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FOR DOCTRINE DEVELOPMENT AND EDUCATION



ANNEX 3-14 SPACE OPERATIONS

SPACE SITUATIONAL AWARENESS

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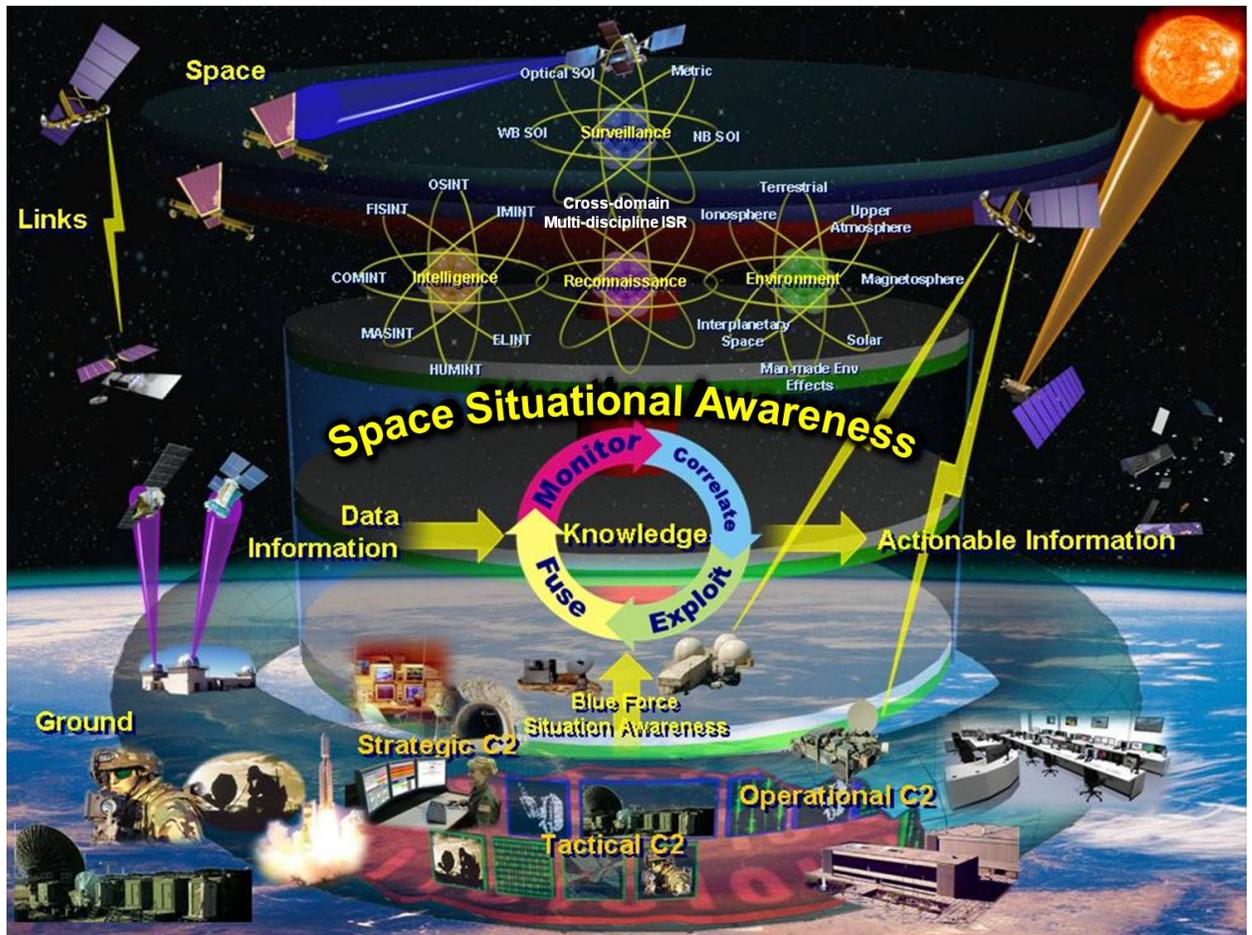
Space situational awareness (SSA) is vital to space superiority because it enables all other space operations. [JP 3-14](#) defines space situational awareness as the requisite current and predictive knowledge of the space environment and the operational environment upon which space operations depend as well as all factors, activities, and events of friendly and adversary space forces across the spectrum of conflict.¹

SSA includes components of intelligence, surveillance, and reconnaissance (ISR), space environmental monitoring, and space warning functions. An important distinction of these components of SSA is that they *focus on* space, so that they enable SSA of the space domain. The discussion later in this annex describes the mission area of global space mission operations (GSMO) discusses other components of ISR, environmental monitoring, and warning that *derive from* space, i.e., from space-based assets.

SSA leverages ISR capabilities and analysis of the space domain, including the status of US and cooperative satellite systems and US, allied, and coalition space readiness. Further, SSA integrates all-source intelligence to help characterize foreign threats to our space capabilities.

SSA supports several key objectives, including: ensuring spaceflight safety; protecting space operations and assets; implementing and verifying international treaties and agreements; enhancing terrestrial military operations; and supporting national security and strategy. See the figure title, Space Situational Awareness, for a graphic depiction of SSA, and see JP 3-14 for a more detailed description of SSA.

¹ JP 3-14, Space Operations.



