



European Security and Defence Assembly
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17 June 2010

FIFTY-EIGHTH SESSION

European security and space debris

REPORT

submitted on behalf of the Technological and Aerospace Committee by
Edward O'Hara, Rapporteur (United Kingdom, Socialist Group)

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Report transmitted to: the President of the Council of WEU; the Secretary-General of the WEU; the President of the Council of the European Union; the High Representative of the Union for Foreign Affairs and Security Policy; the President of the European Commission; the EU Commissioner for institutional relations and communication strategy; the Presidents/Speakers and the Chairmen of the Foreign Affairs, Defence and European Affairs Committees of the 39 national parliaments represented in the Assembly; the Presidents of the Parliamentary Assembly of the Council of Europe, the NATO Parliamentary Assembly, the OSCE Parliamentary Assembly, the Baltic Assembly, the Nordic Council, the Parliamentary Assembly of the Black Sea Economic Cooperation, the CIS Parliamentary Assembly; the President of the European Parliament; the Secretaries General of the Parliamentary Assemblies of the Council of Europe, NATO and the OSCE.

*European security and space debris***REPORT¹**

*submitted on behalf of the Technological and Aerospace Committee
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¹ Adopted by the Committee on 20 May 2010.

RECOMMENDATION 863²
on European security and space debris

The Assembly,

- (i) Considering that the existence of debris produced by human activity in space constitutes a very great risk to the security of space installations and access to space and is therefore a source of extreme concern;
- (ii) Noting that according to the most recent estimates there are in orbit some 15 000 objects measuring more than 10 centimetres, some 300 000 measuring from one to 10 centimetres and more than 135 million measuring less than one centimetre;
- (iii) Noting that the greatest concentration of objects is to be found in the orbits where human space activity is greatest: low earth orbit (LEO) and geosynchronous earth orbit (GEO);
- (iv) Recalling that the speed of orbiting objects depends on their altitude: the closer they are to earth, the faster they travel, which means that objects in LEO can attain speeds close to 20 km per second;
- (v) Stressing that the increase in orbital debris in LEO is therefore a danger not only to the extensive in-orbit infrastructure there, but also to the crews of the International Space Station (ISS);
- (vi) Noting also that the life expectancy of an orbiting object depends on the distance between it and the earth, hence that of an object in GEO is of the order of millions of years, whereas at 825 km it is 200 years and at the altitude of the ISS only six months;
- (vii) Noting further that the majority of debris results from the fragmentation occurring when an object collides with a meteorite, when spacecraft explode or are deliberately blown up or from collisions between man-made objects;
- (viii) Finding regrettable the case, in January 2007, of the decommissioned Chinese Fengyun-1C against which the Chinese army launched an anti-satellite weapon the resulting debris from which test will fall back to earth only after several centuries;
- (ix) Pointing to the fact that it appears that the increase in debris in LEO has sparked off a chain reaction and that its density in certain orbital zones has reached such a pitch that objects are likely to collide at any moment, each time generating further debris;
- (x) Noting that the various protection, avoidance and destruction procedures are subject to numerous technical and legal constraints;
- (xi) Noting that in consequence several solutions are under study with a view to countering the risks debris causes to spacecraft safety;
- (xii) Considering that a power endowed with technology capable of destroying debris could also use it to destroy operational objects and might be seen as a potentially hostile element;
- (xiii) Considering that the most credible way of dealing with orbital debris remains prevention and international concertation with a view to drawing up positive legislation;
- (xiv) Welcoming the work of the Inter-Agency Debris Committee (IADC) which brings together the space agencies of the countries responsible for generating space debris and whose main tasks are to exchange information on debris, facilitate cooperation on debris mitigation and propose solutions;
- (xv) Highlighting the fact that the IADC has already introduced a number of rules of conduct aimed at limiting the proliferation of debris both before and after missions;

² Adopted by the Assembly on 17 June 2010 at the 4th sitting.

