
[11] JDP 02- Intelligence Support to Operations, Chapter 3.
[12] Advanced air platforms such as JSF offer the ability to fuse sensor data on-board the aircraft.
[13] GORGON STARE is a podded system fitted to REAPER with multiple cameras; the concept is attempting to provide coverage of a number of individual targets or synchronised output to provide mosaic wide area coverage.
[14] *Jane's Defence Weekly*, 18 May 2011, The Americas: MUSIC to sync manned aircraft and UAVs, page 8.
[15] UK Ministry of Defence News Brief, 21 Jul 2010, Adoption of new terminology for the RAF: Remotely Piloted Air Systems.