ESA HSR-17
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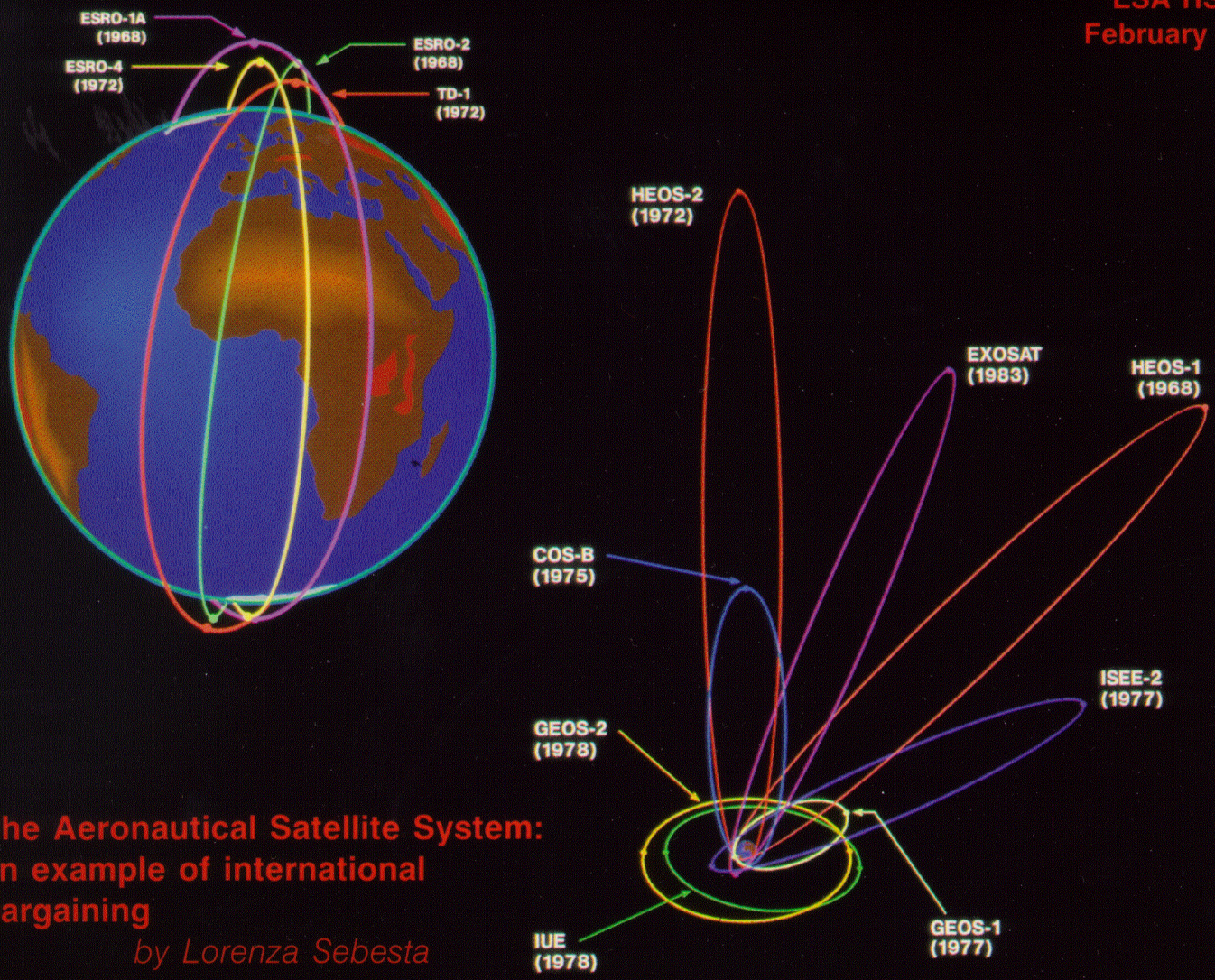
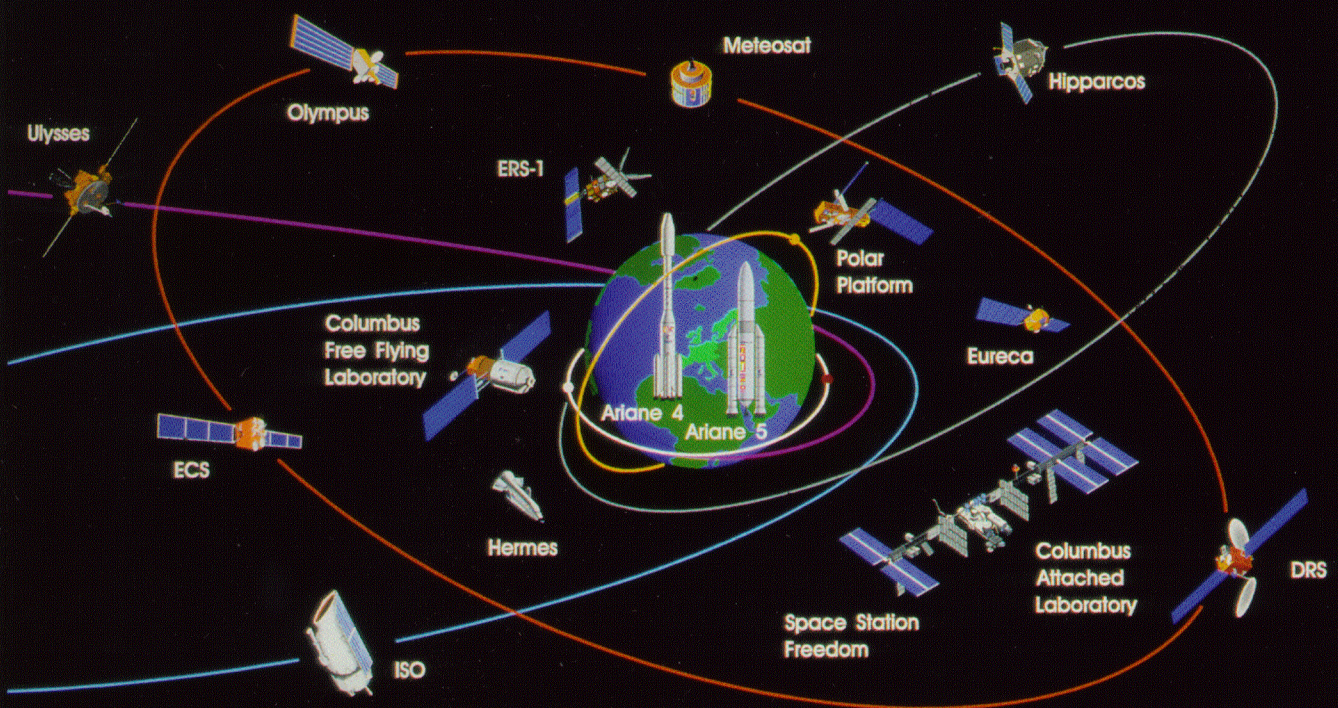


The Aeronautical Satellite System: an example of international bargaining

by Lorenza Sebesta



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ERRATUM

Unfortunately the last two lines of page one (i.e. the last two lines of the second paragraph) were omitted. They read as follows:

'This is all the more true for the civil realm, where the benefits of increased accuracy in terms of safety and performance have to be balanced not only against the vested interests of...'

The ESA History Study Reports are preliminary reports of studies carried out within the framework of an ESA contract. As such they will form the basis of a comprehensive study of European Space activities covering the period 1959-87. The authors would welcome comments and criticism which should be sent to them at the appropriate address below.

The opinions and comments expressed and the conclusions reached are those of the authors, and do not necessarily reflect the policy of the Agency.

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The project is based at the European University Institute, where the ESA archives are also housed. John Krige is the Project Leader.

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Table of contents

1. The meaning

The evolution of navigation systems, were they for boats, submarines, or airplanes, has been a fundamental component of the increasing accuracy of their missions. The importance of accuracy within a transportation service remarkably changed, depending on the historical period and the actual use of the vehicle: where the increase in accuracy for boats in the 16th century meant a dramatic decrease of wreckage due to sloppy navigation, the increase in accuracy for bombers during World War II meant better targeting, i.e. more buildings and people could be destroyed with the same amount of bombs. Safety on the one hand, performance on the other, seemed to be the core values pursued through accuracy. The increase in performance according to these parameters has been classically considered of vital importance within the military realm; recent studies, however, have shown how the progress towards accuracy even in this realm is not linear and cannot be explained by this main "rational" concern, but rather by a series of vested political, social and economic interests which are sometimes contradictory[1].

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[1] For this, see Donald MacKenzie, *Inventing accuracy: a historical sociology of nuclear missile guidance* (Cambridge: MIT Press) 1990.

different groups, but against a series of *aleas*, such as the forecast of future traffic, of costs (increasing fuel prices, inflation) whose definition can vary with time and with the political stand of the one who makes the forecast. Unlike the military realm, where the cost-effectiveness judgements are frequently dismissed on the basis of a superior strategic interest, the civilian realm attaches great importance to judgments of this kind.

During the seventies, the evolution of the air navigation system seemed to share the global trend of every information technology: a trend towards centralization, towards a sort of Orwellian "Big Brother" surveying and controlling human beings[2]. In the case of aircraft, this change corresponded to a progressive shift of power from the pilot, who had for centuries been enabled by the classic navigation systems to determine the position of his transport means himself, to the controller. From the mid-thirties onwards, air-traffic control (ATC) systems determined the position of all users through central surveillance stations[3], thereby dispossessing the pilots of what they felt as a well-rooted, old privilege. The road to accuracy also corresponded to the increased complexity of avionics and ground terminals. Since the advent of the first radio navigation system, each time the system was improved a new "black box" was added in the airplane cockpit and a new terrestrial infrastructure set up.

Yet, the efficiency of these terrestrial systems was still very low for intercontinental flights (it was obviously difficult to set up ground facilities in oceans) and very costly (as a ratio between the cost of the aircraft and the cost of its avionics) for general aviation. By the sixties, ground-based radars could not operate beyond a zone of about 300 nautical miles radius. Thus, they could not be used for ATC over oceanic areas: this meant that, for the purpose of collision avoidance, the crew of an aircraft flying over the North Atlantic Ocean, for example, had to rely entirely on its navigation instruments to determine the aircraft's position and was requested to transmit periodically the estimated position data to the control centre. For this purpose, a very limited number of HF voice channels were available, and these began to be saturated by the end of the decade or to suffer from performance degradation due to propagation phenomena[4].

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[2] Nathan Goldaman, *Space Policy* (Ames: Iowa State University Press) 1992, pp. 155-156.

[3] "There are two modes of surveillance:

dependent surveillance which relies on the aircraft's position *measured aboard* and transmitted to the ground;

independent surveillance which relies on the aircraft's position *measured from the ground* (e.g. by means of a radar, or any satellite system)." Definition given by R. Collette to the author, letter 3 July 1995.

[4] Historical Archives of the European University Institute, Florence (HAEUI), ESRO/ST/341, ESRO Scientific and Technical Committee, Applications Satellites Traffic Control Systems, 2 February 1970.

Soon after Early Bird introduced commercial telecommunication services across the Atlantic Ocean by satellite (1965) discussions began on whether satellites could have a significant part to play in the future development of civil aviation – providing a more accurate means of communication and ATC or whether, conversely, the growth of civil aviation would provide a stimulus for the technological development of yet another kind of commercial satellite.

The rapid increase in aircraft traffic over the oceans forecast for the seventies (a projected 10% per year)[5], the expected introduction of larger and faster civilian aircraft for overseas flights (the Concorde, the Boeing 747 and the Supersonic Transport Aircraft, SST) and the anticipated growing scarcity and unsuitability of existing high-frequency radio communications channels, all highlighted the potentialities of satellites in this field for both communications and air traffic control (position fixing purposes or automatic reporting of aircraft position) in order to expedite and maintain a safe and orderly flow of air traffic and to optimize flight schedules[6].

Voice and data communications, surveillance functions in ground-air-ground networks using radio transmission including relay via an active earth satellite, navigation by computation of a position fix utilizing equipment self-contained within the vehicle (based upon the time of arrival of signals from two or more satellites whose ephemerides were known), search and rescue duties were among the most important activities foreseen.

Aeronautical services, as well as other specialized services such as maritime services, were not specifically included among those to be provided by INTELSAT, the global commercial communications satellite system which ruled the provision and management of public telecommunications via satellite since the interim agreement of 1964. Radio navigation or flight control were thus universally considered as outside INTELSAT's competence – and would continue to be so, against American willingness, even after the coming into force, in February 1973, of the new permanent agreement of August 1971[7]. Article XIV (e) of this new text would

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[5] The first official estimates were prepared by 1970 by FAA, "FAA Operational Requirements 1970-80 for Aeronautical Satellite Services via Satellites", 17 November 1970, cited in HAEUI, folder 50771 "The National Program on Satellite Telecommunications for International Civil Aviation Operations", 19 March 1971, attached to letter Nilson to Hammarström, 2 April 1971.

[6] Safety regulations in the late sixties were such that aircraft flying at the same altitude had to be separated by 120 nautical miles laterally and 20 minutes of flight time longitudinally. Without a satellite system, it was considered feasible to reduce these figures to 90 or even 60 nautical miles and 10 minutes respectively. By using a satellite system, it was expected to provide ATC centres with sufficient accurate aircraft position data for the values to be further reduced to 30 nautical miles and 5 minutes. *ESRO General Report, 1970*, p. 14.

