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Space Situational Awareness and International Policy

Laurence Nardon

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Ifri
27 rue de la Procession
75740 Paris Cedex 15 - France
Tél. : 33 (0)1 40 61 60 00-
Fax: 33 (0)1 40 61 60 60
E-mail : ifri@ifri.org

Eur-Ifri
22-28 Avenue d'Auderghem
1040 - Bruxelles, Belgique
Tél. : 00 + (32) 2 238 51 10
Fax. : 00 + (32) 2 238 51 15
E-mail : info.eurifri@ifri.org

Website <www.ifri.org>

SPACE SITUATIONAL AWARENESS AND INTERNATIONAL POLICY

Introduction

The development of Space Situational Awareness (SSA) programs gives rise to several policy issues in the United States (U.S.) and in Europe, as well as in the transatlantic context. As it happens, SSA capacities can serve different, sometimes opposing policy goals. This is particularly the case in the United States. SSA could also bring a degree of independence to Europe in the transatlantic relationship. Finally SSA could become the pretext for new European ventures in space.

The term "Space Situational Awareness" was coined by the US Air Force. As early as Second World War, German and Allied Air Force officers noted that a large proportion of fighter pilots that were hit did not realize that they were under attack before their plane was destroyed. Either they never knew they were targeted, or they realized, but too late – think of an attacker coming from 6 o'clock. Indeed the Luftwaffe decided to have a pilot fly over the area where other pilots were, in order to warn them of impending attack.

Studies by the United States Air Force (USAF) estimated that the proportion of planes shot while unaware had been close to 80% during the Korean and Vietnam wars. By the mid-1970's, US fighter pilots came to attribute this fatal ignorance to what USAF jargon called a lack of "Situation Awareness".[1] According to 1980's USAF doctrines, SA (by then "Situational Awareness") was essential to the fighter pilots survival. The solution to ensure continued and satisfying SA was to have enough information technology.

As could be expected, the need for Situational Awareness was later on applied to the space environment. The term "Space Situational Awareness" appears in the 2001 Rumsfeld report on space.[2]

However, in the context of space, Situational Awareness becomes much more than an operational concept aimed at helping pilots to protect themselves. SSA can have different applications and can therefore serve different policy goals. This has strong implications in terms of public policy choices.

Laurence Nardon is a Senior Research Fellow and the Head of the Space Policy Program at Ifri. She teaches at the Institut d'études politiques of Paris.

[1] Origins of SA term and concept in B. D. Watts, *Clausewitzian Friction and Future War*, McNair Paper No. 52, Washington DC, INSS, October 1996, chapter 9: "Situational awareness in air-to-air combat and friction", p. 91-104.

[2] *Report of the Commission to Assess U.S. National Security Space Management and Organization*, Pursuant to Public Law 106-65, 11 January 2001, Executive Summary, p. 16.

- In the United States, SSA programs monitor the threat from human-made objects: other satellites and space vessels, antisatellite weapons (asats) as well as space debris. SSA can serve military objectives such as preparing for defensive and offensive operations. But it could also constitute a basis for policies of transparency and confidence in space. There are two sides to the same coin.

- The European Space Agency (ESA) defines SSA in much wider terms. European SSA would include the awareness of threats from asteroids, solar flares, etc., i.e. « astronomical threats ». This could prove important in the European context.

The SSA Debate in the United States

The raison d'être of SSA is interpreted differently by the different actors on the U.S. scene. First of all, SSA is the first step of space weaponization plans currently devised by the Pentagon. Since space acquired a strong role in tactical military operations (i.e. since the 1991 Gulf War), the necessity of protecting existing space assets has been recognized. Space weapons will protect telecommunication, observation or navigation satellites systems that support military actions. Since the Air Force has secured the main budgets for space programs acquisition, USAF texts are most commonly quoted. Experts refer mainly to the *Strategic Master Plan* of the *Air Force Space Command*.[3] The text plans a three-phase weaponization of space over the next 15 years:

1. Monitoring the space environment is the first step of space weaponization plans and relies on Space Situational Awareness per se. SSA systems are already in place through a network of ground-based telescopes and radars called the Space Surveillance Network (SSN) and operated by the USAF Space Command (AFSPC). There are plans to modernize the current SSN system and to complement it with various in-orbit telescopes[4] as well as innovative detection systems on-board future satellites.[5]

2. *Defensive Counterspace* (DCS) aims to protect the fleet of U.S. satellites. Current techniques focus on hardening the satellites against electronic jamming. After 2018, further means should be available, such as in-orbit maneuvering capabilities, launch-on-demand capacities (within days or a few weeks), satellites redundancy and smallsats constellations.

