Assembly of Western European Union

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FORTY-SECOND SESSION

Airborne surveillance

REPORT

submitted on behalf of the Technological and Aerospace Committee
by Mr Lenzer, Rapporteur

ASSEMBLY OF WESTERN EUROPEAN UNION
43, avenue du Président-Wilson, 75775 Paris Cedex 16 - Tel 01.53.67.22.00

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1. Adopted unanimously by the Committee.

2 *Members of the Committee:* Mr *López Henares* (Chairman), MM Lenzer, *Marshall* (Vice-Chairmen); Mrs Aguiar (Alternate: *Coelho)*, MM Arnau, *Atkinson,* Mrs *Blunck,* Mrs *Bribosia-Picard,* Mr Cherribi, Sir *John Cope,* Mr *Diana,* Mrs Durrieu, Mr Feldmann, Mrs Gelderblom-Lankhout, MM Jeambrun, Le Grand, Litherland (Alternate. Sir *Dudley Smith*), MM *Lorenzi, Luís,* Magginas, Martelli, Olivo, Probst, *Ramírez Pery,* Sofoulis, *Staes, Theis, Valleix.*

Associate member: Mr *Dincer.*

N.B. *The names of those taking part in the vote are printed in italics.*

Draft Recommendation

on airborne surveillance

The Assembly,

(i) Considering that space-based systems, owing to certain intrinsic features, do not meet all the requirements involved in monitoring the earth's surface, particularly where continuity of observation, data precision and flexibility of use are concerned;

(ii) Taking the view therefore that satellite systems, which are designed to meet certain strategic needs, must be supplemented by airborne systems capable of meeting tactical requirements;

(iii) Bearing in mind that the new geopolitical situation, characterised by a large number of local conflicts that may be far apart, confirms how important are the requirements described above;

(iv) Noting that the recent conflict in Bosnia and Herzegovina has served to highlight deficiencies in ground surveillance, thereby confirming that airborne facilities supplementing a satellite option would be a more effective way of meeting operational needs;

(v) Regretting that the Council has not yet tasked the Planning Cell to analyse areas in which the airborne surveillance needs of the various European armies converge;

(vi) Considering that such an analysis should lead to the standardisation of headquarters requirements, so that WEU's needs in this respect can be defined,

(vii) Pointing also to the fact that the Planning Cell could draw up draft military specifications and thus guide the work of WEAG Panel I, which would have the specific advantage of improving Europe's industrial capacity and competitiveness in this area;

(viii) Noting the existence within NATO of a study group tasked with assessing Alliance needs in terms of airborne surveillance,

(ix) Taking account of the fact that this assessment should be the basis for determining the number of systems necessary and procuring the system or systems selected;

(x) Considering that such decisions are of major importance, especially from an industrial point of view,

(xi) Noting furthermore that various European countries have made substantial investments in airborne surveillance in recent years, without a single study being undertaken in the framework of European cooperation;

(xii) Observing, however, that the work of various kinds done so far shows many similarities, suggesting a high degree of convergence with regard to needs;

(xiii) Recognising that, at a time when defence budgets in the WEU countries are subject to severe restrictions, it is absolutely essential to achieve a definition of European requirements reflecting virtually all national needs and which might also include some items intended to meet highly specific requirements;

(xiv) Noting finally that the WEU Council is making only very limited use of the Satellite Centre, particularly in view of the new operational capabilities the Helios 1 satellite brings to it and that the Satellite Centre's original terms of reference include analysis of imagery obtained by means other than by satellite,

RECOMMENDS THAT THE COUNCIL

1. Task the Planning Cell with an analysis of areas in which the airborne surveillance needs of the various member countries converge,

2. Ensure that such analysis leads to standardisation of the various requirements, making it possible to identify WEU's needs in this respect;

3. Ensure that a study is made of the various European government and industrial projects and programmes in this field, taking maximum cost-effectiveness into account at all times;

4. Ask the Planning Cell to draw up draft military specifications that would guide the work of WEAG Panel I, thereby helping improve European industry's capacities and competitiveness;