[7] Steven Levy, "INTELSAT: Technology, politics and the transformation of a regime", *International Organization*, vol 29, n. 2, Summer 1975, pp. 673-674. More precisely, during the negotiations of the permanent agreement, the American delegation proposed a very broad definition of public

just mandate members establishing separate systems for "specialized telecommunications services [...], domestic or international" to "furnish all relevant information to the Assembly of Parties, through the Board of Governors". The Assembly, taking into account the advice of the Board, would make recommendations similar to those for the setting up of separate domestic services – whereas the Board would express "in the form of a recommendation, its findings regarding the technical compatibility of such facilities and their operation with the use of the radio frequency spectrum and orbital space by the existing or planned INTELSAT space segment" (Art. XIV (c)). The focus put 1. on the advisory capacities (as opposed to the executive capacities) of the Board and 2. on **technical coordination** rather than technical coordination **and the economic harmfulness** of the systems (as was the case for telecommunication satellites) greatly simplified decisions, diminished the probability of arbitrary decisions and liberalized the setting up of such services[8].

Theoretically, air navigation systems offered a splendid opportunity for Europeans for starting at much the same time as the US and working cooperatively for the North Atlantic traffic where the essential European need lay (more than 50% of aircraft flying over the Atlantic was operated by European airlines). The Europeans could, for the first time, participate in a new type of application satellite programme from its inception. The aim would be to participate in the development and use of the system. An early involvement would give Europe the possibility to acquire a satellite technology which would enable it to compete in the field of applications satellites for communication, broadcasting and navigation. This would imply having a say from the opening stages in the definition of the basic parameters and management rules of the new system, which had a good chance to become commercially viable and rewarding, provided that it was universally adopted by civilian airlines.

As we shall see in detail later, there were two motives of a different nature behind European willingness to get involved in these kinds of applications satellites. On the one hand, from an industrial point of view, the area seemed to open new economic and technological

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telecommunication including "all telecommunication services, fixed or mobile, which can be provided by satellite, to meet the communication needs of the general public or any segment thereof..." cited in *ibid.*, p. 674. This definition was endorsed in paragraph k of art. I, but was complemented by two important specifications: one that excluded from the definition "those mobile services of a type not provided under the Interim Agreement and the Special Agreement" [which did not include maritime or aeronautics services], the other which made reference to "specialized telecommunication services" over which INTELSAT action would be drastically restricted – these services including radio navigation services, broadcasting satellite services for reception by the general public, space research services, meteorological services, and earth resources services.

[8] Marcellus S. Snow, *The International Telecommunications Satellite Organization (INTELSAT)*, (Baden-Baden: Nomos Verlagsgesellschaft) 1987, pp. 84-87.

opportunities; an early entrance in the field would give European industry a competitive position with regard to the future market as a supplier of hardware for the space, air and ground segments. On the other hand, politically speaking, the setting up of such a system could be a leverage in the INTELSAT negotiations due to start in 1969. This would contribute to the credibility of Europe as a potential partner (in case of a cooperative venture) or competitor (in case of a unilateral action), and thus help to foster its requests to moderate the American monopolistic situation in the area of telecommunication satellites[9].

2. The actors

The problems of an aeronautical satellite programme potentially interested many separate sets of actors: users, producers and managers of the future system. They were:

- airlines flying international oceanic routes;
- the international civil aviation organization (ICAO), whose aim was to promote safety of flight in international air navigation and whose approval was needed for any operational activation of new communication services required for air traffic control;
- aviation administrations responsible for air traffic control services (air traffic control services were, in some countries, responsible exclusively for operational procedures, in others also for matters falling within the long-term policies);
- Comsat, the semi-private American corporation which managed INTELSAT[10];
- national agencies responsible for R and D in application satellites technology;
- private firms working in the field.

A seventh, institutionally less visible, but nevertheless important actor in the field was the category of pilots and air traffic controllers who were supposed to be the material beneficiaries of the projected system.

Each set of actors perceived the problem taking into consideration their primary goals, which differed substantially, as we shall soon see, and their specific roles[11]. Economic impacts on prices of the service represented, for example, one important consideration of civilian companies when evaluating future adoption of satellite communications. Even if excluded from the financing of the experimental pre-operational satellite, it was obviously the airlines that would have to

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[9] HAEUI, folder 51220, DG/5290/HB/hw, Minute (no author), 12 September 1968.

[10] For INTELSAT provisions, see further references.

[11] For the fundamental impact of users requirements over the definition of big technology projects in space application satellites (remote sensing and meteorology) see Pamela Mack, *Viewing the Earth: the Social Construction of the Landsat Satellite System* (Cambridge: MIT Press) 1990 and Pamela Mack, *Making big technologies serve the user: US remote sensing programs*, in John Krige (ed.), *Choosing big technologies* (Chur: Harwood Academic Publishers) 1993, pp. 95-107.

finance, through fees, the major part of the equipment in an operational system and they would have to provide the avionics on board their aircraft. The advisability of making the necessary capital investment was influenced by both the reliability and marginal cost-benefit of the system. This last element, on the other hand, was inevitably linked to the traffic volume, the evolution of costs and international prices and was bound to change following their changing estimates.

Other actors were more interested in safety requirements, industrial, security considerations, the pride of "special" élite professions (the pilots and the controllers). A special mention should be given to political considerations, which implied considerations of an internal nature – the power struggle between NASA, the Department of Transport/Federal Aviation Administration (DOT/FAA), the Office of Telecommunication Policy (OTP) and, behind the scenes, the Department of Defense (DOD), for the development and management of the American part of the system – and of more international flavour – US-European relationships in the highly critical period of the seventies (the cooperative project outlived Nixon's, Ford's and Carter's Presidencies and was only definitely abandoned during Reagan's administration).

As far as US industry was concerned, although it was thought that a large potential market (estimated at about $1 billion in a decade) could develop for mobile users of (aeronautical and maritime) satellite communication, the expected initial growth rate of such a market was slow. A political impetus was needed in order to impress on the civilian airlines the need and opportunity to use satellites for aeronautical communications[12]. The private sector was willing to exploit a new potential market, but it asked, and received, help from the state (it could benefit from the R and D funds put aside by NASA for Application Technology Satellites) and from the regulating international aeronautical organizations in order to impose this revolutionary shift on the potential users.

In 1966 the airlines and the Federal Aviation Administration[13] began satellite communications experiments at VHF (very high frequencies) with NASA Application Technology Satellites (ATS) 1 and 3[14]. Satellite-compatible avionics were developed in parallel. In view of the

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[12] Nixon Project, Washington, WHCF, Subject Files, UT1, box 14, Memorandum Walsh to Kissinger on AEROSAT, National Security Council Action 35902, 20 December 1971.

[13] Created by the Federal Aviation Act of 1958, the FAA was given sole responsibility for controlling both civil and military air traffic in the National Airspace System – certain airspace being reserved, though, for military use only.

[14] The overall objective of the Application Technology Satellite (ATS) programme was to investigate and flight-test technological developments for a number of satellite applications. They were used for developing and stockpiling technologies to be used by INTELSAT and by various military systems. Funds for the first five ATS missions were released in 1964 and ATS 1 was launched in 1966. By 1973, every fund for the continuation of the programme beyond the original five missions – of which the last one,

probable future congestion of VHF bands, thoughts were given, especially at European urging, to the study of an L-band (low frequencies) system to solve communication and surveillance requirements in the latter half of the 70s[15].

At the same time, the International Civil Aviation Organization (ICAO) began discussing technical specifications and international understanding on operating procedures within the new system from 1968 onwards[16]. As we have already seen, ICAO, whose membership in the mid-sixties included 120 contracting states (each one being represented in the Assembly), was responsible for adopting telecommunication standards for international civil aviation to assure safe and efficient operation. The development and approval within the ICAO of any standard, procedure and practice (SARPS) – with which participating states were requested to comply to the maximum extent possible – was a delicate procedure, based on technical as well as political considerations. It required approval by the majority of the contracting states and by 2/3 of the 27 members of the Council, the governing body of the organization[17]. The approval of ICAO would thus be necessary for the adoption by international airlines of any operational air traffic control system by satellites.

In March 1968, the ASTRA (Application of Space Techniques Relating to Aviation) Panel was established within the Air Navigation Commission (ANC) of the ICAO. Among its terms of reference was the study of those applications of space techniques which offered improvements in the safety, regularity and efficiency of international air operations. Members of the ASTRA panel were experts from Australia, Canada, France, the Federal Republic of Germany, Japan, the UK,

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ATS 5, launched in August 1969, partially failed – was cancelled by the Congress; ATS 6, the last ATS satellite, was launched in May 1974 and it was used, among other missions, to improve the communications links during the Apollo-Soyuz Test Project in July 1975. Linda Neuman Ezell, *NASA Historical Data Book, vol. III, Programs and Projects 1969-1978* (Washington DC: NASA), 1988, pp. 325-329; Burton Edelson, *The Experimental Years*, in Joel Alper and Joseph Pelton (eds.), *The INTELSAT Global Satellite System* (New York: The American Institute of Aeronautics and Astronautics) 1984, pp. 51-52.

[15] George Low Papers, Rensselaer Polytechnic Institute, Folsom Library, box 19, folder 2, Letter George Low, NASA Acting Administrator to James Beggs, Under Secretary of Transportation, 6 November 1970.

[16] The 1968 General Assembly resolved "that ICAO be responsible for stating the position of international civil aviation on all related outer space matters, and for stating international civil aviation's particular requirements in respect of applications of space technology". Quoted in HAEUI, folder 50242, attachment to Draft letter from the Chairman of the ESRO Council to the European Ministers responsible for Aeronautical Activities, 22 February 1971.

[17] Nixon Project, WHCF, Subject Files, UT1, box 14, Summary of International Aviation and Foreign Policy Issues in the Aeronautical Satellite Program, by the Department of State.

the USA, the International Air Transportation Association (IATA), the International Telecommunication Union and the World Meteorological Organization[18].

Discussions among members revealed deep divisions on the parameters of the new system, first of all on the issue of radio frequencies to be used (the US position in favour of VHF being supported by IATA, but strongly opposed by the other members). The establishment of a unified programme along with an informal constituency around a single parameter would have avoided these polarizations and, thus, the risk of ICAO being blocked over the issue of standardization.

In July 1968 the European Space Conference asked ELDO and ESRO to gather information on satellite navigational systems[19]. This interest was confirmed by the decisions taken by the European Space Conference in Bad Godesberg (November 1968) whereby the activities of ESRO were extended beyond the traditional scientific field to applications[20]. A much debated question in times of deep financial and organizational crisis, this new trend was confined, for the moment, to preliminary studies in communications, meteorological, aeronautical and earth observations satellites[21]. The studies on the Air Traffic Control (ATC) Satellite should cover technical, operational and economical aspects of the system, to be partly performed by industry.

ESRO studies were facilitated by the fact that France – the Centre National d'Etudes Spatiales (CNES) and the Secrétariat Général à l'Aviation Civile (SGAC) – and the UK – the Department of Trade and Industry and the Royal Aircraft Establishment – made available the results of their previous studies in the aeronautical field. In particular, CNES and SGAC provided information on a complete feasibility study know as Dioscures – a project for an air-traffic control system through the use of balloons covering the North Atlantic Ocean. For these experiments, up to three aircraft flew over the Bay of Biscay, communicating at various elevation angles and sea states via balloon-borne transponders with an experimental ground station installed at the CNES balloon base at Aire-sur-Adour. The efforts of CNES and SGAC represented by far the largest ones in Europe towards the definition of the requirements of an Air Traffic Control Satellite System over the Atlantic Ocean and towards the exploration of the most up-to-date techniques.

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[18] HAEUI, folder 50242, Attachment to Draft letter from the Chairman of the ESRO Council to the European Ministers responsible for Aeronautical Activities, 22 February 1971. IATA was an international association of civilian airline companies for setting up fares and service standards.

[19] HAEUI, CSE/CS(68)PV/4, 4 July 1968.

[20] John Krige and Arturo Russo, *Europe in space, 1960-1973* (Noordwijk: ESA Publications Division), 1994, pp. 55-65.

[21] Any decision on the Eurovision Eurafrica satellite, at the core of the commercial satellite programme, was postponed for the moment; see *ibid.*, and A. Russo, *The early development of Telecommunications Satellite Programme in ESRO (1965-1971)*, ESA Report HSR-9 (Noordwijk: ESA) 1993, pp. 48-50.

Economic and operational studies were also provided, as already hinted, by the UK[22]. From the beginning, the British resisted the perspective of a European project based on the French system, on the ground of its insufficient cost/efficiency[23]. Eurocontrol, on the other hand, stated that the ATC system would be economically justifiable by the SST only[24].

An Air Traffic Control "ad hoc" group of member states' aeronautical experts was set up on 29 May 1969 by ESRO (chairman, John J. Robinson) with the purpose of developing users requirements, gathering extensive information on all systems proposed (there existed more than one method to determine the position of a vehicle), assessing their relative merits and shortcomings, preparing system costs and cost/benefit analysis, proceeding further towards the development of satellite parameters and, more generally, harmonizing European views in anticipation of the ICAO ASTRA meetings[25]. In the first and following meetings, the group laid great stress on the importance and urgency of studying a traffic control system using geostationary satellites, able to perform its duties by the end of the seventies[26].