3. *Offensive Counterspace* (OCS) indicates the capacity to attack other nations satellite systems. The only operational systems today are a few electromagnetic pulse (EMP) jamming systems. Ambitious development

[3] Last available version is: U.S. Air Force Space Command, *Strategic Master Plan FY06 and Beyond*, Peterson AFB, October 2003, Plan, p. 21-26.
[4] The open press mentions projects for a "Space-Based Space Surveillance System": a telescope providing optical views of objects in the GEO belt and an "Orbital Deep-space Imager": a telescope that would move around the GEO belt. J. A. Tirpak, "Securing the Space Arena", *Air Force Magazine*, Vol. 87, No. 7, July 2004.
[5] The project is called the "Rapid Attack Identification, Detection And Reporting System" (RAIDRS), *Ibid*.

projects are listed in the USAF report, mentioning lasers and in-orbit asats, that could be operational as soon as 2025.[6] They will target all existing satellites systems.

The U.S. has no peer competitor in space and U.S. military space programs constitute a point of reference for space powers throughout the World. U.S. plans for SSA, DCS and OCS are therefore watched with interest in the rest of the World. However, other actors have different views of SSA.

Looking back, the weaponization of space was ruled out as soon as 1958 by the Eisenhower administration. Its implications in terms of strategy were deemed to be destabilizing. Indeed, the Rumsfeld report of 2001 and the USAF plan represent a recent change in attitude. Today, a number of think tanks, academics and foundations opposes the administration's projects for space weaponization. This so-called disarmament community sees them as a first step in an arms race in space that would be dangerous for everyone.

Although they come from a different perspective, tenants of space disarmament have adopted SSA as a major tool to enable a continuing peaceful use of space. This is based on the notion that information sharing and transparency constitute the basis of international trust. Sharing SSA capacities would work toward confidence-building.

The Henry L. Stimson Center is a Washington-based research center with an agenda to reduce threats to international stability. It supports the adoption of an international Code of conduct in space. Similar to the "Incidents at Sea Agreement" signed in 1972 by the U.S. and the USSR, it would organize for instance the sharing of information on launches and space maneuvers, in order to eliminate all risk that unexpected moves be mistaken for an hostile action or cause unwanted collisions. A degree of trust and non-aggression in outer space would allow nations to feel secure and give up the deployment of further military space means. A Code of conduct is less formal than a treaty and therefore easier to push through international bodies such as the Conference on Disarmament (CD) in Geneva.

The Stimson Center set up a group of international experts in 2006-2007 to draft a Code and now plans to present it to the government of different space-faring nations. SSA systems constitute an essential element in the functioning process of the "Code of Conduct for Responsible Space-Faring Nations", as it is currently drafted. It mentions "the responsibility of countries to enhance cooperation on Space Situational Awareness", in order to "develop and abide by rules of safe space operations and traffic management".

In the U.S. context, SSA can serve space weaponization purposes as well as space non-weaponization purposes.

[6] See L. Nardon, *L'Arsenalisation de l'espace, les projets américains*, Paris, Ifri, "Note de l'Ifri", December 2006.

European Access to Space Situational Awareness

Michel Foucault's assertion that access to knowledge is power also works in international relations. The lack of SSA means in Europe today creates vulnerability, especially compared with the extent of the U.S. SSA arsenal.

The current Space Surveillance Network (SSN) operated by the USAF Space Command consists of 25-30 ground stations operating radars and telescopes. The AFSPC maintains a catalogue of more than 10,000 man-made items that are currently tracked. The plan is to get that figure up to 30,000-40,000 in coming years.[7] This allows the U.S. government to monitor what type of public information is available. Indeed, access to the SSN network information was restricted in 2004.[8] Today, a Yahoo search on the words "real time satellite tracking" will lead to a website engineered by American radio amateurs that presents and tracks satellites based on their radio signature.[9] All countries' satellites are listed, including the French *Helios* and *Essaim* and the German *SarLupe*. U.S. military satellites are presented as well. However, no detailed information is available on U.S. most sensitive satellites operated by the National Reconnaissance Office (NRO).