5. Ensure that the results of all such work are taken into consideration by member countries in institutions which, like the Atlantic Alliance, are soon to take decisions on operational requirements in respect of airborne surveillance and on the selection and procurement of the necessary systems;

6. Make more use of the facilities of the WEU Satellite Centre and especially of the operational capabilities of Helios 1;

7. Ensure that the Planning Cell and the Intelligence Section are closely involved in the work and use of the Satellite Centre

Explanatory Memorandum

(submitted by Mr Lenzer, Rapporteur)

I. Introduction

1. Among the final considerations set out in the recent report on "WEU and Helios 2"[1], the importance was underlined in air-ground surveillance terms of combining airborne and satellite options In other words, data gathered through the use of strategic (satellite) systems should be supplemented by information obtained via tactical (airborne) systems.

2. Indeed, as we shall examine in further detail in a subsequent chapter, certain intrinsic features of space-based systems mean they cannot fully meet all requirements, particularly where continuity of observation, data precision and flexibility of use are concerned, hence the need for other information sources such as airborne systems, to supplement data obtained by satellite

3 This need is becoming increasingly evident in view of the new geopolitical situation, which is characterised by a large number of local conflicts, making it essential for satellite surveillance capabilities to be supplemented by data-gathering facilities available on airborne systems.

4. The need that must be addressed then is how to obtain information on enemy movements directly they occur and ensure virtually instantaneous communication with all forces involved so these can be engaged immediately The conflict in Bosnia and Herzegovina served to highlight these problems and provided an illustration of how an airborne component was used to supplement satellite facilities in order to resolve them effectively.

5. NATO's involvement, for the first time in its history, in crisis-management operations under United Nations mandate in former Yugoslavia, pinpointed deficiencies in surveillance capabilities, particularly in terms of the detection and monitoring of ground movements in areas of interest It became clear that such facilities are essential in order to support political decisions taken with a view to specific activities or to planning what defensive action should be taken

6 Thus in 1994 an initiative was taken in NATO to create a study group tasked with providing the organisation with what was originally referred to as the Alliance ground surveillance (AGS) capability and later became known as air-ground, or airborne, surveillance. This initiative, first set in motion by the United States, initially stemmed from genuine need, but was also undoubtedly influenced by the fact that the United States already had its own system, the Joint Surveillance Target and Attack Radar System (JSTARS), which had been used in operation Desert Shield/Desert Storm in August 1993.

7 Your Rapporteur was told that when an initial assessment of Alliance requirements for an AGS capability was carried out, the number of planes involved proved to be too high (just over 50) Subsequent discussions led to consideration as to whether NATO should have a core fleet covering minimum essential requirements In the United States' view, these requirements should be met immediately through NATO procurement of existing systems, namely JSTARS (4-5 planes) and Horizon (8 systems)

8. This minimum requirement represents what is essential for dealing with local conflicts such as, for example, that in former Yugoslavia In the event of a conflict of larger proportions, those nations having their own facilities would make them available to the Alliance.

9 This proposal raises various problems, the first being to define the size of the core or minimum fleet; secondly, it raises both major industrial issues and the matter of the degree of goodwill it can be assumed nations will show in making their respective assets available to NATO when the occasion arises.

10 These minimum needs therefore have to be defined and an agreement reached on organising a system for assigning national assets which at the same time addresses the concerns of the smaller nations that have no such systems but wish to draw on NATO's for their own national ends

11 However the main problem is undoubtedly of an industrial order, in view of the fact that four

1 Document 1525

countries have air ground surveillance (AGS) systems, which are either already operational or at varying stages of development. These are the US JSTARS system, the United Kingdom's Astor system, France's Mosta and Horizon systems and Italy's Creso system. A chapter of the report will be devoted to examining them further.