Besides the "ad hoc" group, two parties were working on the ESRO side of the Aeronautical satellite project:

- the Directorate of Plans and Programmes (DPP) (more precisely, the Space Application Division of the DPP), headed by Jean-Albert Dinkespiler, whose task was 1. to function as a filter between the ad hoc group and the various ESRO bodies (STC, AFC, Council); 2. to assure the agreements of the establishments and services potentially involved or affected by the decisions taken; 3. to coordinate contacts between ESRO and NASA.
- ESTEC (and, within ESTEC, the Satellite and Sounding Rockets Department) which was responsible for conducting intramurally or extramurally the studies necessary for arriving at

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[22] HAEUI, folder 8695, ESRO/PB-AERO(72)4, 12 October 1972, Experimental Programme. Costing Study of Satellite Navigation System, minutes of meeting n. 1 held at Paris on 13 August 1968 (Manuali, CNES, Collette, ESTEC, Ortner, HQ, Trollope, HQ), HAEUI, folder 51220. Project Dioscures, whose first technical report was dated the beginning of 1967, proposed a system for determining the position of the vehicle by measurement of distance from two geostationary satellites using transmission in the L-band; the method was also proposed by the American RCA and GE, but the French were trying to introduce sophisticated aircraft antenna to reduce the satellite size and mass within the limits of the ELDO launcher capabilites. HAEUI, folder 51220, Aide-memoire concerning the Feasibility study of an Air-traffic-control-satellite system, ATCS/PB/46, no author, 10 June 1969; HAEUI, folder 50242, Letter Aubinière (Director General CNES) to Bondi (Director General ESRO) 9 March 1970.

[23] HAEUI, folder 51220, Letter Dinkespiler to Ortner, 19 September 1968.

[24] HAEUI, folder 50242, Draft status report on European operations and economic studies in the field of Air traffic Control by means of satellites (ATCS), by Lennertz, Directorate Programmes and Planning, Annex V, 16 July 1969.

[25] Minutes of the first meeting of the ATC "ad hoc" group (29 May at ESRO). HAEUI, folder 51220, J.A. Dinkespiler, Director Programmes and Plans was in charge of organizing this group; HAEUI, folder 50242, Draft status report on European operations and economic studies in the field of Air Traffic Control by means of satellites (ATCS), by Lennertz, Directorate Programmes and Planning, Annex V, 16 July 1969.

[26] *ESRO General Report. 1969*, p. 128.

final system specifications, meeting the mission requirements as defined by the ad hoc group and the DPP. ESTEC was deemed to make the largest use of experience and expertise existing within its departments and ATF specialized divisions. In order to implement projects resulting from Council decisions, ESTEC was authorized to have direct contacts with national outside parties involved – CNES, SGAC or NASA[27].

3. The first ESRO-NASA contacts, 1969-1970

Soon after the creation of the "ad hoc" group, Hermann Bondi, ESRO's Director General, approached Thomas Paine, the new NASA Administrator, in order to coordinate efforts. The first ESRO-NASA exploratory discussions were held in NASA's headquarters in June 1969, under the newly elected Nixon administration[28]. Their aim was to "discuss the possibility and the way of performing common NASA/ESRO studies for a NASA/ESRO Air Traffic Control Satellite System (NETCOS)"[29]. This and further meetings were mainly devoted to technical discussions in order to confront ESRO and NASA mission specifications so as to arrive at a common one. By the end of July 1969 approval was given to a first draft of a NASA/ESRO mission specification (later to be frequently revised) for an experimental, pre-operational air traffic control satellite system to determine operational system requirements in the areas of technology and services and to determine the extent to which such technology could actually be used in controlling aircraft.

The main tasks of the system were:

- to monitor flight progress and separation between aircraft via satellite independent radio-determination techniques: the satellite radio-determination system should provide the Air Traffic Control centres with independent position determinations of sufficient accuracy and fix rate to permit the separation between aircraft to be reduced;
- to allow for communication – voice, digital data exchange and telegraph telecommunications – between aircraft and ground station(s) (at least one on each side of the Atlantic) and between Air Traffic Control centres[30].

The extension of these functions to ship traffic was deemed desirable but premature. Parameters for ground stations, aircraft avionics and radio frequencies (for both satellite/aircraft/satellite and ground/satellite/ground links) were specified.

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[27] HAEUI, folder 50242, The Air Traffic Control Satellite Project, Note concerning the distribution of responsibilities and cooperation between services involved, 20 March 1970.

[28] HAEUI, folder 50242, Letter Bondi to Paine, 30 June 1969; *ibid.*, Letter Paine to Bondi, 18 July 1969.

[29] On the American side, Barnes, Coerr, Ehrlich, Marsten, Morris; European representatives were Dinkespiler, Lennertz, Mayer and Vandenkerckhove; HAEUI, folder 51220, ESRO, Internal Minutes of the 1st NASA/ESRO meeting on ATC, 26 and 27 June 1969.

[30] HAEUI, folder 50242, First Draft of a common NASA/ESRO Mission Specification for a NASA/ESRO Traffic Control Satellite (NETCOS) System, 25 July 1969. Earth terminals, communications and air traffic control (ATC) centers were all generally defined as ground stations.

Technical characteristics such as transmission bands, the number of channels available, reliability and lifetime of the satellites, coverage and distribution of channels in that coverage, channel quality requirements, surveillance accuracy, the number of satellites and rockets to be used were still, and would remain for a long time, uncertain. For these reasons, cost estimates of the experimental pre-operational satellite were tentative and reached an overall expense of $120 million for both NASA and ESRO contributions – including the development of a 250 kg spacecraft, four flight units and three Delta launchers, ground facilities and aircraft equipment plus internal costs.

A revised version of common mission specifications was presented for comment to the ICAO in October 1969 and February 1970. The panel recognized that the project would be "an important contribution to joint international research and development" and agreed to recommend to the Air Navigation Commission (ANC) "that states directly concerned with this programme accept and act on any ICAO requirements and keep ICAO fully informed of all developments"[31].

By December 1969 the first working session including ESRO, NASA, the FAA and European ATC experts (Eurocontrol, UK Board of Trade, SGAC) was organized in Paris, the common leadership being provided by A. Jones (NASA, Goddard Space Flight Center, old director of Syncom project) and D. Lennertz (ESRO, Manager Air Traffic Control Mission)[32].

Throughout 1969 and 1970, upon NASA's insistence, ESRO/NASA discussions were kept exploratory and informal; neither management responsibilities nor industrial arrangements for the development of a common satellite were ever discussed. Moreover, NASA did not seem to have any combined official position with FAA, responsible since 1958 for controlling both civil and military air traffic in the National Airspace System[33]. Its difficulties were increased by the fact that the new Nixon Administration, which entered office in January 1969, seemed willing to take a strong position on the question of communication by satellite – and, actually, a proposal to establish a special office attached directly to the White House was presented by Nixon to Congress in February 1970.

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[31] Cited in *ESRO/ELDO Bulletin*, n. 9, April 1970, p.18.

[32] Information about this meeting is given in HAEUI, folder 50782, Minutes of the 4th NASA/ESRO review and coordination meeting on NETCOS, 10-12 December 1969.

[33] HAEUI, folder 51220, Vandenkerckhove report on discussions with NASA (Paris 1-2 December 1969), attached to DPP/AS/MAR/12 403, 23 December 1969. See also HAEUI, folder 50771, Report on attendance at 6th NASA/ESRO Review and Coordination Meeting on Aeronautical Satellites, NASA, 15-16 June 1970, and Associated Discussions, ESTEC.

All the same, the ELDO general report of 1969 noted with satisfaction "an encouraging similarity of views on various essential technical aspects"[34]. By 1970, Europeans felt entitled to believe that there was a broad understanding "that the formula to be drawn up should not follow that of previous cooperative programmes but should rather permit closer involvement of both sides of the Atlantic in all respects: in particular in the management of the programme, the design, development and manufacture of the hardware, and the development and use of the software"[35]. This formula fitted with the invitation that Thomas Paine had extended in October 1969 to Europeans to participate in the American post-Apollo programme and helped to create a rather rosy picture of the prospects of collaboration in space with the US in future. In the document which had been presented to Europeans on that occasion, the US declared themselves "ready to provide launch service and share technology wherever possible" and to "make arrangements to involve foreign experts in the detailed definition of future United States space programs and in conceptual design studies required to achieve them"[36].

The European position on financing, management and contracts was clarified to American partners by J.A. Dinkespiler in a letter sent to A. Frutkin, NASA's Assistant Administrator for International Affairs, in April 1970. A NASA/ESRO Integrated Project Team responsible for the execution of the programme was foreseen. External contracts were to be placed for the development, manufacture and test of space, air and ground segments; the distribution of work between the US and Europe was to be done in terms of percentage of contributions, which were to be equally shared between the US and Europe (with no transfer of funds across the Atlantic foreseen). The creation of consortia including European-US firms was deemed necessary: two consortia should be selected under tender action, to develop competitively the Project Definition Phase, at the end of which one consortium would be selected for the subsequent development phase[37]. The principle of availability and exchange of results obtained during the execution of the project – a principle which would be soon accepted in INTELSAT – was also asserted[38].

By March 1970 the possibility of using ATC satellites over the Atlantic beyond 1975 was positively considered by ESRO. An Experimental Programme was immediately started in view of

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[34] *ESRO General Report. 1969*, p. 128.

[35] HAEUI, folder 51220, Air and Maritime Traffic Control Satellite System.

[36] See Lorenza Sebesta, "The Politics of Technological Cooperation in Space: US-European Negotiations on the post-Apollo Programme", in *History and Technology*, 1994, vol. 11, p. 325.

[37] HAEUI, folder 50242, Letter Dinkespiler to Frutkin, 1 April 1970.

[38] *Ibid.*, Letter Bondi to Frutkin, 20 May 1970.

the aircraft/balloon[39] tests to be carried out in September of the same year. Participation of the UK, the USA (NASA) and Germany (observers only) was obtained as well as coordination with the French programme of tests. Air traffic safety and savings on operational costs for airline companies, resulting from the reduction of aircraft separation distances (lateral, longitudinal and vertical) were two of the main merits of the project[40].

After consultation with British, French and German air traffic control agencies, Bondi informed Frutkin about European willingness to proceed with an L-band system, instead of the hybrid VHF/L-band system the US were proposing[41]. The third ASTRA panel of ICAO meeting in February and March 1970 also stated its preference for the UHF frequency band for the system[42].

In July 1970, the ESRO Council accepted in principle the guidelines for cooperation between NASA and ESRO concerning the execution of an experimental and preoperational aeronautical satellite system over the North Atlantic[43]. Thereafter, the Ministerial Meeting of the ESC formally decided "to embark upon a programme of applications satellites" and in particular "to execute an aeronautical satellite programme and to make an immediate start on the project definition in cooperation with NASA". The Conference also decided to make available to ESRO for the rest of 1970 and for 1971 $ 5.8 million for this purpose. This decision was taken in the context that the estimated share of the cost to Europe of a North-Atlantic pre-operational system would be of the order of 60 million dollars (i.e. half of a 120 million dollar system). Informal presentations of the programme to European civilian airlines were made in August in Washington by the FAA/NASA and in Paris by ESRO. The beginning of discussions on an ESRO-NASA Memorandum of Understanding was scheduled for September 1970 and specifications, work statements and supporting working papers jointly prepared by ESRO and NASA[44].

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[39] Transponders carried by balloons were used as simulations of aeronautical satellites with the purpose of measuring multipath effects in the L-band, comparing various modulation techniques for voice data and ranging signals and testing the performance of high gain aircraft antennae.

[40] HAEUI, folder 50242, ESRO, 8779/PB/LV 16 March 1970, Considerations concerning the preparation of the Air Traffic Control Satellite Project.

[41] HAEUI, folder 50771, Letter Bondi to Frutkin, 14 May 1970.

[42] HAEUI, folder 50242, Report of studies carried out in the field of Aeronautical satellite systems during the period January 1970 to June 1970 (ESRO).

[43] Preoperational differed from experimental systems in that they would perform operational as well as technical evaluations. While such systems might often be designed as potential operational systems, they might also provide only some of the functions that would be required ultimately in an operational system. This definition is taken from the "Statement of Government Policy on Satellite Telecommunications for International Civil Aviation Operations", 7 January 1971, *cit.*

[44] For the July ESC Ministerial Meeting, see *ESRO/ELDO Bulletin*, n. 11, September 1970, pp. 8-24; also HAEUI, folder 50242, letter Depasse to Frutkin, 3 August 1970.

Placing of the contracts for these studies, however, was delayed pending the American government decision on the preferred frequency band and on the assignment of management responsibility within the US[45].

While awaiting the partner's decision, on 22 December 1970, ESRO approved a $5 million budget allocation for phase B studies of the technical parameters and design of an air traffic control satellite system for the North-Atlantic.

4. The first official American position on satellite telecommunication for international civil aviation operations, January 1971

On 7 January 1971 the reasons for NASA's cautious attitude towards Europe became clear. In a much publicized "Statement of Government Policy on Satellite Telecommunications for International Civil Aviation Operations", the Office of Telecommunication Policy (OTP) – a creation of the newly elected Nixon administration to keep under control both NASA's policies and private firms behaviour (especially on export licences) on telecommunication policy – defined US policy vis-à-vis satellite communications for overseas civilian aeronautical operations. This policy was to provide the framework for the development of aeronautical satellite programmes during the 1970s[46].

OTP was directed from September 1970 by Clay T. Whitehead, a young and resolute system analyst coming from the RAND corporation. The office was directly attached to the President of the US. Among its main objectives, the directive was to "assure that program institutional arrangements" be "responsive to the requirements of users, compatible with the evolving National Aviation System, and consistent with the foreign policy objectives and commitments of the United States".