Lack of SSA means has often left European countries in the dark. For instance, in 1996, the French experimental satellite *Cerise* was hit by a piece of debris from an *Ariane 4* rocket that had been launched ten years earlier. A British radar first noticed the hit that was later confirmed by U.S. SSA means. France never had a chance to check the information independently. Since then, France has developed a radar system called Graves (*Grand Réseau Adapté à la Veille Spatiale*, i.e. large network adapted to space monitoring). It is a demonstrator owned by the French Air Force and operational since 2005. Graves can watch the sky up to 1,000 km above the French territory. It is rumored that Graves did witness the Chinese asat test of January 2007. Specifically, Graves could have seen a missile closing in on the Chinese meteorology satellite and, at the next pass, a cloud of debris where the satellite used to be[10].

Along with other European radar and telescope systems, Graves may constitute the basis for future European SSA. Acquisition of independent means has always meant a lot for the European space effort. After Ariane and Galileo, SSA seems the logical evolution today.

Self-standing SSA means would certainly alter the transatlantic relationship by modifying defense attitudes in Europe. Experts claim SSA would provide European countries with a capacity of space deterrence. The French High Council for Defense (Conseil Supérieur de Défense, CSD) declares that extended space surveillance capabilities would allow France to know in real time what or who has attacked one of its satellites, let the attacking country know that it has been found out and adopt retaliatory measures. CSD assumes this would deter such attacks in the first place.[11] This in turn would allow France to forgo deployment of further weapons in space. Also, SSA would give Europeans independent means to verify compliance to an international Code of Conduct for Space, should such a text be adopted in

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[7] NASA's Jet Propulsion Laboratory and Goddard Space Flight Center maintain ephemeris of Near Earth Objects (NEO) as well as solar system bodies. They rely partly on data from the Satellite Surveillance System.
[8] *National Defense Authorization Act for Fiscal Year 2004*, 117 Stat. 1565 Public Law 108-136, 24 November 2003.
[9] See Annex.
[10] Interview, Paris, 2007.
[11] Interview, Paris, February 2007.

future years. Indeed CSD proposes that France extends its current limited LEO (Low Earth Orbit) surveillance means to GEO (GEosynchronous Orbit).

Europe is a major space power, but remains far behind the U.S.: cooperation ventures between NASA and ESA are fairly asymmetric; European military space developments are limited. Acquisition of independent space surveillance means would change the situation. However, all European countries do not share the same motivation for space or indeed for military independence.

How Can Europe Acquire SSA Means?

ESA has undertaken a review of European countries' needs for Space Situational Awareness.[12] The record for European space cooperation shows that two models could prevail in future programs.

Bilateral or multilateral projects have so far been favored for military-related projects. The *Helios* observation satellite program and the Musis (MUltinational Space-based Imaging System) observation project constitute two major examples. In such cases, cooperation will involve countries with an acquisition goal that is clearly identified. This ensures a deep level of commitment to the project. Unfortunately, in the absence of an overarching cooperation architecture, such projects leave more room for national viewpoints to emerge. For instance, the French Ministry of Defense (MoD) acquisition body (Délégation Générale pour l'Armement, DGA) has been said to be too arrogant in past dealings with its European partners. Cooperation projects in the 1990's, such as Trimilsatcom or *Helios 2*, have suffered from this attitude.

On the other hand, cooperation projects led by ESA benefit from a set and tested architecture. Optional programs allow countries with less interest to opt out if they wish. ESA projects also put more emphasis on the European nature of the programs, rather than combining parallel national needs. ESA could in the future undertake security-related programs, perhaps developing present studies of SSA needs into a full-blown program. ESA's civil charter limits its area of activity to space programs with "peaceful uses", but these are now understood as including Petersberg missions.[13]

This evolution must be seen in the light of the rapprochement between ESA and the European Union that was reinforced by the Framework Agreement signed in 2004 by the two institutions. The EU develops a growing role in space (witness Galileo and Europe's Global Monitoring for Environment and Security [GMES] program) as well as a growing role in security matters (following the Petersberg Summit). The EU conducted a "Space and Security" study in 2004 (Spacek exercise), looking at military space needs and capacities. A possible evolution of Europe's ambitions in military space as well as a redefinition of institutional processes for conducting such programs are therefore emerging alongside the SSA exercise. The ESA Ministerial Council of 2008 is expected to shed some light on this evolution.

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[12] See L. Del Monte's presentation on "The European Space Situational Awareness Initiative", ESPI, 6 September 2007.
[13] This dates from an implicit agreement to a declaration by ESA's Director General in March 2004.