12. At present, an embryonic project office and a steering committee already exist The office is to become an Agency (similar to that set up for the European Fighter Aircraft (EFA) as soon as a firm decision is taken by the Conference of National Armaments Directors, which could take place around April 1997 Prior to this, NATO's Military Committee should first find that the project is urgent and give its opinion on which system should be chosen.

13 According to *Defense News*[2], SHAPE (Supreme Headquarters Allied Powers Europe) officials are in no doubt as to its urgency and have said as much to NATO's Military Committee. *Defense News* adds that the fact that the project is urgent gives JSTARS, built by Northrop Grumman Corporation, the edge over its rivals that are still under development, although their constructors say they could bring their systems up to operational level immediately and claim they would be cheaper

14. From another angle, WEU has not yet discussed airborne surveillance and has no plans to do so The Armaments Secretariat has not considered the matter, nor has the Planning Cell been tasked by the Council in that connection However this should not, in your Rapporteur's view, prevent the Assembly's Technological and Aerospace Committee reaching its own conclusions and endeavouring to secure the adoption by member countries, acting as WEU alone or within NATO, of a firm stance in defence of Europe's political, military and industrial interests

II. Ground surveillance from space

15 Over the last six years the Committee has produced eight reports on the subject of military observation satellites and the development of a European space-based observation system for security and defence purposes Two colloquies on these issues have also been organised, which gives an idea of their importance and our concern that Europe should have its own independent surveillance system which, in our view, is essential to the security and defence of our continent.

16 In 1986, France launched its Helios programme for a military observation system by satellite. While France's decision to seek the cooperation of other countries was influenced by high programme costs, political considerations also steered it in that direction. Italy and Spain joined the Helios 1 programme, taking funding shares of 14% and 7% respectively.

17. The Helios 1 programme, whose final cost is assessed as being in the region of ten billion francs, consists of two satellites, Helios 1A and 1B Helios 1A was launched on 7 July 1995 by an Ariane 4 rocket from the Kourou base in Guiana while construction of Helios 1B began in mid-1995 and is due for completion at the end of the current year Helios 1B's launch date will depend on Helios 1A's performance and on launch forecasts for the Helios 2 satellite, to which we shall return later.

18. The theoretical lifetime of Helios 1 satellites is between four and five years and they weigh some 2 5 tonnes They are designed for high-resolution (circa 1 metre) optical observation, which restricts their observation capability to daylight hours in good visibility. Helios 1 is stationed in a sunsynchronous polar orbit at an altitude of 677 km and has a repeat flyover time of 24 hours, given its speed of roughly 7.8 km per second

19 As your Rapporteur noted in Document 1525[3] the satellite's orbit and manoeuvring capabilities guarantee that a given location can be observed every day and that 15 or so scenes can be taken daily from orbits corresponding to priority interest zones such as Europe, Africa and the Middle East

20. The Helios 1 programme is based on the same platform as the Spot 4 civilian satellite and the general architecture of both satellites is very similar, showing that optimum synergy can be obtained between the civilian and military sectors. Moreover Helios 1 has shown that a military space-based observation system can be shared quite satisfactorily and that the organisational set-up

2 9-15 September, 1996

3. "WEU and Helios 2", Document 1525, report submitted on behalf of the Technological and Aerospace Committee by Mr Lenzer, Rapporteur

required for construction and operation of the satellite can be small, flexible and functional.

21 The first Helios images reached the WEU Satellite Centre at Torrejón (Madrid), on 1 May 1996 and were immediately analysed, in accordance with instructions concerning Sarajevo received from the Planning Cell.

22. The need both to replace the Helios 1 satellites and to upgrade the programme has led to a new system, Helios 2, being built This draws on the experience gained with its predecessor, incorporates new technologies and improves the programme by introducing infrared components for night-time observation, thus allowing more data to be gathered

23. Like Helios 1 and Spot 4, Helios 2 is geared to synergy between the civilian and military sectors through compatibility with the civilian satellite Spot 5 Bearing this in mind, the lessons learnt and experience gained from Helios 1 should make it possible with Helios 2 to cut the time required for collecting images by a half or a third and obtain a detection capability far greater than that of its predecessor, owing to its ability to take scenes simultaneously and its higher resolution (of the order of 50 cm).