Because of the involvement of the international community, the State Department was to be responsible, on the behalf of the Department of Transportation/Federal Aviation Administration (DOT/FAA) (which had the statutory responsibility for air traffic control), for seeking "international **utilization** of the pre-operational system and should initiate cooperative activity with

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[45] *ESRO/ELDO Bulletin*, n. 13, April 1971, *ESRO News*, p. 22.

[46] The policy was established "with participation by interested agencies in the Executive Branch". George F. Mansur, Deputy Director, OTP, chaired the study group and coordinated the OTP policy formulation. WHCF, Subject Files, UT1, box 14, Executive Office of the President, Press Release, Nixon Administration announces policy on aeronautical satellite communications, 7 January 1971. This statement was supplemented by another one issued on 19 March 1971 "The National Program on Satellite Telecommunications for International Civil Aviation Operations" (HAEUI, folder 50771, attached to letter Nilson to Hammarström, 2 April 1971) which followed the same lines.

other nations to establish an operational system in the Atlantic and Pacific ocean areas by 1980"[47]. The statement advocated that "unambiguous leadership" for the programme be vested in the DOT/FAA. It would be given the "responsibility for defining requirements, program budgeting, and management of pre-operational and operational systems activity" for the Pacific by 1973 and by 1975 for the Atlantic[48]. DOT should also explore along with "appropriate government agencies" the possibility of performing both aviation and maritime services from a single system.

The FAA should "contract for services on a lease basis in contrast to government procurement and ownership of systems". NASA was left to "conduct independent research and development on technologies which have broad application and, under the management and budget of the Department of Transportation, to provide other technical support unique to transportation applications"[49].

As far as technical parameters were concerned, in line with repeated European suggestions, the hypothesis of a hybrid satellite was abandoned and the UHF frequency band near 1600 MHz scheduled for both operational and pre-operational satellite air traffic control and communication.

Before publication, when the document had been circulated at the level of a draft within the responsible agencies, NASA had strongly reacted to both the prospect of such a restricted role for itself and to the limited internationalization of the programme. From this point of view, it had been pointed out that "US policy should recognize the desires of the Europeans to participate in the **development as well as the utilization** [emphasis added] of the preoperational system in the Atlantic and the desirability to the US, from cost-sharing and other standpoints, of having them do so". Therefore, NASA expected to continue, in concert with DOT and the Department of State, to work cooperatively with ESRO in further studies of the system to meet the requirements stated by the DOT-NASA memorandum and agreed by Europeans.

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[47] Emphasis added by the author of this paper. Pre-operational were those "aeronautical systems with emphasis on performing operational as well as technical evaluations. For the purpose of their evaluation they would need to operate in parallel with conventional communication and/or radio-determination systems serving Air Traffic Control. It is understood that carriage of the airborne elements of such systems would be on voluntary basis. It is also understood that while such systems might be designed as potential operational systems, they might also provide only some of the functions that would be required ultimately in an operational system". Nixon Project, WHCF, subject files, UT 1 box 14, Executive Office of the President, Office of Telecommunications Policy, "Statement of Government Policy on Satellite Telecommunications for International Civil Aviation Operations", 7 January 1971.

[48] *Ibid.*

[49] Nixon Project, WHCF, subject files, UT 1 box 14, Executive Office of the President, Office of Telecommunications Policy, "Statement of Government Policy on Satellite Telecommunications for International Civil Aviation Operations", 7 January 1971.

As far as NASA's role was concerned, the National Aeronautics and Space Act of 1958 had advocated for NASA the responsibility to develop advanced research for prospective applications, i.e. **experimental** satellites. As had happened with meteorological satellites (where NASA was collaborating with the Department of Commerce), NASA considered that its budgetary and management responsibilities should extend in aeronautical satellites to the **preoperational** systems, in case the experimental satellites were successful[50]. In this case "NASA should be responsible for the actual development, working against requirements specified by the responsible operating agency, at the appropriate time, for use in preoperational or operational systems". In the case of the US-ESRO satellite, NASA considered that DOT/FAA should be the lead agency, specifying the requirements to be met and managing preoperational and operational activities[51].

Some features of the OTP policy statement seemed to go against the preliminary guidelines reached between ESRO and NASA – mainly the **international utilization** of the system, versus its **joint development and utilization**[52], the **contract on lease basis** versus the government procurement and ownership of systems. Moreover, the legitimacy of NASA as credible negotiator on the US side was heavily damaged by the decision to entrust the whole responsibility for the satellite, in both the preoperational and operational phase, to the FAA/DOT[53].

It is important to remember that OTP's inflexible attitude towards cooperation on AEROSAT fitted into its extremely negative attitude towards US-European cooperation in space in general. In February 1971, one month after the release of the OTP policy statement, Whitehead heavily criticized the contents of US-European negotiations on the post-Apollo programme, whose sole effects would be, in his opinion, to give away US space launchers, space operations and related know-how at too low a price[54].

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[50] For interagency disagreements between NASA, the Weather Bureau and the Department of Defense on weather satellites see Pamela Mack, *Making big technologies serve the user: US remote sensing programs*, in John Krige (ed.), *Choosing big technologies* (Chur: Harwood Academic Publishers) 1993, pp. 96-99.

[51] Low Papers, box 19, Letter Low to Whitehead, 31 December 1970.

[52] In "the National Program on Satellite Telecommunications for International Civil Aviation Operations" statement, the American position towards international participation had been somehow bettered. Along with the new formulation "DOT/FAA, in coordination with the Department of State, should seek cooperation with other interested governments as appropriate in planning and implementing the National Programme"; see OTP, "The National Program on Satellite Telecommunications for International Civil Aviation Operations", 19 March 1971; HAEUI, folder 50771, attached to Letter Matt Nilson to Ove Hammarström, 2 April 1971.

[53] HAEUI, folder 50242, Draft letter from the Chairman of the ESRO Council to the European Ministers responsible for Aeronautical Activities, 22 February 1971.

[54] L. Sebesta, *art. cit.*, pp. 329-330.

5. *"There is room for mild optimism, but we have a lot of hard work ahead of us"*[55]*: towards the first ESRO-FAA Memorandum of Understanding, June-December 1971*

ESRO quickly reacted to the OTP announcement of January by an ESRO Council decision of 23 February 1971 to start three research contracts, each amounting to $600,000, with three European industrial consortia [Mesh/AEG, Cosmos and Star] for the predevelopment of the payload and other critical subsystems, to be launched in 1974-75 by an American Delta or by a Europa II rocket. These studies were started on 1 April 1971 and terminated in January 1973 when additional funds of $300,000 each were given for the continuation of the predevelopment effort on payload elements[56]. The specification and work statement took into account the result of the ICAO ASTRA panel meetings and were prepared by ESRO under guidance from the ad hoc group[57].

Soon after, G. Puppi, Chairman of ESRO Council, addressed a letter to all delegations proposing the creation of a European delegation (later to be called the European Ministerial Group for Aeronautical Satellites, which had its first meeting on 30 April 1971, headed by J.J. Robinson and, later, by the Spanish Minister for Air, Salvador Diaz-Benjumea) to explore the possibilities of further cooperation with the US in the light of these new developments[58].

Facing the prospect of the development of a rival system to a wholly US project – which could result in a potentially dangerous adversary within ICAO – the Office of Management and Budget (OMB) instructed DOT on 11 June 1971 to "fully explore the possibilities of making this [the aeronautical satellite programme] an international project" in order to further international cooperation in line with the President's overall objectives, to share the costs of the programme and to insure necessary approval by the ICAO. Ten of the twenty-seven members of the ICAO Council could veto standards – and both the Europeans and Canada had actually implied that they would veto a US-only system[59].

A first exploratory informal meeting took place between the US (the Federal Aviation Administration and NASA), ESRO (the European Ministerial Group for Aeronautical Satellites set up in March), Australia, Canada, Japan and the Philippines on 15-17 June 1971 in Washington.

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[55] The expression was used by Roy Gibson in his report on the Washington meeting, HAEUI, folder 50933, Memorandum Gibson to Hammarström, 21 June 1971.

[56] HAEUI, ESRO/PB-AERO(73)34, Annex I, Activities financed through the 1973 AEROSAT Budget, 14 November 1973.

[57] HAEUI, folder 50242, ESRO/CERS Communiqué, System Definition and Design Studies Aeronautical Satellite Programme, 21 April 1971.

[58] HAEUI, folder 50933, First Report of the European Ministerial Group for Aeronautical Satellites to Minister Lefèvre, ESC, 17 June 1971.

[59] NSC action 35902; Nixon Project, WHCF, Subject Files, UT1, box 14, Memorandum from John Walsh to General Haig on About-face on AEROSAT, 21 October 1971.

Europeans and Americans decided to stop their unilateral studies. The Europeans made unequivocally clear that they would not accept a preoperational programme in which they would merely be subscribers to services provided by a system unilaterally established by the US. The Europeans also made clear that financial support for a cooperative programme was available and if such a programme were not attainable, they would proceed on their own[60].

Notwithstanding the US delegation's initial hesitation on the cooperative formula for fear of consequent delays, the principle of a unified, joint programme for pre-operational aeronautical satellites was considered desirable: this was an impressive departure from the OTP's public declaration. Yet, problem areas which would be permanent weak points throughout the negotiations, clearly emerged under the more optimistic generalizations. These were questions related to the cost-sharing, the leasing versus pre-funded programme, the procurement procedures, the system management and launch priorities[61]. A joint International Collaboration ad-hoc Group (ICAHG or ASIC) (with four Americans, four Europeans, a Canadian, an Australian, a Japanese and a Philippine) was formed in order to consider the whole range of technical and administrative problems associated with the programme.

Its proposals for the creation of a unified aeronautical satellite system, to be called from now on AEROSAT, were discussed at a second meeting, held in Madrid from 3 to 5 August, under the chairmanship of the Salvador Diaz-Benjumea. "For the first time", commented the scientific expert of *Le Monde*, "cooperation with the United States in the field of application satellites seems to be getting underway under conditions of equality"[62].

According to the European report of the meeting "The Aeronautical Satellite Meeting concluded that to bridge the gap in time and knowledge between the current experimental efforts and an operational satellite capability anticipated around 1980, a preoperational aeronautical satellite system for Atlantic and Pacific Oceans be jointly developed, funded, managed, implemented and evaluated by Europe (participating ESRO member states and other European states associated with ESRO), the US (FAA) and other interested states, based on the principle of equal sharing of responsibilities, expenses and effort between the major parties (US/Europe) in which other states can participate, and based on a system specification to be jointly prepared". A

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[60] Nixon Project, WHCF, Subject Files, UT 1, box 14, Summary of international aviation and foreign policy issues in the aeronautical satellite program, no date, no author (but, probably, by the Department of State).

[61] HAEUI, folder 50933, First Report of the European Ministerial Group for Aeronautical Satellites to Minister Lefèvre, Chairman, European Space Conference, 17 June 1971.

[62] Dominique Verguèse, "Les Etats Unis et l'Europe étudient la création d'un nouveau système de communication par satellite", *Le Monde*, 9 September 1971.

distinction was made between the **integrated programme**, to cover the space segment – satellite development, the manufacturing of the spacecraft flight units, the launches, the satellite control facilities, the programme management – and the **coordinated programme** which should cover ground stations and developments of avionics[63].

The signature of a Memorandum of Understanding to formalize the agreement along these lines was envisaged for October, as was the creation of an AEROSAT Council for managing the project, to be composed of an equal number of European and American representatives. In the meantime the ICAHG would try to prepare a request for proposals (RFP), intended to generate proposals for design, manufacture and launch of not less than four geostationary satellites to provide preoperational aeronautical services. This programme was to be funded by the states concerned in accordance with their respective national policies[64].

After a further meeting in Washington (19-20 August)[65], the FAA reached an agreement on a joint project with ESRO (representing ten European nations), Australia, Canada and Japan in London in November[66]. Four launches would take place between 1974 and 1980, after which the operational system would be gradually set in motion. The agreement was limited to a pre-operational system for test and evaluation purposes, with the operational follow-on system to be negotiated in the future.

The essential features of the MOU were:

- provision for joint US-European procurement of four identical stationary satellites, two over the Atlantic and two over the Pacific, to be placed in orbits by 1977 at a cost ranging between $125 million and $142 million (cooperative programme);
- provision for separate but coordinated procurement of ground stations and pre-production aircraft avionics (coordinated programme);
- provision for use without charge of satellite capability by the major partners and the other nations wishing to join in the coordinated aeronautics experimentation (thus, the FAA was renouncing the leasing concept for the preoperational phase of AEROSAT). The US appeared to be by far the major utilizers and were expected to use about two-thirds of the system capability without user charges;
- Europeans were ready to assume half the full programme costs – half the launch costs, half the administrative costs of the management facility and the necessary US procurement to fulfil contractual obligations allocated to European subcontractors by an anticipated American prime contractor. The Americans agreed on a kind of *juste retour* principle whereby Europe would

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[63] HAEUI, folder 9356, folder 9356, Report of the "Aeronautical Satellite (AEROSAT) Meeting", Madrid 3-4 August 1971.

[64] HAEUI, folder 50933, ESRO/CERS Communiqué, 6 August 1971.

[65] All ESRO members but Denmark participated.