Space Situational Awareness²

Space situational awareness contributes to overall [battlespace awareness](#) required for planning and executing operations. SSA provides knowledge of the space medium, intelligence on space systems, and correlation of effects—all of which are vital in protecting [space systems](#). Accurate prediction of the space environment allows proactive asset management, such as turning solar arrays parallel to oncoming meteor showers to minimize damage or repositioning satellites to avoid collision. Space system information, combined with the ability to correlate effects, allows operators to predict and avoid electromagnetic interference and fratricide against friendly space systems. Likewise, SSA is necessary to predict and defend Air Force space systems from potential adversary attack. SSA is crucial to accurately determining space system failures, whether from environmental effects, unintentional interference, or attack, giving decision makers and commanders information needed to pursue appropriate actions. Finally, SSA provides detailed intelligence on adversary space systems and programs, enabling Air Force space control planning, execution, and assessment.

² Operational View 1 of Enabling Concept For Space Situational Awareness, Oct 2007

SSA Components: ISR

The ISR component of SSA is focused on the space domain itself, which differs from the space-based ISR function discussed later in this chapter. ISR is considered to be an indivisible and holistic process, but an understanding of the role of ISR in SSA requires a detailed discussion of the individual components.

Intelligence. [Intelligence](#) is the product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, areas of actual or potential operations, or other areas that may support our national security. The process used to perform this analytical function is called intelligence preparation of the [operational environment](#).³ Intelligence is a domain-neutral term. For SSA, intelligence provides the characterization and analysis of foreign (adversary and third-party) space order of battle and capabilities, to include foreign use of space systems to their advantage. Characterization may include how forces and assets operate, their impact upon military operations, their vulnerabilities and strengths, or their indications of hostile intent. Indications and warning (I&W) is an intelligence function to detect and report time-sensitive intelligence information on foreign developments that could involve a threat.⁴ Characterization and analysis of space capabilities supports planning of defensive measures and targeting for offensive operations. Reliable, timely, and accurate intelligence also supports combat assessment.

Requirements drive the production of all intelligence products. The intelligence community must be told what information space operators need so they can plan and execute ISR operations to meet those needs. Space operators must levy information requirements on the Air Force, Department of Defense (DOD), and national intelligence community to ensure timely and high fidelity intelligence is produced to feed SSA. Space operators must also define commander's critical information requirements, which in turn allow intelligence planners to develop priority intelligence requirements and essential elements of information. Properly defining these requirements will help guide the development of intelligence support to space operations. Intelligence operators, in turn, must be proactive in communicating with their space counterparts to ensure intelligence capabilities, options, and limitations are understood. See Annex 2-0, [Global Integrated ISR Operations](#) for more information.

Surveillance. Surveillance is a persistent or near-persistent observation. Surveillance, as a part of SSA, includes space surveillance and surveillance of other domains. Space surveillance is the systematic observation of man-made objects orbiting the Earth. Surveillance contributes to orbital safety, I&W of space events, and intelligence production.

Space events include satellite maneuvers, anticipated and unanticipated launches, reentries, and [space weather](#). Space surveillance data is one source used to produce

³ JP 2-0, [Joint Intelligence](#).

⁴ JP 2-0, [Joint Intelligence](#).

the satellite catalog—a fused product providing locations of satellites and man-made space debris (figure on Space Debris). Satellite catalog information allows predictive orbital analysis to anticipate satellite threats and mission opportunities for friendly, adversary, and third party orbital activities. SSA also requires surveillance of other domains. By definition, SSA includes knowledge of ground and link segments as well as diverse factors such as adversary industrial base, related [computer networks](#), and hostile intent. Surveillance of targets, such as launch facilities or adversary computer networks, can provide information that is useful in the development of SSA.



Space Debris

Reconnaissance. Reconnaissance provides detailed characterization of specific objects or locations needed to analyze and assess the operational environment. Like surveillance, reconnaissance for SSA can be divided into space reconnaissance and reconnaissance of other domains. Space reconnaissance is reconnaissance of objects or data in the space domain. Frequently, this reconnaissance takes the form of electro-optical, infrared, or radar imagery, but reconnaissance is not limited to just imagery intelligence or other forms of geospatial intelligence. Non-persistent signals intelligence of a space object may be space reconnaissance. Reconnaissance of terrestrial domains, such as human intelligence reporting on an adversary's counterspace capabilities, contributes important information to SSA. Reconnaissance data from an airborne platform imaging an adversary satellite ground station can aid in determining adversary capability or intent and provide actionable intelligence to counter enemy actions, if needed. Often, assets that perform reconnaissance are also capable of conducting surveillance.

SSA Components: Space Environmental Monitoring

SSA includes a characterization and assessment of space environment, such as solar flares, and its impact on space systems. This is done through space environmental

monitoring. This monitoring also helps predict impacts on communications links, terrestrial weather near related ground sites, and natural and man-made phenomena in outer space, such as orbital debris. This environmental information must be accurate, timely, and predictive to protect space systems and support space operations planning and execution. Predictions of natural environmental effects should be integrated with military commanders' courses of action (COA) to enhance military effects. Environmental monitoring is critical in space control operations, and is often integral to military commanders' decisions on friendly COAs. Accurate environmental monitoring improves SSA and can help operators differentiate between natural phenomena interference and an intentional attack on space systems—greatly enhancing decision makers' ability to respond appropriately.

SSA Components: Command and Control

The relationship between command and control (C2) and SSA is reciprocal. Command and control is “the battlespace management process of planning, directing, coordinating, and controlling forces and operations.”⁵ C2 enhances SSA by providing feedback on the status/readiness of forces and insight on how integrated space capabilities are contributing to military operations. Multiple sources of information, including C2 information, are combined to form a space common operating picture. In turn, the space common operating picture provides C2 nodes with SSA needed to plan, execute, and assess space operations.

⁵ Annex 3-30, [Command and Control](#)