24 On 7 December 1995, France and Germany agreed to cooperate on earth observation using military satellites. The agreement covers the French Helios 2 programme and the German Horus radar satellite project Since then, talks between the two countries, mainly intended to clarify the financial and industrial aspects of cooperation, have run up against Germany's budget problems, with the German defence minister insisting repeatedly that he did not have the necessary resources for this type of project.

25 However, all the signs now are that the project will go ahead, thanks to the intervention of the German Foreign Affairs and Research Ministers[4], but it is clear that the longer it takes for the agreements to be firmed up, the more difficult it will be to keep to the schedule envisaged for the start of the project

26. In principle, the launch of Helios 2 is scheduled for 2001. Project definition studies on Horus are to begin in 1998, construction will follow in the year 2000 and its launch should take place in 2005. Spain and Italy are also waiting for the agreements between the French and the Germans to take their final shape before possibly joining the project alongside these two countries

27. As little information is available on the Horus radar satellite, all that can be said at this stage is that it will make 24-hour observation possible, with a very high yield, irrespective of atmospheric conditions The platform will be specially adapted to satellites in the three-tonne category and the satellite architecture will be designed around the payload. Lastly, Horus is to have synthetic aperture radar

28. The Helios 1 programme consists of two segments, the Helios space component – which comprises the satellite and the station-keeping centre – and the user ground component, which consists of the Helios main centres and the image-receiving centres

29 The duties of the station-keeping centre are to operate and monitor the satellite on a daily basis, through two control rooms, the satellite control centre – which provides an on-line link to the satellite and carries out programmed operations when the satellite flies over the telecommand stations – and the utilities management centre which manages the satellites and their payloads off-line The utilities management centre prepares the operations, in particular the satellite programming messages, that are drawn up on the basis of work schedules received from the user ground component

30. As has been said, the user ground component primarily consists of the Helios main centres and image-receiving centres Each of the three Helios 1 participating countries, namely France, Italy and Spain, has its own main and image-receiving centres. The French Helios main centre at Creil is the hub of the system, centralising image requests from the three countries and relaying them to the station-keeping centre for the purpose of drawing up the satellite's daily work schedule

31 Thus each national Helios main centre sets objectives, states requirements and lists its priorities on the basis of urgency and the importance of its country's needs. The French main centre is the forum for tripartite dialogue between military representatives of the three countries, at which decisions on the daily programming schedule are

4. *Financial Times*, 8 October 1996.

taken As has just been explained, the programming schedule is then sent to the station-keeping centre whence it is uploaded to the satellite Each image-receiving centre has its own images delivered to it in real time or slightly deferred time for onward transmission to its main centre where they are analysed

32 As a result of agreements WEU has signed with the Helios 1 countries, the WEU Satellite Centre has also started receiving Helios images, as stated earlier.

33 According to Document 1525, to which reference has already been made, a series of measures will need to be adopted for the WEU Satellite Centre to become genuinely operational To avoid repetition, the Rapporteur refers the reader to the relevant passages of that document.

III. Requirements still to be met

34 Space-based observation is clearly an essential link in the network of ground surveillance systems Observation satellites also have the advantage of having access to any part of the world without infringing the sovereignty of the states they overfly, as the legislation governing space contains no prohibitions on overflying any country

35 Notwithstanding, it has to be acknowledged that satellite systems do not meet every observational requirement, mainly because they are not particularly flexible in the way they can be used and because the information they provide is not likely to be sufficient in itself for an accurate assessment to be made of a given situation in times of conflict or crisis.

36 Therefore it would be fair to assume, as the introduction to the present report points out, that satellite systems are essentially suited to collecting information for the creation of documentary databases and for global strategic reconnaissance, rather than for tactical and operational reconnaissance, in this last area, accurate online intelligence is essential and this can only be obtained using a range of different systems that are extremely flexible in their use.