[66] HAEUI, folder 7706, ESRO AF(71)75, rev. 3, London, 22 November 1971.

obtain half the industrial contracts. While the choice of the prime contractor should be made according to an international bid (best price, best time and best cost) the prime contractor should have European partners carrying on the work;

- provisions for joint and equal management requiring unanimous US-European agreement through an AEROSAT Council on which the US and the Europeans, as a group, would each have one vote. This would be equivalent to a veto by either party;
- provisions for joint and equal ownership of the satellites. Because of the pre-operational character of the programme, ownership of the follow-on operational system, whose use would become mandatory after approval by ICAO, was to be subject of future negotiations.
- Australia, Canada and, most probably Japan, would participate on a non-partnership, advisory basis, each contributing $4 million and engaging in the testing and evaluation effort, but on a non-production basis.
- The MOU furthermore established that the FAA and ESRO should "ensure by means of their contract with the AEROSAT Contractor that they [were] able to obtain a full disclosure of all technical information and inventions generated by work performed on their behalf and that they [obtained] from the AEROSAT contractor the right, without additional payment to him, to disclose and use, and authorize others, under the jurisdiction of the Member States of ESRO participating in the Joint AEROSAT programme, of the United States, of the Commonwealth of Australia, of Canada and of Japan, to disclose and use, within the same jurisdiction, such technical information and inventions including any new embodiment so generated of a previously existing invention incorporated in such information" (art. 11, point 1). This article was similar in spirit and wording to the one introduced in the permanent INTELSAT agreement signed in August 1971, by which Europeans had obtained a much more liberal access to technology developed within INTELSAT than previously anticipated in the Interim agreement[67].

The MOU was to terminate on or before 1 January 1980.

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[67] The text of the agreement, opened for signature in August 1971 and entered into force in February 1973 (done and entered into force at the same dates) is in *Space Law and Related Documents. International Space Law Documents. US Space Law Documents*, 101st Congress, 2nd Session, S. Print 101-98, June 1990, pp. 211-318. Under article 17, INTELSAT would have "the right without payment to have disclosed to it all inventions and technical information generated by work performed by it or on its behalf" (point I) and "the right to disclose and have disclosed to Signatories and others within the jurisdiction of any Party and to use and authorize and have authorized Signatories and such others to use such inventions and technical information: a. without payment, in connection with the INTELSAT space segment and any earth station operating in conjunction therewith, and b. for any other purpose, on fair and reasonable terms and conditions to be settled between Signatories or others within the jurisdiction of any Party and the owner or originator of such invention and technical information or any duly authorized entity or person having property interested therein". Point D of article 17 further specified that INTELSAT should ensure for itself the right, on fair and reasonable terms and conditions, to disclose and have disclosed to Signatories and others within the jurisdiction of any Party, and to use and authorize and have authorized Signatories and such others to use, inventions and technical information directly utilized in the execution of work performed on its behalf but not included in paragraph B, to the extent that the person who had performed the work was entitled to grant such aid and to the extent that such disclosure and use was necessary for the effective exercise of the rights obtained pursuant to paragraph B. A similar provision was contained in point 4 of article 11 of AEROSAT MOU.

6. "About-face on AEROSAT"[68]: the deadlock on the ESRO-FAA Memorandum of Understanding

Despite positive consideration by the ASTRA panel of the NASA/ESRO programme, criticisms of AEROSAT were aired in 1971 by one of the major airline companies, TWA, by the organization set up by commercial airlines to provide joint point-to-point communications for all owners in the HF band (not entitled at the time to provide satellite communication services), ARINC, and by IATA, on grounds of "conservative" concerns. This behaviour was not unexpected, in view of the reluctance usually shown by organizations to adopt any new project implying long-term investments and deep organizational change that could be to the detriment of their current position. The airlines resented having substantially been excluded from negotiations on requirements and parameters; their criticisms mainly concerned costs implied in the future operational project (future increase in user charges) and its reliability (fear of possible UHF problems, for example)[69].

To these diffuse criticisms by future potential users, OTP added three strong objections to the text of the Memorandum – in this respect it is very interesting to note that George Mansur, a close collaborator of Whitehead in OTP, was Director of ARINC[70]. Peter Flanigan, Special Assistant to the President, was soon informed by Whitehead about these objections, which touched upon the ownership of the system, the production sharing versus competitive bid and the opportunities for use by maritime and other interested partners[71].

1. Ownership. Traditionally, commercial communications were provided by government-owned postal, telephone and telegraph (PTT) administrations in Europe, while a semi-private corporation, COMSAT, was entrusted to do the same for communications by satellites in the US. COMSAT's almost monopolistic situation within INTELSAT had been resented by Europeans since 1964 and this resentment was aired during the negotiations of the permanent agreement, begun in 1969. In AEROSAT, Europeans had decided to struggle for an international "version" of their state-owned systems. Therefore, the MOU established that the FAA and ESRO would become "**co-owners of the satellites**" (art. 7, point 4) and stated that ESRO and the FAA should "equally share the

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[68] This expression is used under the heading "subject" by John Walsh, member of the National Security Council, in a memorandum addressed to general Haig on 21 October 1971; Nixon Project, WHSF (Special Files), Staff Member and Office Files, Flanigan, box 9.

[69] HAEUI, folder 50933, Telegram from Israel to Vielliers, 22 October 1971; *ibid.*, Discussion paper by Israel (David Israel was Director, Office of Systems Engineering Management of the FAA) for the FAA/ATA/ARINC meeting, 1 November 1971.

[70] Information provided to the author by R.C. Collette, letter 3 July 1995.

[71] Nixon Project, WHCF, subject files, UT1, box 14, Letter Clay Whitehead to Alexis Johnson, Under Secretary for political affairs, 12 August 1971; *ibid.*, Memorandum for Mr. Flanigan, Attachment A, 14 February 1972.

responsibilities, expenses and efforts on the Integrated Program" (art. 1, point 1)[72]. By contrast, the policy issued by OTP in January stated that the Government should "utilize commercial telecommunications facilities and services to the maximum extent feasible in both pre-operational and operational systems". Though the expression "to the maximum extent feasible" seemed to leave a door open for some flexibility, OTP later clarified its wish to define the expression restrictively. Alexis Johnson, Under Secretary of State and State representative for US-European space cooperative affairs, was told in August 1971 that "ownership of the system [was] to be in the private sector with the FAA service requirements provided through lease arrangements"[73].

2. Production sharing versus competitive bid. In general terms, cost/efficiency considerations pushed for the choice of the most qualified among the bidders, while political concerns on the necessity to catch up technologically went in the opposite direction suggesting some sort of affirmative action to support weaker firms. It was the same question that had divided European space organizations and had been solved in ESRO through the *juste retour* formula, by which the percentage of European contracts had to be linked to the contribution of the country involved[74].

OTP's directive did not deal directly with this topic. However, the omission, against NASA's suggestion, of any reference to the share of development and management clearly indicated OTP's reluctance to co-handle these phases of the project. This reluctance was repeatedly clarified to FAA officials by George Mansur in summer 1971: the principle of competitive bidding had to be considered "implicit" in the OTP directive. Performance requirements, in contrast to equipment specifications, had to be the guidelines for any cooperative venture. In order to reinforce his statement Mansur made reference to a "clear precedent not to enter into arrangements with any nations whereby predetermined 'production sharing' by formula [was] a criterion for cooperation". American policy within NATO and INTELSAT were the "clear precedent" he was referring to[75].

References to both NATO and INTELSAT were somewhat dubious. NATO's application of international bids for armaments had been discussed within the US administration since the

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[72] The Joint Aeronautical Satellite Programme (referred to as the Joint AEROSAT Programme) consisted of an integrated programme and a coordinated programme: this last one dealt with ground facilities (communications centres and Earth terminals) and aircraft avionics (development, installation, testing and preoperational evaluation of the necessary aircraft avionics).

[73] Nixon Project, WHCF, subject files, UT1, box 14, Letter Clay Whitehead to Alexis Johnson, Under Secretary for political affairs, 12 August 1971.

[74] John Krige and Arturo Russo, *Europe in space, 1960-1973* (Noordwijk, ESA Publications Division), 1994, pp. 121-122.

[75] Memorandum for the file, on AEROSAT, Results of meetings of 15, 16 and 17 June 1971, George Mansur, 21 June 1971, *ibid.*.

beginning of the fifties, when the creation of an integrated defence production and procurement system was discussed. The criterion did not come to have universal support either among European allies or within the US administration. Favoured by the Department of Defence – especially concerned to keep international orders for its own military-industrial complex – it had been opposed by the Department of State and the European Cooperation Administration (ECA), willing to use arms production for political purposes. The latter two understood quite well that the structural and historical advantage of the US military sector would inevitably mean assigning all the contracts to US firms. Therefore, European states would be pushed, in their opinion, to give public subventions to military industries, keeping prices artificially low in order to compete in the international bids. In any case, the integrated system of procurement had failed by the end of the fifties and NATO integrated production was limited to some aeronautical projects[76].

Reference to INTELSAT as an example of international bidding was rather ironical. One of the big controversial issues within INTELSAT, as regulated by the Interim agreement (still in force until the ratification of the permanent one) had been COMSAT's willingness to give priority to in-house R and D over international contracts in order to give primary consideration to the corporation's need to increase its managerial competence and to discharge its task with the maximum possible efficiency. It was only under pressure from the other members that the percentage of contract expenditures had been progressively increased from 13% in 1968 to 50% by the end of the consortium's life, in 1972[77]. Reference to the procurement practice of "open international invitations to tender", with some limitations provided in the article, was added to the INTELSAT permanent agreement (art. 16) originally against COMSAT's will[78].

The FAA-ESRO MOU, on the contrary, "in view of the special nature of this partnership and to encourage the broadest future participation and competition on the industrial side" agreed that "the objectives of keeping costs to a minimum and entrusting the work to a competent

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[76] Till Geiger and Lorenza Sebesta, "National Defence Policies and the Failure of Military Integration in NATO. American Military Assistance and Western European Rearmament, 1949-1954", to be published in the proceedings of the conference *The United States and the Integration of Europe: Legacies of the Post-War Era*, St. Louis, 1993. See also Ine Megens, *American aid to NATO allies in the 1950s. The Dutch Case*, PhD Thesis, Groningen, 1994, pp. 183-189.

[77] Steven Levy, "INTELSAT: Technology, politics and the transformation of a regime", cit., pp. 661-664. The text of the Agreements establishing interim arrangements for a global commercial communications satellite system is in *Department of State*, press release n. 364, 28 July 1964, reproduced in House of Representatives, *Hearings before a Subcommittee of the Committee on Government operations*, 88th Congress, Second Session (Washington DC: US General Publishing Office) 1964, pp. 775-786.

[78] The provision of the interim agreement (contained in point c of art. 10 of the Special Agreement) attached to the Agreement establishing interim arrangements for a global commercial communications satellite system done in July 1964.

industrial contractor [should] be accomplished with **fair and reasonable distribution of work** among member states of ESRO participating in the Joint AEROSAT programme and the United States" (art. 7, point 3)[79].

3. Multiple (or general) user system. Guidelines provided by the OTP in January favoured the creation of a "single system" "to support both maritime and aviation services" in order to assure economic benefits. This directive, though, was discretional and left the Department of Transport the freedom to "work with appropriate Government agencies to explore the feasibility and desirability of such an approach". The ESRO-FAA memorandum, on the contrary, envisioned a pre-operational aeronautical satellite and did not make reference to the potential users of the system other than aeronautical companies.

On the basis of these three main objections, Whitehead and Mansur tried from August 1971 onwards to stop negotiations in order to obtain "an in-depth policy review prior to formalization of a joint program"[80]. Their reservations, Mansur stated, were shared by the industry and by the civilian airlines[81].

John Shaffer, Administrator FAA, did not deflect from his decision to pursue discussions with the Europeans, though admitting that proposal arrangements should be "subject to further review within the US government". On the contrary, he showed resentment for OTP's comments, which he qualified as "unfortunate" and which "could undermine our important relationships and dealings with the world's civilian aviation community. We certainly appreciated", continued Shaffer, "your point that this preoperational AEROSAT program has implications well beyond FAA's unique aeronautical interests; however, it is also important to note that FAA interests, responsibilities, and commitments to international civil aviation go well beyond and are much deeper than the telecommunication aspects of the AEROSAT program. This duality must be recognized by both parties" [82].

By the time the FAA began seeking budgetary approval, serious problems were raised by other high-level officials, such as Peter Flanigan, Special Assistant to the President, very close to Whitehead, and Rice, from the Office of Management and Budget (OMB). OMB's policy was part of a broader trend of the late 60s against the start of any public-funded space application

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[79] Possible participation by the industry of Australia, Canada and Japan was not excluded.

[80] Nixon Project, WHCF, Subject files, UT 1, box 14, Letter Whitehead to John Shaffer, Administrator, Federal Aviation Administration, 17 September 1971.

[81] *Ibid.*, Letter Mansur to Shaffer, 24 September 1971.

[82] *Ibid.*, Letter Shaffer to Mansur, 29 September 1971.

programme if not supported by a strong financial partnership of potential users[83]; all this had to be framed in a period of retrenchment of space expenses after the attainment of the lunar goal and in the context of serious internal and international economic crises.

In this specific case, criticisms stemmed from two main observations: 1. "US industry should be allowed to exploit its good competitive position in an unrestrained way"; 2. "a joint program would transfer to Europe technology which was expensively developed with US investment". Still, John Walsh, an authoritative member of the highly influential National Security Council, treated the first observation as a (highly disputable) "philosophical" stand, considered the technology transfer "more imagined than real" and favoured an open-minded approach to the problem. "Our already fumbling post-Apollo cooperation effort", he stated, "might be further crippled by our withdrawal from AEROSAT". "We are too far down the road", he added, "to back out with any semblance of grace at this time".