(xvi) Considering furthermore that surveillance of orbital debris is crucial to ensuring the greatest possible spacecraft safety, since by identifying objects and their trajectories it is possible to determine their origin and allocate responsibility in the case of a collision;

(xvii) Noting that the United States shares with its partners the world's only catalogue of debris, (entitled Two-Line Elements (TLE)) which does not include information relating to certain US military installations in space;

(xviii) Recalling the European Space Agency (ESA) Space Situational Awareness (SSA) project for European global surveillance of space;

(xix) Noting that the effective combined use of the GRAVES (France) and TIRA (Germany) radars in the framework of active bilateral cooperation is a first step towards a European space surveillance system independent of the American one;

(xx) Emphasising the importance of international cooperation in an area which can be highly sensitive due to the presence of military assets;

(xxi) Welcoming the fact that Arianespace, in respecting the procedures and guidelines adopted by ESA in the IADC framework, offers an example of Europe's growing awareness of the debris issue,

RECOMMENDS THAT THE WEU AND EU COUNCILS AND MEMBERS OF THE EUROPEAN SPACE AGENCY:

1. Give greater political support to the work of the IADC with a view to its carrying out the tasks required of it;
2. Ensure that prevention and international concertation are the cornerstone of the work to be done in connection with the risks associated with space debris;
3. Ensure that any guidelines adopted in the ESA and IADC frameworks are fully respected;
4. Pay special attention to monitoring space debris and ensure that ESA's SSA project continues beyond the preparatory stage;
5. Ensure in that connection that Europe has its own independent space surveillance capability;
6. Ensure that the EU Satellite Centre has wide responsibility in this sphere and that its budget is commensurate with such responsibility.

EXPLANATORY MEMORANDUM

submitted by Edward O'Hara, Rapporteur (United Kingdom, Socialist Group)

I. Space debris: a recurring threat

1. The debris generated by human activity in space has become a crucial issue. The dense satellite population and also military activities on the part of certain powers have led to a chain reaction in the creation of uncontrolled objects in low earth orbit. This is a worrying situation: the question of how space debris affects the security of our space structures and our access to space has become acute.

1. Characteristics of space debris

What is space debris?

2. Space debris is the corollary to man's adventure in space, which began on 4 October 1957, when the Soviet Union succeeded in placing the first man-made object in orbit. Human space activities have increased drastically since then, setting off the well-known chain of events. Sputnik 1, weighing 84 kilos, accounted for only 1% of the mass of the structures launched that day by the Soviets.³ The launcher together with its fairing – a further 6 600 kilos in all – found themselves placed in a similar orbit.

3. Since 1957 there have been more than 4 500 launches⁴ and some 5 000 satellites placed in orbit. All man-made objects orbiting the earth, with the exception of about 600 operational satellites,⁵ can be classified as debris. Unfortunately there is currently no clear and internationally agreed legal definition of the term "space debris". French law, for example, defines debris as any "non-functioning man-made space object or fragments and components of such objects in earth orbit or entering the earth's atmosphere".⁶ But there are other, broader definitions in the scientific literature that in some cases even classify natural debris (meteorites) or operational satellites as space debris.

4. According to the latest figures there are some 15 000 objects measuring more than 10 centimetres⁷ in orbit: modern telescopes cannot easily detect objects smaller than that. However, the number of objects measuring from one to 10 centimetres is estimated at about 300 000, and those measuring less than one centimetre at more than 135 000 000.⁸ In-orbit pollution caused by human activity is therefore much greater than the natural pollution caused by meteorites.⁹

5. Furthermore the distribution of debris is not uniform: it corresponds rather to the most widely-used orbits. The greatest concentration of objects is to be found in low earth orbit (LEO) and geosynchronous earth orbit (GEO). LEO corresponds to the much-used zone up to 2 000 kilometres' altitude. This is where the numerous remote sensing, meteorological and communications satellites (Iridium), not to mention the International Space Station (ISS), are to be found. Given the dense human – in some cases manned – activity in this orbit, it is not surprising that there should be large quantities of debris there. Moreover, the speed of orbiting objects depends on their altitude: the closer they are to earth, the faster they travel, which means that objects in LEO can attain speeds close to 20 km/s. No protective plating can withstand collision with an object of more than one or two centimetres travelling at such speeds. Thus the increase in orbital debris in LEO is a danger not only for the extensive in-orbit infrastructure there, but also the ISS crews.

³ ALBY Fernand, "The space environment and its impacts", CNES (French space centre), 2008.