(i) Observation continuity

37 The concepts of permanent observation and online data relay are increasingly finding application in situations where armed forces constantly need to have the fullest possible information available to them so as to reach instant decisions on the best course of action to be adopted in the field

38. Irrespective of altitude, a satellite will only overfly the same point after what is bound to be a fairly long interval. If observation of the entire planet is required, the satellite will have to be placed in sunsynchronous orbit at an altitude of approximately 900 km. It takes it some 102 minutes to travel one such orbit and an interval of several days can elapse before it returns to practically the same orbit

39 A similar problem arises when delivering observation data to the ground user station as the station has to be "visible" to the satellite. Hence a satellite-based system cannot by itself deliver permanent observation

(ii) Observation precision

40. Even a high-yield satellite is limited in the information it can gather Satellites equipped with sensors operating in the visible and even in the infrared spectrums can prove ineffective if the area of interest is veiled by cloud cover of a given thickness

41 Although sufficiently high resolution to identify small objects can be obtained by reducing the altitude of the orbiting satellite, this significantly reduces its life-span as the atmosphere applies considerably more drag to its movement in orbits at an altitude of less than 500 km Furthermore, to operate in this way would mean a large supply of engine-fuel being carried on board, hence the need for a heavier and more expensive satellite.

42. To avoid cloud-cover problems, it is planned, by dint of much effort, to put radar satellites supplying high-resolution images into orbit These basically have the advantage of operating round-the-clock, regardless of atmospheric conditions, but their high electrical power consumption prevents their being used continuously over a long period

43 Moreover, radar satellites have to be placed in a high enough orbit to ensure a sufficient life-span – a requirement hardly conducive to high resolution unless recourse is had to a very long integration period which has the disadvantage,

however, of reducing the possibility of observing a wide area.

(iii) Flexibility of use

44. Situations may evolve so rapidly that the time that elapses between an event occurring and its notification to the relevant authorities must be short enough for the appropriate decision to be taken and implemented effectively

45. It must therefore be possible for surveillance systems to be used flexibly and to be capable of receiving and transmitting information to the appropriate authorities in a very short space of time Furthermore, in recent years, theatres of operation have become much larger with pockets of fighting that are widely dispersed. Such factors make surveillance especially difficult and mean that the systems used must be fully complementary.

46. At present, satellites are not able, for the technical reasons which have just been referred to, to fully meet the requirements of flexibility, speed and precision which are now the order of the day

47. In strategic and tactical terms, air reconnaissance is undeniably an asset when it comes to evaluating threats and conducting operations as it makes it possible to create the databases that are essential for compiling documentary intelligence, monitoring developments, drawing up orders of battle and producing theatre and target information kits.

48. At the political level, accurate information about the activities of a suspect state can, if conveyed with enough advance notice, help ensure that an appropriate decision is taken or serve to alert the attention of the international authorities. This preventative approach is a crucial one in today's world. However in order to make it possible, online observation and transmission are a must and surveillance and reconnaissance aircraft, helicopters and drones can meet this requirement.

Other surveillance systems

49. There are a number of air systems available to supplement surveillance by satellite, each with its own special features and designed to meet specific needs. Generally speaking, they complement one another in a given area.

(i) The high-altitude flying platform

50 The capabilities of this system, which seems the best suited to permanent observation, will be described in a later section. The system is one which allows very high-resolution images to be produced, making it possible to recognise medium-size targets, and enables a single zone to be observed using different types of sensor. These systems normally use wide-bodied aircraft as their platform

(ii) Helicopter systems

51 These systems have the advantage of being very flexible in their use Helicopters can take off quickly in an emergency and make directly for the surveillance area. Helicopter-mounted systems can be used independently provided the aircraft has the same equipment as the ground station

52. A helicopter's field of action is restricted to tactical surveillance to assist ground forces and provides information about what lies ahead and whether it moves Its operating range does not normally exceed 200 km Helicopters may also be used in conjunction with high-altitude fixed-wing systems, for observing areas masked by the contours of the terrain Finally, helicopters can be used in defining and optimising the tasks of drones or UAVs (unmanned air vehicles)

(iii) Drones

53. The importance of UAVs has grown since the end of the Gulf War and such drones are being increasingly widely used Although their operating range is limited to a few hundred kilometres above the battlefield and their relatively slow speeds make them particularly vulnerable to surface-to-air defences, these systems are of major interest to armies owing to their low cost, flexibility of use and because no loss of life is involved.