Henry Kissinger, the National Security Advisor to the President, was called upon to settle the dispute; Walsh prepared for his signature a Memorandum favouring the ratification[84]. State Department support for the ESRO-FAA memorandum was stated in two subsequent documents: a memorandum by Philip Trezise, Assistant Secretary for Economic Affairs, sent to Rice (OMB) on 20 October 1971 and a higher-level document sent from Under Secretary Johnson to Kissinger on 1 November[85]. The latter summed up the standard opinions in favour of cooperation:

- the unfavourable impact that a withdrawal could have "not only in future cooperation in post-Apollo and other space-related activities, but on overall US-European relations";
- a clear diminution of American influence in ICAO and, in case the US decided to go it alone over the Pacific, a possible decision by the Europeans to proceed unilaterally over the Atlantic. In this last case the Europeans had the power to make their own systems specifications as operational standard by ICAO over any competing US proposals – and the US had given (limited) assurances on their willingness to launch European satellites;
- a favourable balance of payments effect.

As for the technology transfer, Johnson thought that "given the state of the art in Europe, the benefits of a joint program (could) be obtained without the loss of United States technological

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[83] Homer Newell, *Beyond the Atmosphere. Early Years of Space Science* (Washington DC: NASA History Series) 1980, pp. 374-375.

[84] Nixon Project, WHSF (special Files), Staff Member and Office Files, Flanigan, box 9, Memorandum Welsh to General Haig, 21 October 1971, "About-face on Aerosat", National Security Council urgent action.

[85] Nixon Project, WHSF (Special Files) Staff Members and Office Files, Flanigan, box 9, Letter Philip Trezise to Donald Rice, 20 October 1971; *ibid.*, Memorandum Alexis Johnson to Henry Kissinger on DOT/FAA Preoperational Aeronautical Satellite Program, 1 November 1971.

advantage". Moreover the MOU included provisions ensuring the application of the standard technological export controls through the Munitions Control regulations[86].

These two documents reached Kissinger, as well as a supplementary piece of information on the industry position on the subject. Apparently, this paper had been prepared to offset claims by the OTP that US industry was totally opposed to the ESRO-FAA memorandum. Satellite manufacturers General Electric, TRW, RCA, Philco-Ford and Hughes during their conversations with representatives of the Department of State and DOT/FAA favoured, it was stated, such an agreement[87]. Moreover, with the exception of Hughes, they did not favour any "lease" arrangement.

On 17 November, Johnson was reached by a telegram, then passed to the White House, from the US Embassy in London, which stressed in strong terms European, and especially British, concerns for a possible delay in the signature of the Memorandum. "The British", it was said, "feel AEROSAT is a single element of space program for which (airline attitudes not withstanding) there is definite and early need". The hypothesis of a reconsideration of the US position was seen by the British as "pretty disastrous" (inverted commas used in the text to report UK position). In addition, the British government was counting on AEROSAT "to help its 'European problem'" by which it meant the overcoming of "the ambiguous British position caused by limited UK enthusiasm for European launcher development and other parts of European space programme". It was hoped that the memorandum could be signed before ESRO's decisive Council meeting in December 1971 in order to help foster Europe's difficult redirection of work towards application satellites[88].

The memorandum whose draft had been prepared by Walsh was duly signed by Kissinger on 22 November 1971, showing Kissinger's support for the State Department views: "I share your concern", stated Kissinger, "that withdrawing from negotiations at this stage would unfavourably impact overall US-European relations"[89].

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[86] Memorandum Alexis Johnson to Henry Kissinger on DOT/FAA Preoperational Aeronautical Satellite Program, November 1, 1971, Nixon Project, WHSF (Special Files) Staff Members and Office Files, Flanigan, box 9.

[87] In passing this document to Kissinger, Walsh commented on the industry's support: "I believe that a more apt description is that 'they can live with' an international program". Nixon Project, WHSF (Special files), Staff Members and Office Files, Flanigan, box 9, Memorandum John Walsh to Kissinger on Aerosat, National Security Council information 34695.

[88] Nixon Project, WHSF, Staff Members and Office Files, Flanigan, box 9, Telegram from US Embassy London to Secretary of State, 17 November 1971.

[89] "and have consequently so informed Mr. Flanigan", the memorandum ended. The text without signature is attached to Nixon Project, WHSF (Special Files), Staff Members and Office Files, Flanigan,

Soon after, the ESRO Council approved the so-called "first package deal", whereby nine member states (Belgium, France, the Federal Republic of Germany, Italy, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom) agreed to take forward the line of action approved at Bad Godesberg three years earlier. Three new satellite programmes were approved. The Aeronautical Satellite Programme, with a forecast cost of 100 MAU, was one of them – the other two being a yet undecided meteorological satellite programme (for a total of 115 MAU) and an equally yet undecided communications satellite programme (100 MAU being committed for its experimental phase)[90].

An Arrangement between the nine member states and ESRO concerning the execution of an Aeronautical Satellite Programme entered into force on 20 December 1971. Under this Arrangement, the participants decided to undertake, in cooperation with states that were not members of ESRO (the US, Australia, Canada and Japan), a programme aiming at the design, development, launching and exploitation of a pre-operational air traffic control system up to a ceiling of 100 MAU plus a 20% overrun (a clause which would subsequently be applied to all ESA optional programmes) calculated on the cost of the Space Segment Capability[91]. The envelope was to cover the organization's share of the integrated programme, the part of the programme that provided for the placing of the satellites in orbit as well as their operation throughout the 7-year period envisaged for the duration of the programme. The coordinated programme, covering the setting up of aircraft avionics and ground terminals was not included in the provisions of this memorandum[92].

Between 22 November 1971 and 9 February 1972, Kissinger reversed his position. His memorandum written on the latter date opposed the FAA-ESRO MOU on the basis of a review of domestic, Congressional and international considerations not further specified. OTP was directed to provide an updated statement of policy and to undertake responsibility for the substantive portion of the reopened negotiations[93]. By March 1972, the American government let the

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box 9, Memo Walsh to Kissinger on Aerosat, 15 November 1971; the signed copy of Memorandum Kissinger to Johnson, 22 November 1971 is in Nixon Project, WHCF, Subject Files, [EX], OS, box 1.

[90] J. Krige and A. Russo, *op. cit.*, pp. 105-107. Spain did not participate in the communications satellite programme.

[91] HAEUI, ESRO/AF(71)81, rev. 3. On 12 April 1973 the ESRO Council decided not to modify such an agreement, though proposing minor amendments its annexes; HAEUI, folder 8682, ESRO/PB-AERO/MIN/13 February 1974, Eleventh Meeting (21 January 1974).

[92] HAEUI, folder 8772, ESRO/PB-AERO(75)8, The AEROSAT Project, 6 May 1975.

[93] Nixon Project, WHCF, Subject File, UT 1, box 14, Memorandum Kissinger to the Secretary of State and the Secretary of Transportation, 9 February 1972.

Europeans know that the MOU which had been negotiated ad referendum was unacceptable: FAA would not be able to sign the draft agreement prepared in 1971.

This decision has to be understood in the framework of a more restrained attitude towards cooperation with Europe in space which developed in the US from the end of 1970 onwards. As a matter of fact international negotiations on the post-Apollo programme, which had been going on between the US and Europeans since the end of 1969, also experienced a final reduction of scope during the same months: in June 1972 the Europeans were informed that cooperation on the Space Transportation System (STS) had to be focused on Spacelab, one of the three elements originally open for foreign participation, the other two being the Shuttle and the Tug [94].

Some of the reasons presumably conducive to the hardening of the American position in this context can also help us in explaining the outcome of the AEROSAT negotiations. A special reference must be made, first of all, to NASA's decreasing willingness to collaborate with Europeans on the generous, yet indefinite, terms set out by Paine, after his departure from the Agency, in September 1970.

American interest was later weakened by the tormented decision taken at ESRO Council of July 1971 to complement the Bad Godesberg resolution on launchers (i.e. that European launchers would be used provided they did not cost more than 125% of the equivalent US ones) with the provision that the US should formally agree in principle to provide launchers for all application satellites referred to in the resolution, for both their experimental and operational phases[95].

The signature of the INTELSAT agreement in August 1971 further curtailed US interest in European cooperation and the effectiveness of the pro-European constituency at the Department of State. In addition, as has been already noted, there was a parallel increasing preoccupation shown by the officials of the new Administration about technological transfer or, as it was generally referred to, about the "give out" of American technology at cheap prices to allies in both military and civilian realms. This preoccupation, initially shared by a restricted number of high level officials of Nixon's entourage (Flanigan and Whitehead first of all) led to a thorough scrutiny of the problem by the National Security Council, which ended in 1972 with the adoption of a still classified national policy on the matter. Last but not least, one should remember that the reduction in scope of US-European cooperation occurred during the final stages of the preparation of the US-USSR Summit of Moscow (May 1972), one of whose outcomes was the decision to announce

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[94] L. Sebesta, *United States-European space cooperation in the post-Apollo programme*, ESA Report HSR-15 (Noordwijk: ESA) 1995, pp. 32-35.

[95] J. Krige and A. Russo, *op. cit.*, p. 108.

the bilateral cooperative space mission Apollo-Soyuz, whose official negotiations had begun in October 1970[96].

There is no doubt that, within the context of American foreign policy of that period, US-USSR détente (of which Apollo-Soyuz was an important element) had a clear priority over preserving ties with the old European allies. A brief sketch of US-European relationship within the context of American policy during the climax year 1971 will serve to better clarify this point.

Two events symbolize the drama in the country: the first was the start of the publication, in June 1971, by *The New York Times* of the Pentagon Papers which heavily criticized the government's handling of the whole Vietnam war, and, through it, the whole question of the US's "mission" in the world; the second was the top-secret meeting called by Nixon in summer 1971 to discuss the disastrous balance-of-payments deficit (accompanied by a severe reduction of gold reserves and the first US trade deficit since 1894) and to try to solve it. Neither representatives of the Department of State nor Kissinger himself were present at the meeting. The President relied, instead, on Treasury Secretary John Connally, who urged Nixon to put an end to the Bretton Woods system by refusing to sell foreign central banks any more gold and to stop defending the dollar's value at the Bretton Woods fixed exchange rates (thereby enabling the USA to continue running their deficit). In a blunt and somewhat coarse compact version of his philosophy, Connolly explained that "all foreigners are out to screw us, and it's our job to screw them first"[97]. When Nixon announced his New Economic Policy (NEP) on 15 August 1971 he warned against international money speculators who had been waging a war on the American dollar. Among the most popular decisions besides the floating of the dollar, there was the 10% tax on the value of all imports. What was generally perceived, among the same members of the Administration, as a general crusade against the other industrial democracies led to a war of nerves between the USA and a combative, and enlarged, European Economic Community – a treaty of accession was to be signed by the UK, Ireland, Denmark and Norway in January 1972[98].

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[96] For all these aspects, see L. Sebesta, "The Politics of Technological Cooperation in Space: US-European Negotiations on the post-Apollo programme", *cit.*, pp. 334-336.

[97] Seymour Hersh, *The Price of Power* (New York: Summit Books) 1983, p. 462.

[98] Frank Costigliola, *France and the United States. The Cold Alliance Since World War II* (New York: Twayne Publishers) 1992, pp. 167-172. On this point see also Pierre Melandri, *Une incertaine alliance. Les Etats-Unis et l'Europe, 1973-1983* (Paris: Publications de la Sorbonne) 1988, pp. 45-77; and the insightful account written by the then American Ambassador to the European Communities, Robert Schaetzel, *The Unhinged Alliance. America and the European Community* (New York: Harper) 1975, pp. 42-53.

Within this context, it was all too obvious that the Atlanticist constituency in the Department of State felt isolated and deprived of any real chance of advancing the European cause. Economic crises, this is a well-known fact, feeds isolationism; problems of internal social cohesion and national identity are not a favourable background for extensive cooperative efforts.

Nothing was heard about the alternative American position during 1972. In the meantime the 7th Air Navigation Conference of ICAO, meeting in April 1972, encouraged the states and international organizations "to carry out an international programme to provide a satellite system for experimentation and system evaluation"; "to develop in a timely manner specifications of airborne equipment to operate in such system"; "to make available to ICAO the plans, specification and program of the system"; "to ensure adequate liaison with ICAO on questions of mutual interest relating to the evaluation and development program"[99].

On 31 October 1972, at the first meeting of the AERO Programme Board – established through the December 1971 Arrangement between ESRO Member States and ESRO – a new group of experts charged with negotiating with the FAA – composed of Robinson (UK), Villiers (France), Eckhardt (Federal Republic of Germany) and Stadermann (Netherlands) – was created. Though willing to reopen negotiations with the USA, the Europeans were firm in reaffirming the necessity to secure a clause explicitly providing for work in industry to be shared on a fifty-fifty basis between Europe and the USA. Moreover, the Board considered that, until an international solution had been firmly secured, steps should be taken to safeguard a wholly European solution[100].

In order to move forward their decision, ESRO members enquired in October about the availability of US launchers for an aeronautical satellite to be launched over the Atlantic Ocean in early 1977, followed by a second satellite over the same ocean about one year later. Prices, time periods between order and launch dates, cost and payments schedules of DELTA 2914, Atlas Agena and Atlas Centaur rockets were requested by the Europeans and provided by the Americans[101].

On the other hand, the Europeans accepted the American wish to separate the handling of the avionics and ground terminal system, i.e. the use of the system (coordinated programme), from

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[99] Cited in HAEUI, folder 8698, ESRO/PB-AERO(72)1, 13 October 1972, HAEUI, folder 8692; see also *ibid.*, letter Hocker (ESRO Director General) to Fletcher 3 October 1972, Annex I ESRO/PB-AERO(72)7.