⁴ CNES, presentation on space debris, 29 January 2010.

⁵ Air and Space Academy, "Europe and Space Debris", recommendations. Dossier No. 22, 2003.

⁶ Law on space operations of 3 June 2008.

⁷ Orbital Debris Quarterly News, National Aeronautics and Space Administration (NASA), Volume 14, Issue 1, January 2010.

⁸ CNES, op. cit.

⁹ ALBY Fernand, op. cit.

6. GEO corresponds to a precise altitude of 35 786 kilometres. Also known as the Clarke orbit, GEO is at the exact point in altitude at which the orbiting speed of the satellite is equal to the speed of rotation of the earth, which means that it appears motionless when observed from a point on the earth. This is the orbit used for many telecommunications satellites which need to fly above the same region of the earth (Eutelsat). GEO is widely used and much debris is to be found there.

7. It must be noted that the problems with debris vary according to altitude. The life expectancy of an orbiting object depends on the distance between it and the earth. The higher its orbit, the less it is affected by the earth's gravitational pull and atmospheric friction: the life expectancy of an object in GEO is of the order of millions of years, whereas it is only six months at the 400 km altitude of the ISS, or 200 years at 825 km.¹⁰ Thus different criteria come into play for the management of potential debris depending on whether it is located at an altitude of 400 km or in Clarke's orbit. Most man-made objects orbiting the earth are located somewhere between the two, in a zone where object life expectancy is measured in centuries, if not millennia.

Classification of space debris

8. There are wide variations not just in terms of speed and altitude, but also as regards the nature and origin of debris. Although there is no clear definition of space debris, it is possible to classify the man-made objects orbiting the earth according to their origin. According to the French space centre CNES, the some 600 operational satellites account for 5% of those objects. Decommissioned satellites remaining in orbit represent 20% of the total.¹¹ The next category, accounting for 14%, is composed of the upper stages of the launchers used to place the satellites in orbit. Next, at 8%,¹² comes the operational debris comprising objects released during missions, such as protective covers, clamp bands or separation devices. There are also unquantifiable propulsion residues such as the particles released by the solid boosters at the end of the boost phase, in particular when the satellite is moved from transfer orbit to GEO. Aging of materials is another major source of debris: space is an aggressive environment with large temperature variations and ultra-violet radiation that can cause the detachment of materials ranging from the photoelectric cells of solar panels to flakes of paint.¹³

9. However, the majority of debris – 53% of the observable total – is the result of the fragmentation occurring when an object collides with a meteorite or when spacecraft explode or are deliberately blown up. More than 400 in-orbit explosions have been counted since 1957.¹⁴

10. Another cause of fragmentation, until recently considered to be hypothetical, has now also emerged: collisions between man-made objects. The first such incident was reported in 1996 when a fragment from the third stage of an Ariane launcher that had exploded in flight 10 years earlier hit and sectioned the stabilisation boom of France's Cerise satellite, causing the loss of the satellite. This was a risk that until 2007 was perceived as small. That year, however, there was a major new development that sparked growing concern about orbital debris and the threat it poses to space activities.

2. A new situation

Destruction of China's Fengyun 1-C satellite and the collision between Iridium 33 and Cosmos 2251

11. According to several NASA¹⁵ and CNES¹⁶ experts, two events have given a whole new dimension to the problem of space debris. On 11 January 2007 China conducted a test over Chinese territory involving the deliberate destruction of one of its satellites. The Chinese army launched an anti-satellite weapon (ASAT) against the decommissioned Fengyun-1C (FY-1C) meteorological satellite. The test took place at an altitude of 865 km, which means that the resulting debris will only

¹⁰ CNES op. cit.

¹¹ ALBY Fernand, op. cit.

¹² Ibid.

¹³ Ibid.

¹⁴ CNES, op. cit.

¹⁵ LIOU J.C., "An Update Assessment of the Orbital Debris Environment in LEO", NASA Space Debris Quarterly News, January 2010.