54. Drones fall into three categories, each corresponding to a different operational level:

- regimental level· corresponding to a range of roughly ten kilometres and frequently used by army regiments;
- tactical level corresponding to a range of approximately 100 km,

- strategic level corresponding to a range of some 1 500 km and used mainly by air forces

IV. Capabilities of airborne observation systems

55 The maximum flight altitude of an airborne system is of the order of 30 km At that altitude the radio horizon lies at a distance of some 600 km – the optical horizon is nearer but this factor is of little interest since atmospheric attenuation very quickly restricts the observation range. It should be noted that distance from the radio horizon is not a useful measurement as it corresponds to a grazing angle Now the earth's surface is made up of reliefs and superstructures which create large numbers of areas which are in shadow whose size is largely dependent on the angle of incidence and it is very difficult to determine the minimum angle necessary for effective observation.

56 Since flying at an altitude of 30 km requires the use of aerodynamics and propulsion technologies involving highly specialised development work, they are very costly The question then arises as to whether there is an observation altitude that is more accessible financially

57 An altitude of 20 km might be considered This raises far fewer problems as it lies at the limit of altitudes used for commercial flights and is, by the same token, one where usable technologies have been mastered At this altitude the effective observation ranges are 280 and 170 km

58 For observation of the earth's surface to yield usable data for tactical purposes, it has to be virtually continuous. For permanent observation to be carried out effectively, the ratio of outward and inward journey times to time spent at the observation station must be very low, improving observation by reducing transit time is possible only by increasing speed – which is a costly option – while any improvement involving an extension of the time spent at the observation station has as its first consequence an increase in the amount of fuel carried aboard and the use of low-consumption engines

59 The mass of fuel carried by an aircraft forms part of the authorised payload mass If large quantities of fuel are to be carried, the mass of the observation system has to be reduced accordingly by taking aboard only what is strictly necessary.

60 Equipment that is strictly necessary obviously includes observation sensors and remote transmission systems for data gathered by the sensors It will be noted that it is not necessary to have data merge and analysis systems aboard, much less operations control systems Which, then are the observation sensors that are absolutely essential?

61 Remote observation (distances of over 100 km) implies the use of radar sensors and electromagnetic interception systems, while use of optronic sensors is confined to ranges under 50 km if propagation through the lower layers of the atmosphere takes place over a long distance. One can therefore conclude that this last type of sensor is only of any real advantage when it is possible practically to overfly the zones of interest – as satellites do – preferably when no cloud layers are present, even if these are broken

62. The use of high-resolution synthetic aperture radar (SAR) and moving target indicator systems (MTIs) in conjunction with equipment for detecting, locating and identifying electromagnetic radiation would appear to be the basis of any long-range observation system As this system can be installed in observation stations which are remote from analysis centres, it must also include a transmission facility capable of relaying data at high flow rates via satellite or, in the absence thereof, other air or surface systems

63 The high-resolution SAR system must be capable of producing images with metric resolution and the moving target indicator system of detecting and tracking moving echoes on the surface within a required range of speeds

64 The electromagnetic interception system should be capable of detecting and pinpointing most of the various emissions with a range compatible with the size of the area under observation

65 It is interesting to note that a combination of these different systems on a single observation platform promotes synergy between their capabilities and makes for quicker reconstitution of the real situation in the zone observed – which is of course the prime purpose – by facilitating a merger of their output and above all by cueing sensors to home in quickly on items of interest.

66. It was stressed earlier that the time spent at the observation station should be as long as possible The observation system should therefore