As ESA has had no experience of military projects in the past, it may suffer from a lack of experience in classification procedures and in the information-sharing of sensitive data. But this could be easily remedied to. A more serious issue might be the possible hostility of national space agencies to ESA's military undertakings. National space agencies have had more say in the development of military programs in the past and would be reluctant to see that role taken away.

The current SSA study undertaken by ESA is therefore extremely important. It may provide Europe with a credible SSA architecture in the next decade. It may also herald an evolution in the goals and conduct of the European space effort. An added bonus here is the fact that European SSA also covers potential "astronomical threats". This could bring countries with less incentive for developing European autonomous military means to adhere to the project.

Annex. Military Satellites Tracked by N2YO (radio amateur website)

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Name	Country	NORAD ID[1]	Launch date	Period (minutes)	Perigee (km)	Apogee (km)	Inclination (°)	Other comments
Radcal	U.S.	22698	25-06-1993	101.2	751	881	89.5	LEO
STRV 1A	U.K.	23125	17-06-1994	514.4	259	29,515	7.2°	
STRV 1B	U.K.	23126	17-06-1994	500	254	28,722	7.5°	
Helios 1A	France	23605	07-07-1995	98.4	679	682	98.1°	LEO
REX 2	U.S.	23814	09-03-1996	101.1	795	829	90.2°	LEO
Cosmos 2346	Russia	24953	23-09-1997	104.4	938	994	82.9°	LEO
Argos	U.S.	25634	23-02-1999	101.5	821	837	99.1°	LEO
Helios 1B	France	25977	03-12-1999	97.5	636	638	98.3°	LEO
MTI	U.S.	26102	12-03-2000	95.3	519	546	97.2°	LEO
STRV 1C	U.K.	26610	16-11-2000	707.8	610	39,250	6.2°	
OFEQ 5	Israel	27434	28-05-2002	93.8	457	469	143.4°	LEO
Helios 2A	France	28492	18-12-2004	98.4	680	682	98.1°	LEO
Essaim 1	France	28494	18-12-2004	98	659	662	98.2°	LEO
Essaim 2	France	28495	18-12-2004	98	658	663	98.2°	LEO
Essaim 3	France	28496	18-12-2004	98	655	666	98.2°	LEO
Essaim 4	France	28497	18-12-2004	98	653	668	98.2°	LEO
Koreasat 5	South Korea	29349	22-08-2006	1436.1	35,779	35,794	0°	
Cosmos 2422	Russia	29260	21-07-2006	717.5	1,023	39,320	63.2°	
Skynet 4D	U.K.	25134	10-01-1998	1436.1	35,778	35,797	4°	
USA 115	U.S.	23712	06-11-1995	91.4	336	347	51.6°	No elements available, Milstar 1-2
Eros B	Israel	29079	25-04-2006	94.7	501	509	97.4°	LEO
SarLupe 1	Germany	29658	19-12-2006	94.3	466	504	98.2°	LEO
Insat 4B	India	30793	11-03-2007	1,436.1	35,770	35,804	0.1°	
OE (Astro)	U.S.	30772	09-03-2007	94.5	490	498	46°	LEO
MidStar 1	U.S.	30773	09-03-2007	94.5	494	498	46°	LEO, experiment

OE (NextSat)	U.S.	30774	09-03-2007	95.2	519	533	46°	LEO
STPSat 1	U.S.	30775	09-03-2007	95.8	558	560	35.4°	LEO
FalconSat 3	U.S.	30776	09-03-2007	95.8	558	559	35.4°	LEO, experiment
CFESat	U.S.	30777	09-03-2007	95.9	558	562	35.4°	LEO
USA 193	U.S.	29651	14-12-2006	92.9	411	424	40°	No elements available, NRO
NFIRE	U.S.	31140	24-04-2007	93.5	398	490	48.2°	LEO
Cosmos 2427	Russia	31595	07-06-2007	89.5	174	321	67.1°	LEO
OFEQ 7	Israel	31601	10-06-2007	94.2	384	571	141.8°	LEO
USA 194	U.S.	31701	15-06-2007	103.9	782	1,104	98°	No elements available, NRO
Sar Lupe 2	Germany	31797	02-07-2007	94.3	471	499	98.2°	LEO
Cosmos 1867	Russia	18187	10-07-1987	100.6	776	802	65°	LEO

Note : 1. The NORAD (North American Aerospace Defense Command) ID number is a 5-digit satellite identification number.
2. LEO : Low Earth Orbit.
3. NRO : National Reconnaissance Office.