¹⁶ BONNAL Christophe, interview on 11 February 2010, CNES.

fall back to earth in a few centuries' time. The explosion created thousands of particles of debris in what is a densely populated orbit. According to Christophe Bonnal from CNES, the event shows poor understanding of the dangers of space pollution on the part of the Chinese military who were anxious to demonstrate their new claims. In fact, military and civilian space activities in China are managed in completely separate fashion and it would seem that the civilian scientists were unable to warn the military about the risk. It would have been better to conduct the destruction test in very low orbit in order to limit the life expectancy of the resulting debris. This is apparently what the United States' Missile Defense Agency did when it tested its new device in 2008, probably in response to the Chinese test.¹⁷

12. The second major event, two years later, was a collision between an Iridium communications satellite and Cosmos 2251, a decommissioned Russian telecommunications satellite, over the Taimyr Peninsula (Siberia) on 10 February 2009. To give some idea of the force of the impact, one must realise that the two objects – whose respective weights on the ground are 560 kg (Iridium 33) and 900 kg (Cosmos 2251) – collided at a speed of 42 120 km per hour. According to New Scientist, the impact was even more violent than that caused by China's ASAT. It generated more than 10 000 fragments of debris (three times more than the destruction of Fengyun-1C), ranging from one centimetre to the "size of a tennis ball".¹⁸

13. Indeed, according to NASA those two incidents, of a force greater than anything seen before, generated by themselves 5 000 objects measuring more than 10 cm, increasing the total population of that category of debris by about 50%.¹⁹

A chain reaction in LEO

14. According to concurring sources within NASA and CNES, that sudden increase in the number of debris in LEO has sparked off a chain reaction. The debris in certain orbital zones has increased so much that the objects are likely to collide at any moment, each time generating further debris.²⁰ This only takes account of objects larger than 10 centimetres, reported to account for 99% of the orbiting mass and likely to be the source of future increases in the number of uncontrolled objects.

15. It is useful to study the scenarios that NASA has produced on the basis of simulations in order to get an objective idea of the implications for the low orbits considered in this report. Three possible scenarios are envisaged. The first, called "business as usual", is based on human activities in space continuing at the current rate. The second also envisages human space activities continuing, but with 90% of the objects launched into orbit complying with such risk-limitation procedures as end-of-life deorbitation and passivation to avoid the risk of explosion. The third is based on a total halt in human space activities: although currently no more than an unlikely hypothesis, it shows that even in the absence of human intervention the quantity of debris in LEO will continue to rise for a further hundred years at least.

II. Safety risks and means of response

1. Space debris: the safety challenges

A real danger to orbiting structures

16. Having taken stock of the situation the next step is to examine more closely the threats posed by the increasing quantities of debris in certain orbits. The risks in LEO are particularly acute due to the high speeds of objects, making them potentially lethal for the ISS astronauts. On 13 March 2009, for example, the ISS crew was obliged to take refuge in the Soyuz rescue vehicle after a 13 cm piece of debris was detected on the station's trajectory. There was no collision, but according to New Scientist

¹⁷ KREPON Michael, "After the ASAT test", Stimson Center, 24 March 2008.

¹⁸ MARKS Paul, "Satellite collision more powerful than China's ASAT test", New Scientist, 13 February 2009.

¹⁹ LIOU J.C. op. cit.

²⁰ Ibid.

the ISS came close to disaster: a five cents coin travelling at the same speed (10 km/s) would have had an impact equal to that of a small car hurtling at 80 km/h.²¹

17. Unmanned spacecraft in low orbits of course face similar risks. On 17 January 1995, for example, the upper stage of an American Thor launcher collided with a fragment from a Chinese C24 rocket, leading to a loss of control of the US spacecraft and the creation of more debris.

18. A further source of risks in LEO, in addition to those that come from large fragments (more than 10 cm) is so-called microdebris, defined as any object between 100 microns and 2 to 3 cm resulting from human activity in space. Although the impact force of such debris is less spectacular than for larger objects, it considerably aggravates wear and tear of orbiting structures²² as has been illustrated on at least two occasions involving Europe. In 1984 NASA launched the Long Duration Exposure Facility (LDEF) to study the resistance of materials to long-term exposure to the vacuum in space. When NASA brought it back to earth in 1990 an examination of the ESA (Eureka) platform it was carrying revealed more than 30 000 impact marks, including 5 000 from objects more than half a millimetre in diameter. Europe's Gorid detector launched in 1996 regularly detects dust clouds that are probably composed of aluminium oxide from the combustion of solid boosters.²³ The wear and tear caused by microdebris is such that the Space Shuttle needs to have one or two portholes replaced after every mission.²⁴