[100] HAEUI, folder 8671, ESRO/PB-AERO/MIN/1, ESRO Aereonautical Satellite Programme Board, First meeting (31 October 1972), 21 November 1972.

[101] Approximate costs for a DELTA launch were $10 million, rising to $15 for an Atlas Agena and $19 for an Atlas Centaur; HAEUI, letter Frutkin to Hocker, Annex I to ESRO/PB-AERO(72)7, 25 October 1972.

the development and ownership of the purely space capability (the space segment programme), to be negotiated directly with a commercial entity. To this end, at the beginning of November 1972 ESRO issued a press release in which it declared that "In pursuance of its intention to execute an aeronautical satellite (AEROSAT) programme, ESRO now plans on the one hand to select a suitably qualified American industrial partner to co-finance the development of the space segment, and on the other to enter into an agreement with the US and other interested aeronautical authorities covering utilization of the proposed system"[102].

By February 1973, COMSAT, Fairchild Industries, ITT World Communications Inc, RCA Global Communications and Western Union International Inc. informed ESRO of their interest in collaborating on the AEROSAT programme. Negotiations towards contractual arrangements were to be initiated in April 1973 with COMSAT and RCA in parallel, whose proposals had been deemed equally excellent[103].

7. A fresh start

COMSAT had been the first American commercial corporation to contact European authorities. In March 1972 McConnell, chairman of COMSAT's board of directors, and Charyk offered to A. Hocker (Director General of ESRO) possible arrangements for the establishment of a joint ESRO-COMSAT aeronautical satellite. In September, COMSAT wrote to the OTP in order to know if its intervention would be acceptable to the US government. Under the agreement envisaged by COMSAT and reported to OTP, there would be joint ESRO-COMSAT management, contracts would be awarded in response to bids offering the best combination of quality, price and the most favourable delivery time. The communication capacity of the satellites would be allocated to the partners in proportions to their investment in the joint programme. COMSAT was prepared to commit up to 50% of the programme; it would offer to lease channels to the FAA from its share of this capacity[104].

In a quite anodyne response, Whitehead clarified that an arrangement between ESRO and COMSAT ("or any qualified US company") would be "not inconsistent with national policy". In a following explanatory note, OTP stressed that such a programme should be preoperational in

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[102] ESRO, *General Report. 1972*, pp. 122-123.

[103] HAEUI, ESRO/PB-AERO(72)10, 27 November 1972, Annex, Selection of a US partner for the AEROSAT space segment. Report of the first phase: HAEUI, folder 8701, "Identification of Interested US Companies". HAEUI, folder 8716, ESRO/PB-AERO(73)15, 11 April 1973, Selection of a US Company for partnership with ESRO in the AEROSAT Space Segment Programme. HAEUI, folder 8749, ESRO/PB-AERO(74)17 (2 August 1974), Annex, Choice of the US Co-owner.

[104] Nixon Project, WHCF, Subject Files, UT1 box 14, Joseph Charyk, President, COMSAT, to Clay Whitehead, 22 September 1972.

nature and "without prejudice to any future operational system". The leasing of circuits provided by such a system, however, would be dependent on its meeting US government requirements and on the availability of funds through Congressional appropriations[105].

In order to answer COMSAT's requests and to respond to European enquiries on the modifications requested in the rejected Memorandum of Understanding, an agreement was reached in October 1972 among the Department of State, the Department of Transportation and the OTP on a new position on AEROSAT. This ended the stalemate lasting from the previous February. The US government was to negotiate the definition of the experiment (e.g. the type and quality of signals to be used) with ESRO but was to leave it up to an American company (COMSAT or otherwise) to work out arrangements with ESRO for the provision of communications channels for experiments and eventually, if supported by Congressional appropriations, lease them from COMSAT. ESRO was informed that, from now on, it should negotiate with a private US company an arrangement "to provide aeronautical satellite communication services necessary to carry out a joint governmental oceanic air traffic control experimental program"[106].

The year 1973 and the early part of 1974 were devoted to working out a new cooperation formula within this framework on the development and production of the payloads and on the availability of American launchers. Furthermore, some intra-European questions affecting the project needed clarification: 1. the negative attitude expressed by the British National Air Traffic Services towards some basic features of the programme in April 1973[107]; 2. the financing of the coordinated programme (avionics and ground stations); 3. the amendment of the ESRO-ESRO's member states' arrangement of 1971; 4. the development of alternative all-European options – by exploiting capacities within already-existing programs such as the OTS platform (AEROSAT and OTS had several technical elements in common) or Marots[108]. In the meanwhile, ESRO endeavoured to keep and develop the capacity of European industry regarding both system design and technology. Emphasis on the wish "that advanced technology be used, for the sake of

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[105] HAEUI, folder 8697, ESRO/PB-AERO(72)2, 13 October 1972, COMSAT Interest in AEROSAT Programme, plus Annex I, Letter plus attachments addressed to Dr. Hocker from Dr. Charyk (COMSAT), 18 September 1972; *ibid.*, Note handed over to the Director General of ESRO by Bromley Smith, US Office of Telecommunication Policy on 16 October 1972, Annex I to ESRO/PB-AERO(72)6.

[106] Nixon Project, WHCF, Subject files, UT1 box 14, Memorandum Whitehead to Kissinger and Flanigan, 2 October 1972.

[107] Reference to this letter is in HAEUI, folder 8717, Letter of the Director General of the organization to the Minister for Aerospace and Shipping of the United Kingdom dated 13 April 1973, attached to ESRO/PB-AERO(73)16, 16 April 1973.

[108] HAEUI, ESRO/PB-AERO(73)25, Study of alternative European solutions for an AEROSAT programme, 19 July 1973.

promoting space techniques" was expressed by all delegations, especially the German and the French, during the debates in the AERO programme board[109]. To this end some expenditure, though limited, was committed – 10.96 MAU at mid-1974 price level up to 31 December 1974. Other specific interests, such as the British one to have the ground station on its soil as a prerequisite for its participation in the programme, were also discussed[110].

The main problem, as singled out in a memorandum by the French delegation, seemed to be that "those responsible for space activities (might) rightly fear making heavy capital investments in a space applications system for the benefit of users whom they cannot clearly identify and who have not yet secured the means of carrying out a coherent specific action; they may also fear that this still-unclarified situation may continue in the future, particularly at the time when responsibility for taking decisions will rest mainly with civil aviation"[111].

In August 1974, a new agreement was signed. The main differences between it and the previous FAA/ESRO draft were the following:

- The scope of the programme was reduced, providing experiments over the Atlantic region only. However, subsequent extension to the Pacific was not excluded. As a consequence, Australia and Japan were no longer parties in the programme, which involved only two satellites to be placed in orbit.
- While the European contribution would take the form of pre-financing of the system, the American contribution would consist of the leasing of circuits by the FAA from a private company[112].
- Therefore, the responsibility for the production and implementation of the space segment on the American side was entrusted to a private firm selected by ESRO and approved by the American Administration. By September 1974 COMSAT was selected for this role. The principle of "diversification of procedure" was thus admitted: whereas ownership and pre-funding was adopted by ESRO and Canada, the US government opted for leasing the services from a private company, COMSAT, which was to become owner of the space segment, for the USA. Thus Canada and Europe being owners of 6% and 47% respectively of this part of the system, would not have to pay leasing charges while the FAA, not being owner of the system, would have to reimburse – in the form of leasing charges – 47% of the capital advanced by COMSAT.
- Following American pressure, an additional experimental VHF capability was introduced, hence introducing the obligation to use a more powerful launcher – a Thor-Delta 3914 instead of a 2914[113].
- The joint programme would not include responsibility for the establishment of communications ground facilities and the development, installation and evaluation of aircraft avionics. Each

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[109] See for example, HAEUI, folder 8673, ESRO/PB-AERO/MIN/3, 27 March 1973.

[110] *Ibid.*.

[111] HAEUI, folder 8745, ESRO/PB-AERO(74)13, Memorandum from the French delegation, 29 May 1974.

[112] HAEUI, ESRO/PB-AERO/Min/3, 27 March 1973.

[113] HAEUI, folder 8772, ESRO/PB-AERO(75)8, The AEROSAT Project, 6 May 1975.

signatory would retain a fair degree of independence in respect of the implementation of its own part of this so-called coordinated programme. As it would emerge from later discussion, a major problem for Europe in this respect was that while an efficient R and D organization existed, there was no organization of users for the operational phase of the programme.

At the request of the American authorities, the MOU contained a financial provision whereby the carrying out of the whole programme was subject to the express condition of the funds being available.

The programme was intended to be executed in fulfilment of recommendation 2/6 of the 7th Air Navigation Conference of the ICAO which encouraged the states and International organizations "to carry out an international programme to provide a satellite system for experimentation and system evaluation"; "to develop in a timely manner specifications of airborne equipment to operate in such a system"; "to make available to ICAO the plans, specification and programme of the system"; "to ensure adequate liaison with ICAO on questions of mutual interest relating to the evaluation and development program"[114]. The cost of the space segment programme was to be shared following a 47 (Europe)/47(USA)/6(Canada) percentage; procurement should be based on competitive tendering but, as in the case of the first memorandum, the percentage of industrial work was to reflect the proportion of each party's contribution.

In September of the same year, by 7 votes to one (United Kingdom) and with one abstention (of the Federal Republic of Germany), the AEROSAT Programme Board selected COMSAT General as the American partner for the Aerosat programme. British and German reservations stemmed primarily from their desire not to help reinforce COMSAT's monopoly in commercial satellite management. While COMSAT was a managerial company with no industrial capacity, the UK stressed the strictly industrial character of RCA, which it preferred, "the attractiveness of its offer and the improvements that it had very recently suggested making as regards the geographical distribution of the work"[115].

On 3 and 4 December 1974 the AEROSAT Council, the AEROSAT governing body of the programme, met for the first time in Washington; the Council members represented the three principal parties in the programme, the USA, Europe and Canada. The main concern of its first

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[114] Cited in HAEUI, folder 8692, ESRO/PB-AERO(72)1, 13 October 1972.

[115] HAEUI, folder 8687, ESRO/PB-AERO/MIN/17, Draft Minutes Seventeenth meeting, 4-5 September 1974.

meeting was the adoption of a schedule for the requests for proposals (RFP), which was eventually issued in early 1976[116].

Following the signature of the MOU, the implementation of the "Joint AEROSAT Evaluation Programme" started on the space side with preparations for procurement of the space segment and on the aviation side with the development of an overall system concept and evaluation programme and with the definition of the appropriate airborne and ground elements[117].

8. The FAA opts out

By 1975 the work of the AEROSAT Council was in chaos. At its fourth meeting (London, 24-25 September 1975), the US Delegation advised the body of the FAA's financial problems with respect to the programme. The reason was the escalation of the estimated programme costs, which appeared to have become twice the estimates prepared in 1974 and discussed with the Congress ($67,5 million for the space segment, $104 million in total). After having discussed with COMSAT General the terms of the lease contract, the FAA had apparently discovered that the lease scheme implied much higher costs than forecast. The severe impact of inflation played a great role in all this[118]. "The credibility of FAA as a partner" was put in doubt by a non-biased actor such as the Federal Republic of Germany: "The German delegation", as was stated on the AEROSAT Programme Board extraordinary meeting of 3 October 1975 called after the American announcement, "wondered how it was possible that FAA had discovered that it did not have enough money. It wondered whether internal pressures within the United States were not responsible, and whether there was any point in Europe pursuing its interest in the programme"[119].

In the meantime, a new situation was developing in civil aviation, as a reflection of the economic crises of the international system in the late 1960s. The abandonment of fixed exchange rates and inflationary policies, nascent protectionism, and, last but not least, the sudden and dramatic increase of oil prices in 1974-75 slowed economic performances and created very uncertain long-term perspectives for the development of air traffic. The cost of fuel, representing

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[116] A contractor was selected at the time, General Electric (associated with a large number of European, Canadian and US subcontractors) and a contract signed early in 1977, when the work was stopped by lack of funds from the FAA. HAEUI, Assessment of past events, Draft 2 JLM (no author), 12 September 1977.

[117] HAEUI, AEROSAT Development, attached to letter Geigner to Gibson, 17 April 1978.

[118] HAEUI, folder 3481, Statement by the US delegation, Annex ESA/PB-AERO(75)4, Aeronautical Satellite Programme Board, Fourth Meeting of the AEROSAT Council, 2 October 1975.

[119] HAEUI, folder 3465, ESA/PB-AERO/MIN/3, 15 October 1975, Aeronautical Satellite Programe Board, Extraordinary Meeting (3 October 1975).

25% of direct operational expenses in the early 1970s, increased by 50% in the early 1980s[120]. In addition, the introduction of a wide-bodied jet at the end of the decade (the Bocing 747), coupled with the abandonment of the American project for a supersonic civilian aircraft, the SST, in Spring 1971, on grounds of cost and environmental concerns, and the postponement and reduction in the number of Concordes – both projects were conceived to be strong users of the system – all heavily undermined AEROSAT[121]. The successful introduction of inertial platforms and navigation system (INS), on the other hand, improved navigation accuracy and further weakened the position of AEROSAT's sponsors[122].