Protection, avoidance and destruction procedures: technical and legal constraints

19. Several solutions are under study with a view to countering the risks to spacecraft safety caused by debris. For the moment there is no way to "clean up" an orbit. Moreover, any solution, just like the risks, depends on the size and altitude of the debris. Spacecraft can be partially shielded against microdebris in low orbits. But our current technology offers no means of protection against fragments measuring more than one or two centimetres. Moreover, spacecraft protection can be prohibitively expensive in terms both of developing and purchasing the shielding and of the additional launch costs resulting from the extra weight.

20. For debris bigger than two centimetres various hypotheses have been drawn up but are far from offering effective solutions. Firstly, any system designed to capture debris using, for example, absorbent foam interceptors or "butterfly nets" would be destroyed on impact due to the velocity of the orbiting objects.²⁵ The solution would therefore be counter-productive, leading to the creation of more debris. Other ground-based systems involving the destruction of debris using powerful lasers have also been envisaged, but are far from reliable in the current state of the art.

21. Another possibility would be to use a space vehicle (such as the Space Shuttle or Europe's ATV) to pick up larger pieces of debris travelling along a dangerous trajectory. But in addition to the major technical problems that would need to be resolved (calculating the rendezvous with a piece of "non-cooperative" and probably rotating piece of debris at an uncontrolled altitude),²⁶ such a solution would call for considerable financial investment. In addition to the initial mission cost, one must consider that a vehicle like the Space Shuttle with its limited energy reserves would most certainly be unable to bring back more than one piece of debris per mission.

22. While theoretically we could develop the technology to destroy debris, it must be borne in mind that such technology could also be used to destroy operational objects. Given the United States' traditional stance on the status of its military infrastructure,²⁷ it therefore seems logical that a power endowed with such technological capabilities might be seen as a disruptive element.

²¹ MCKEE Maggie, "Debris threat prompts space station crew to evacuate", New Scientist, 12 March 2009.

²² Air and Space Academy, op. cit.

²³ Ibid.

²⁴ ALBY Fernand, ARNOULD Jacques, DEBUS André, La pollution spatiale sous surveillance, p. 68, Ellipse, 2007.

²⁵ ALBY Fernand, op. cit.

²⁶ Ibid.

²⁷ GOLDENBERG Suzanne, Bush issue doctrine for US control of space, The Guardian, 19 October 2006.

2. Collective action at international level

Prevention and regulation through international structures: the most credible option

23. Thus the most credible way of dealing with orbital debris remains prevention and international concertation with a view to drawing up positive legislation. According to Fernand Alby, the collision between Cerise and the Ariane fragment need not have happened: the explosion that created the debris in the first place could have been avoided if the rocket engines had been drained of their fuel.²⁸ This, of course, raises the question of prevention. The problem is that near space is an environment that is in constant movement, where there are no fixed points of reference on which to base individual prerogatives. In this global environment without borders international cooperation makes sense, above all when it comes to combating space debris.

24. The Inter-Agency Debris Committee (IADC) which brings together the 11 space agencies²⁹ responsible for generating space debris, describes itself as “an international governmental forum for the worldwide coordination of activities related to the issues of man-made and natural debris in space”. The IADC’s main tasks are to exchange information on debris, facilitate cooperation on debris mitigation and propose solutions.³⁰ It publishes standardisation documents drafted in negotiation by the 11 agencies, in order to formulate common guidelines. Those documents may be addressed to the UN Committee on the Peaceful Uses of Outer Space (COPUOS) or to the international standards body ISO.

25. Most important of all, however, is that its 11 members, which between them account for a large share of space activities, undertake to respect the guidelines. The IADC has already introduced several rules of conduct aimed at limiting the proliferation of debris both before and after missions. The latter involves mitigating the operational debris (clamp bands, protective covers) released with the satellite. It is also crucial to minimise the risks of explosion during the object’s stay in space. While for obvious reasons operators already take steps to avoid explosions during the satellite’s operational lifetime, it is also necessary to avoid them in the post-operational phase by means of passivation (reduction of all onboard energy sources). A satellite that has reached the end of its life-time must also comply with certain constraints. A satellite in low orbit must not remain for more than 25 years in so-called protected zones. It must be deorbited using either direct (ground-controlled) or indirect means. The latter involves gradually decreasing the perigee so that atmospheric friction causes the satellite to fall back to earth within the required deadline.

26. Such codes of conduct are of course necessary but are only effective for those space objects to which they are applied: the guidelines do not affect the objects already in orbit before the guidelines were introduced and collision between two spacecraft therefore remains a major potential source of debris. The risk can be reduced by means of avoidance measures, as long as the operator has enough information to calculate a new satellite trajectory. Those data, based on the surveillance of orbiting objects, are also necessary in order to minimise the risks to new missions (by choosing less densely populated orbits).

Surveillance: a crucial element

27. Surveillance of orbital debris is thus crucial to ensuring spacecraft safety. By identifying objects and their trajectories it is possible to determine their origin and allocate responsibility in the case of a collision. Yet for all its importance surveillance is not sufficiently effective, due first and foremost to the fact that even the world’s best radars can only track objects bigger than 10 centimetres in low earth orbit; and, as we have seen, anything exceeding two centimetres can be lethal if it collides with a functioning spacecraft.

²⁸ CNES, “La queue de cerise fait déborder la coupe”, *Conversations spatiales*, November 2008.

²⁹ ASI (Agenzia Spaziale Italiana), BNSC (British National Space Centre), CNES (Centre National d’Etudes Spatiales), CNSA (China National Space Administration), DLR (German Aerospace Centre), ESA (European Space Agency), ISRO (Indian Space Research Organisation), JAXA (Japan Aerospace Exploration Agency), NASA (National Aeronautics and Space Administration), NSAU (National Space Agency of Ukraine), ROSCOSMOS (Russian Federal Space Agency).

³⁰ IADC, *Space Debris Mitigation Guidelines*, 15 October 2002.

28. The main problem, however, is that the world's only catalogue of debris is produced by the North American Aerospace Defense Command (NORAD) in partnership with NASA. In theory that catalogue, entitled Two-Line Elements (TLE), lists all orbiting objects exceeding 10 centimetres in size and their trajectories.

29. For reasons of coherence Washington shares the TLE, a document concerning its national security, with its partners. However, given the link with US SPACECOM it may be presumed that the catalogue, as a tool for US sovereignty, does not include information relating to certain US military installations in space. When the US Army blew up an old satellite (USA 193) in LEO in February 2008 it claimed that all the resulting debris would be brought back into the atmosphere, unlike that generated by the Chinese test six months previously.³¹ According to Christophe Bonnal,³² however, there is currently no way of checking the claims of the Americans, who make no mention of any debris from that explosion in the TLE.

30. It is generally agreed that the TLE published by Washington is incomplete. In view of the threats that orbital debris presents for security/safety in space, Europe will need in the near future to develop an independent space surveillance capability.

III. A major challenge for European security:

1. Europe and space: Europe's credibility as a leading player in the effort to mitigate debris

Space and the CDSP: an opportunity for Europe to assert its role as a leader

Assuming responsibilities

31. The European White Paper on "Space: A new European frontier for an expanding Union – An action plan for implementing the European Space policy" adopted in November 2003 highlights the advantages of extended space cooperation among the member states. It examines the political and financial means needed for strengthened space cooperation in an enlarged Union, focusing in particular on the following objectives: competitiveness of satellite equipment; bridging the digital divide; averting humanitarian crises; Europe's security.

32. The reference to space as a "new frontier", reminiscent of the United States' early ventures into space, also confirms the EU's intention to develop space as a project that is common to all European states: for Europe to have independent access to space and the means to protect its space-based assets is a matter of credibility. The development of space is part and parcel of the EU's CFSP and CSDP, in that a European space project could be a tool for European construction and integration and for developing a new leadership role for Europe. However, that ambition of strengthening its role through the use of space depends to a large degree on the policies put in place to combat and limit the proliferation of space debris. The notion of independent access to space means mastering the technologies and having the requisite information to deal with an increasingly polluted orbital environment.