In the wake of the Arab-Israeli war of October 1973, air traffic estimates made during the second half of the sixties appeared much too optimistic. ICAO's North Atlantic System Planning Group estimated in 1974 that traffic over the North Atlantic would be 10% less in 1974 than in 1973 and would probably not regain the level of 1973 before 1978. Civilian airlines, along with IATA estimates, were expecting to enter a period of deficits and increasing costs for users. In these conditions, it was not at all sure that one could continue to count "even on luke-warm support from the airlines" and the civilian aviation authorities.

In fact, there was reason to think that the number of HF frequencies, whose use had been improved through technical improvements, would be sufficient until the early 1980s and that only towards the mid-1990s would the available frequencies cease to be adequate to meet requirements. Almost all previous cost-benefit analyses seemed challenged by these new developments[123].

At the AEROSAT Council meeting of January 1976, the US delegation announced that it had solved its financial problems by adopting a modified approach to the financing of the program. In particular:

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[120] HAEUI, ESA papers, microfiches, ESA/PB-AERO(82)2, Perspectives de l'utilisation des satellites dans l'aviation civile, 14 April 1982.

[121] For the cancellation of the SST project, see D. Dickson, *The New Politics of Science* (Chicago and London: University of Chicago Press) 1988 (I ed. 1984), pp. 224-225.

[122] These reflections were made in the French document "Aeronautical Satellites – Luxury Gadget, Space Technology 'Consumer' or System of the Future?", presented at the ESRO AERO Programme Board, during the meeting of 29 May 1973, HAEUI, folder 8723. The French preference was for the third answer. The document was later reprinted by G. Villiers, under the title "Aeronautical satellites: luxury gadgets or system of the future?", in *Revue Française de Navigation*, n. 84, 1973.

[123] This opinion was voiced by the UK delegation at the ESRO AERO Programme Board, ESRO/PB-AERO/MIN/18, 13 November 1974, folder 8688. In December 1975 the French delegation to the Aeronautical Satellite Programme Board provided the committee with an "Economic study on aeronautical satellites" which, notwithstanding major uncertainties as to many future developments, was substantially optimistic on the utility of satellite communications and its cost-effectiveness from the 1980s onwards.

1. Launches would be excluded from the lease services. The American government would furnish the two TD-3914 launches as a part of its participation in the AEROSAT programme, and COMSAT would be credited with an amount equivalent to NASA's reimbursable charges for these launches (this meant that the FAA would pay for both launchers at government prices, but the other parties would reimburse their share at commercial prices and the payment of their contributions would be made directly to COMSAT General[124]);
2. The FAA would commence payment to COMSAT General on the lease two years in advance of the original schedule, thereby reducing the total payments to COMSAT.

These actions would result in a substantial reduction in COMSAT General's direct investment and an earlier payback of their investments[125].

After less than a year, however, the FAA informed its European partners of yet another anticipated slippage. The news was transmitted informally at the beginning of September 1976 while the new American position was officially announced during the 6th AEROSAT Council of 3-4 November 1976. The FAA's problem arose from a conflict between AEROSAT programme's provisions for long-term expenditures and American rules for authorizing the commitment of Government funds when a product like AEROSAT involved expenditure beyond the annual budget approval. Legal action would be necessary to obtain a waiver of the US Anti-Deficiency Act and it would take longer than originally planned[126]. By summer 1977 the US further clarified their position; it was "virtually certain" that the FAA would not be able to proceed with the AEROSAT programme as planned in the 1974 MOU due to unavailability of funds. In the eyes of the appropriations committees of the House and the Senate, AEROSAT should be deleted, except for funds to conduct a feasibility study programme. The reasons cited were the increasing costs and a much more modest rate of growth in the North Atlantic traffic than previously expected. The US delegation at the AEROSAT Council then proposed a reconstruction of the programme "having fuller support of both the provider and the user communities"[127].

The unequivocal nature of the FAA's financial difficulties was confirmed during the Eighth meeting of the AEROSAT Council in September 1977. The European delegation took note

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[124] HAEUI, folder 3505, ESA/PB-AERO(77)1, 5 April 1977.

[125] HAEUI, AC MIN 76-1, 21 January 1976, Annex IV, Agenda item 3.1: Statement of the US Delegation.

[126] HAEUI, AC MIN 76-3, Draft minutes of the sixth meeting, 3-4 November 1976 plus Annexes.

[127] HAEUI, AC WP 77-12 14 July 1977, Status of US AEROSAT Programme; AC WP 77-14, 2 August 1977, US Position Paper, attached to AC MIN 77-1 draft.

of this statement "more in sorrow than in anger"[128]. It was as if the exhausted European players felt relieved from the heavy burden of keeping in life a patient which had been moribund for too long. Yet it would take them another five years, until 1982, to dismantle the rather complex organization which had been set up around AEROSAT.

9. What next?

At the end of 1977 the ICAO Council disbanded the ASTRA Panel[129]. The European Conference of Directors of Air Navigation, in analyzing AEROSAT history, noted that "the civil aviation community at large had never yet been sufficiently confident of the need and the cost-effectiveness of aeronautical satellite services. Only when the aeronautical administration and the air operators were convinced on this score", they continued, "would a way ahead have any chance of success"[130].

In the meanwhile, European studies began exploring the possibility of associating maritime and aeronautical services by sharing spare capacity within Marots satellites or of re-utilizing existing satellite platform designs such as that of OTS[131].

In order to better understand the American position, it is worth mentioning that in June of the same year the first test satellite of the Navstar Global Positioning System (more commonly known as GPS) had been launched. Navstar was a military navigation satellite system for ground, air and sea mobiles. It was scheduled to **become available to civil users** in future, though in its lower accuracy version. Still, the Department of Defence worried that higher accuracy signals "could be used for the targeting of foreign weapons like the Scud" or "for Third World or terrorist cruise missiles"[132]. It would take advantage of the FAA's contemplated computer modernization programme in both the airborne part of the programme and the earth control centres.

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[128] HAEUI, folder 3511, ESA/PB-AERO(77)7, Future of the AEROSAT Programme, point 1: Report on the Eighth Meeting of the AEROSAT Council, 7 October 1977.

[129] HAEUI, AEROSAT Council, Tenth Meeting, May 1979, agenda item 4.1. External activities of interest to the Council, 15 March 1979.

[130] HAEUI, folder 3513, ESA/PB-AERO(77)9, Annex II, European Civil Aviation Secretariat, 2 December 1977.

[131] HAEUI, folder 3507, ESA/PB-AERO(77)3, Progress report on internal studies, 12 July 1977.

[132] Dwayne Day, "Transformation of National Security Space Programs in the Post-Cold War Era", paper presented at the 45th Congress of the International Astronautical Federation, 9-14 October, 1994, Jerusalem, Israel, p. 12 and pp. 11-12 for general information on NAVSTAR. See also Glen A. Gilbert (President General Gilbert and Associates Inc.) *Fourth Generation ATC. An Integrated System Concept for the 1990s into the 21st Century*, presented to J. Lynn Helms (FAA Administrator), December 1981. For DoD interest in "selling" GPS to civilian authorities, Aerosat Council, Notes on Preparatory Meeting of the Committee, 22 March 1972 in ESA Office, Washington DC, folder 137, Aerosat.

Implementation was forecast by the mid-1980s while full operational capability would be achieved by mid-1995 (as indeed happened).

The military need for communication, navigation, identification systems of high reliability and invulnerability against intentional jamming was obviously higher than that of the civilian field. It became even higher after the electoral victory of Reagan (November 1980) and the launching of the so called Strategic Defense Initiative (SDI).

DoD was, and continues to be, GPS's unique manager and the costs of the system were, and are, charged to US taxpayers via the military budget, although the system could be commercially exploited. This was, first of all, a much easier way to fund, develop, build and manage a highly complex technological system than that of the anticipated US-European frame-work. The double function of the satellite (civilian and military) definitely put a stop to what had been increasingly perceived as a "nuisance", not an opportunity, by the American administration.

The decision of the US government not to provide its share of the cost, and the opposition of the airlines to the execution of the programme, forced a reassessment of the programme in order to determine whether or not satellite techniques had an application to civil aviation. In order to facilitate it, the following AEROSAT Council meeting decided to involve in study programmes both the provider and the user communities. A Committee was then established (June 1978) – called the Committee to Review the Application of Satellite and other Techniques to Civil Aviation, abbreviated to ARC – in order to reevaluate the requirement for an aeronautical satellite programme, to reach an international consensus on its future role, the related time scale and associated costs and to develop a milestone chart for the critical elements of such a programme[133]. The work performed by the ARC was continued, under the aegis of ICAO, by a special committee named Future Air Navigation System (FANS). The committee established recommendations and plans for a future Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) system that were finally approved by ICAO in 1991[134].

Under the chairmanship of R.E. Cox of the British Civil Aviation Authority, the Committee had by May 1979 prepared a series of recommendations for a study programme dealing with the methodology, the subjects and areas for study and the tasks to be performed[135]. By the end

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[133] HAEUI, no folder number , AEROSAT Council, Minutes of the Ninth meeting, 18-19 January 1978; HAEUI, no folder number, AEROSAT Development, attached to letter Geigner to Gibson, 17 April 1978.

[134] Information provided to the author by R.C. Collette, letter 3 July 1995.

[135] Recommendations for a study programme, prepared by the Committee to review the application of satellite and other techniques to civil aviation (March 1979), in HAEUI, no folder number, AEROSAT Council, Tenth meeting, May 1979.

of 1981 it produced a three-volume study, the bulk of which (vol. III) was an FAA sponsored study called OASIS – an acronym for "Oceanic (and selected non-oceanic) Area Systems Improvements Study" –, an assessment of the manner in which the volume and pattern of air traffic would change in the years until 2005 and an analysis of the contemporary navigation techniques. Among the most important declarations was the one according to which "AEROSAT had foundered primarily because it could not be shown to be cost-effective"[136].

As we hope to have shown in this paper, this is a rather simplistic way to dismiss a highly controversial story, with many different kinds of actors and their relative aims; a story which took place in a context of increasingly difficult US-European political and economic relations.

Epilogue

Technology and users' requirements constitute the basic formal parameters that actors must take into consideration when discussing cooperative projects in commercial satellites.

On the one hand, technology set the limits of the potential actions to be performed by a device; on the other hand, users' requirements – both technical and financial – contribute to defining its scope. In the case of AEROSAT, the presentation of the project to ASTRA was originally considered a sufficient guarantee, in view of the fact that US/European negotiations had agreed on having a pre-operational satellite which was to be funded with public funds. No solution was found for a whole series of problems linked to the operational phase of the project. Decisions on it were postponed and negotiations were subsequently strictly limited to the pre-operational phase.

As the AEROSAT case clearly shows, there is always room for negotiation on technical specifications – negotiations are time-consuming, but compromises can be elaborated. By comparison, in the case of projects that represent a breakthrough in technology, it is more difficult to attract the interest of users who tend to be conservative in guaranteeing for themselves the position already acquired in the management of the old system and the exploitation of technology already developed. Cost/effectiveness concerns also play an important role; this is all the more true, if, as in the case of AEROSAT, it is not clear at which point the introduction of a new technique could have repercussions on tariffs of the service produced (this being especially true in a period of inflation and other *aleas* in operating costs due to uncertain factors such as oil prices).

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[136] HAEUI, EDA dep., microfiches, ESA/PB-AERO(81)4, Final Report of the AEROSAT Council's Review Committee (ARC), 26 November 1981.

Further difficulties emerge from the prospective competition between national firms which will be involved in the development and construction phase of the project. Whereas the pre-determined 'production sharing' formula can defuse competition, it conflicts with cost/efficiency considerations and with the interests of those firms which would be best qualified for winning international bids.

This set of interrelated problems greatly increases the 'structural' difficulties of cooperative ventures, those stemming from the fragmented character of such decision-making structures as the American one and requires a strong political intervention to induce the various national actors to agree or to accept the responsibility for their future hostility. National political leaders will accept to lose the support of some of their internal sponsors (such as, for example, industrialists) only if they perceive that they will get strong rewards from the cooperative endeavour they are promoting, or that their position will be remunerated by the international community in other related fields[137].

American political leaders lacked this perception: confronted with a determined internal opposition, they could not locate any strong reward in the prospective agreement. This negative perception was reinforced by a difficult phase in US-European relationships during the first half of the seventies and, after 1977, by the setting up of the military-sponsored GPS. The US went on their own way and European were later 'coopted' into their system.

This choice is worth some second thoughts. Leadership is obviously more efficient and economically rewarding for those who exercise it, and implies few risks of losing internal consensus in the short term. It requires, however, a politically hegemonic position and a technically dominant posture. Monopolies have to be enforced with overwhelming power politics and they always risk provoking the birth of at least one competitor in the international arena, when political as well as technical goals are at stake. The danger of antagonizing potential allies is high in times of precarious political relations, prospective transformation within the international system or qualitative changes in technology, especially if the allies are important users. Cooperation through consensual modes is more time-consuming and needs higher diplomatic negotiating skills, but, in the long term, the maintenance of an operative cooperative regime seems more convenient than pure competition even for the leading actor.

The actual sharp contrast between the USA and the Europeans on the building up of an autonomous European multi-users satellite system with civilian and military functions of data

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[137] On the theoretical aspects of this argument, see Robert Putnam, "Diplomacy and domestic policy: the logic of two-level games", *International Organization*, Summer 1988, pp. 427-460.

relay, navigation, communications and earth observation for both logistic military requirement and environmental monitoring, clearly shows the risks connected with the first course of action, i.e., agreements whose terms have been imposed through leadership instead of consensual modes[138].

[138] Assembly of Western European Union Colloquy, "Towards a European Space Observation System", 24-25 March 1995, San Agustin, Gran Canaria downloaded from Internet.

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