A real threat to European security

33. Thus one of the first challenges that Europe must tackle in order to build a common space project is that of limiting the production of space debris: indeed, there are a number of areas in which the European Union, in cooperation with the European Space Agency (ESA), must set an example.

34. Now that the spectre of anti-satellite weapons (ASAT) has been raised, the risk of a conflict in space – while it must be put in perspective – must be taken into account for Europe's security or indeed that of any state which uses space for peaceful purposes. The destruction of just a few orbiting objects could generate so much debris that all human activity in space would become impossible for a long time to come.

35. Moreover, with Europe developing systems like Galileo and given the risk of a piece of debris colliding with an operational satellite, it must give thought to the ways and means of assuring a

³¹ Air and Space Academy, "For a European Approach to Security in Space", Dossier No. 31, 2008.

³² BONNAL Christophe, interview on 11 February 2010, CNES.

permanent supply of information: complete and sufficiently detailed data are essential in order to be able to take avoidance action or to rapidly move a destroyed satellite into a safer orbit.

36. Space surveillance appears therefore to be one of the keys. The current scale of the problem of space debris, combined with Europe's dependence on the United States for the relevant information, is a major obstacle to opening that "new frontier" both in theory and practice.

2. Space Situational Awareness (SSA): a European response

37. In November 2008, ESA expressed the desire to develop a genuinely European system for the global monitoring of space activities. That project illustrates a new awareness in Europe of the need for a proper command of space-related information. The Space Situational Awareness (SSA) programme also shows that the states concerned have understood the importance of close cooperation with a view to the two-fold objective of technological efficiency and political expediency.

From Franco-German assets...

38. Up until now Europe did not have its own means for the monitoring of debris in low earth orbit. (For geostationary orbit ESA has a telescope located in the Canary Islands). That activity, of a military nature and hence at the discretion of the member states, has been developed above all by France and Germany which cooperate on the basis of a bilateral treaty on the surveillance and identification of objects. The French radar space surveillance system, known by its French acronym GRAVES (Grand Réseau Adapté de VEille Spatiale) and developed by the French national research centre ONERA, is currently able to detect an object with a surface area equivalent to one square metre at a distance of 1 000 km as it overflies French territory at an angle of 35 degrees. However, GRAVES is not designed to identify the objects in question. Germany's TIRA radar for its part is able both to detect and identify two-centimetre objects at a distance of 1 000 km. TIRA, unlike GRAVES, does not have the capacity for surveillance of low orbits, but working in cooperation with the Max Planck Institute's radio telescope it can produce radar images that are useful for satellite reconnaissance and identification, making it complementary to the French system.

39. The effective combined use of TIRA and GRAVES in the framework of active bilateral cooperation is a first step towards a European space surveillance system independent of the American one, with a view to planning avoidance manoeuvres in space or locating the landing spot of falling debris. In 2000, during a 24-hour detection campaign, TIRA detected more than 471 orbiting objects, only 94 of which had already been listed, demonstrating the usefulness of independent surveillance capabilities.

... to a genuine European global surveillance system

40. Following those national programmes (GRAVES is operated by the French air force) and Franco-German bilateral initiatives, the SSA programme represents a new step forward towards building an integrated European system at the service of nations and citizens.³³ The SSA's aims are twofold: the surveillance and identification of orbiting objects of natural or man-made origin; and space meteorological prevention, with a particular focus on the impact of solar flares on ground or space-based operational structures. Clearly the SSA initiative corresponds to the growing need for information in order to guarantee the security/safety of our space activities. In that context the European Union Satellite Centre (EUSC) at Torrejón in Spain could become one of the strongest links in the SSA chain by providing the member states with part of the infrastructure needed to establish a fully operational surveillance system. In this connection the European Parliament, in a resolution in July 2008, recalled the need for the Centre to be more closely integrated into the European Security and Defence Policy (ESDP) and referred to the part played by the Centre in early warning. In view of the link between the whole area of space debris and ESDP, it is clear that the EUSC will come to play an increasingly significant role, notably by establishing a framework of cooperation with ESA.³⁴

³³ European Space Agency, interview with Nicolas Bobrinsky, 13 November 2008.

³⁴ European Parliament Resolution of 10 July 2008 on Space and Security, 2008/2030(INI).

41. That initiative will in the long run also enable Europe to free itself of certain constraints imposed by the United States in terms of restricting access to information for reasons of national security. The SSA appears to be the first step towards a “European voice” in the surveillance of orbital debris. Once it has the SSA, Europe will have every interest in cooperating with other space powers such as the United States and Russia in order to supplement and corroborate its own information on space debris. It will then be in a position to start negotiations at international level with a view to establishing multilateral cooperation in this area, thereby confirming its determination to shoulder its responsibilities in the field of space debris.

3. Underlying challenges

(a) industrial cooperation, the commercial sector

42. The issue of space debris poses an underlying challenge for the SSA. We are talking here about international cooperation in an area which can be highly sensitive due to the presence of military assets. With China now using ASAT, such a space situational awareness capability may be perceived as a risk by the only real space power, the United States. It is for the moment in Washington’s interests to be in control of space object surveillance activities. Europe’s acquisition of such a capability in the near future could pose the problem of information control, for the United States in particular.

43. As regards information on debris, the collective spirit of responsibility that prevails within the IADC is encouraging. One could envisage a similar scenario for the exchange of data: but what about military information?

The attitude of private companies: closely linked with that of governments

44. As we have seen, with a view to in-orbit safety and security, debris mitigation activities are governed by rules drawn up by space agencies and the IADC. However, while those public institutions remain the main operators in space, NASA has announced its intention to call on more private investors, for the development of commercial launches, for example; this poses the question of the role to be played by private companies in the field of space debris. Given the fact that there is no binding normative framework in this area, the question is perfectly justified. With private operators playing an increasing role in the future is there not a danger of irresponsible behaviour on the part of some of them that could lead to a fatal recrudescence of the problem of debris outside of all state control?

45. According to Isabelle Sourbès-Verger,³⁵ such a scenario is unlikely in that it is a matter here of taking human practices on the ground and transposing them to a radically different environment. Indeed, access to space is anything but simple, and it is hard to imagine a private player developing a space activity with no government backing. The economic model of launcher companies does not correspond to a commercial activity in the strict sense of the term (which means anyone having free access to a market provided they have the means to do so); rather it is a matter of securing a return on a considerable R&D investment in which the state is closely involved.

46. That theoretical model applies to Arianespace, which is developing its activity jointly with ESA. Arianespace therefore respects the procedures and guidelines adopted by ESA in the IADC framework and acts like a “shop window” displaying Europe’s growing awareness of the debris issue. This European operator, which already enjoys a good reputation, is therefore indirectly involved in the procedures for preventing space debris. That continuum between the public and private operators on the launcher market may therefore be perceived as a guarantee for the application of the IADC’s non-normative, non-binding rules.

(b) Diplomatic and legal issues

47. The significance of ensuring that such operators take due responsibility is the greater given that there is no binding legal international framework for space activity. Whilst it is true that the 1967

³⁵ Isabelle Sourbès-Verger is a research fellow at the CNRS (National Centre for Scientific Research), working in the “Communications and Policy” Laboratory. Her research involves an international comparison of space policies and the modes of occupation of the space around the earth. She is the co-author of “L’espace, nouveau territoire, atlas des satellites et des politiques spatiales”, F. Verger (Ed.), Belin, Paris, 2002.

Outer Space Treaty stipulates that states “shall bear international responsibility for national activities in Outer Space, including the Moon and other Celestial Bodies” and “for assuring that national activities are carried out in conformity with the provisions set forth in the ... Treaty”, even going so far as to say that “The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty”.³⁶ Although many states now have space legislation, the whole issue of space debris raises the question of the liability of private or state entities in the event of a collision or damage caused by a space object that is out of control. The 1972 Convention on International Liability for Damage caused by Space Objects stipulates that the state launching the object has liability rather than the user. However, in the event of a collision with a piece of space debris, establishing liability on the basis of an object that may be difficult to identify, on an uncontrolled trajectory, seems extremely problematic.

³⁶ Treaty on principles governing the activities of states in the exploration and use of outer space, including the moon and other celestial bodies, 27 January 1967, Article 6.

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