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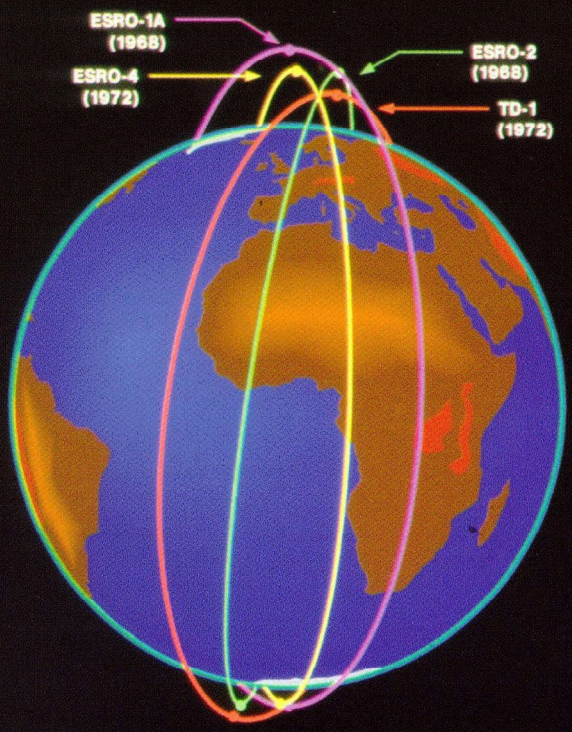
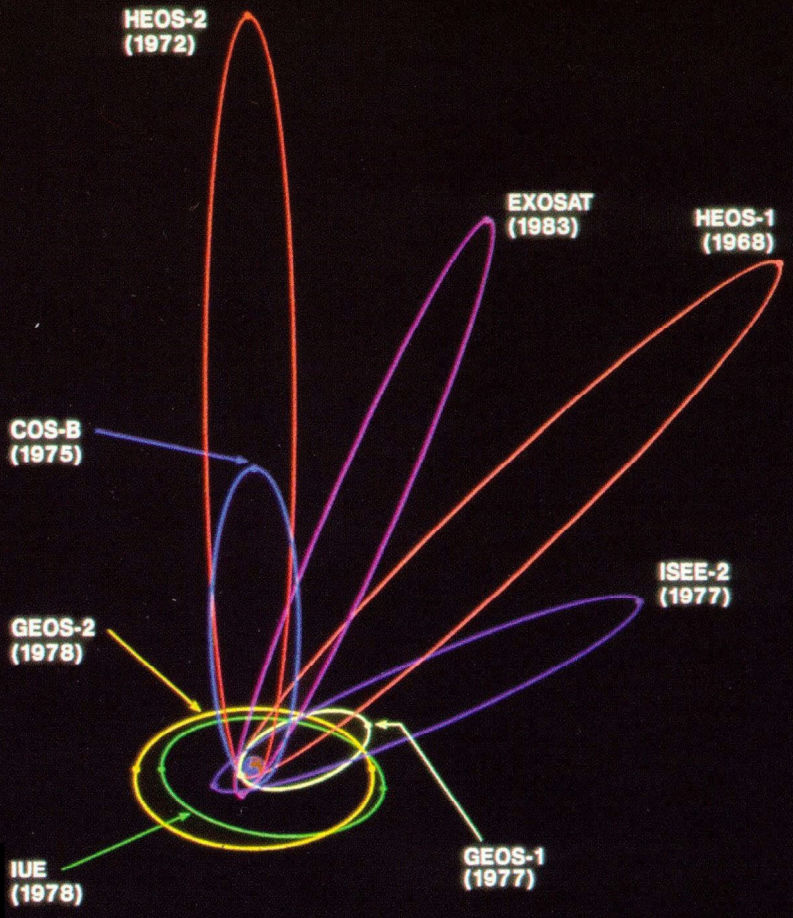
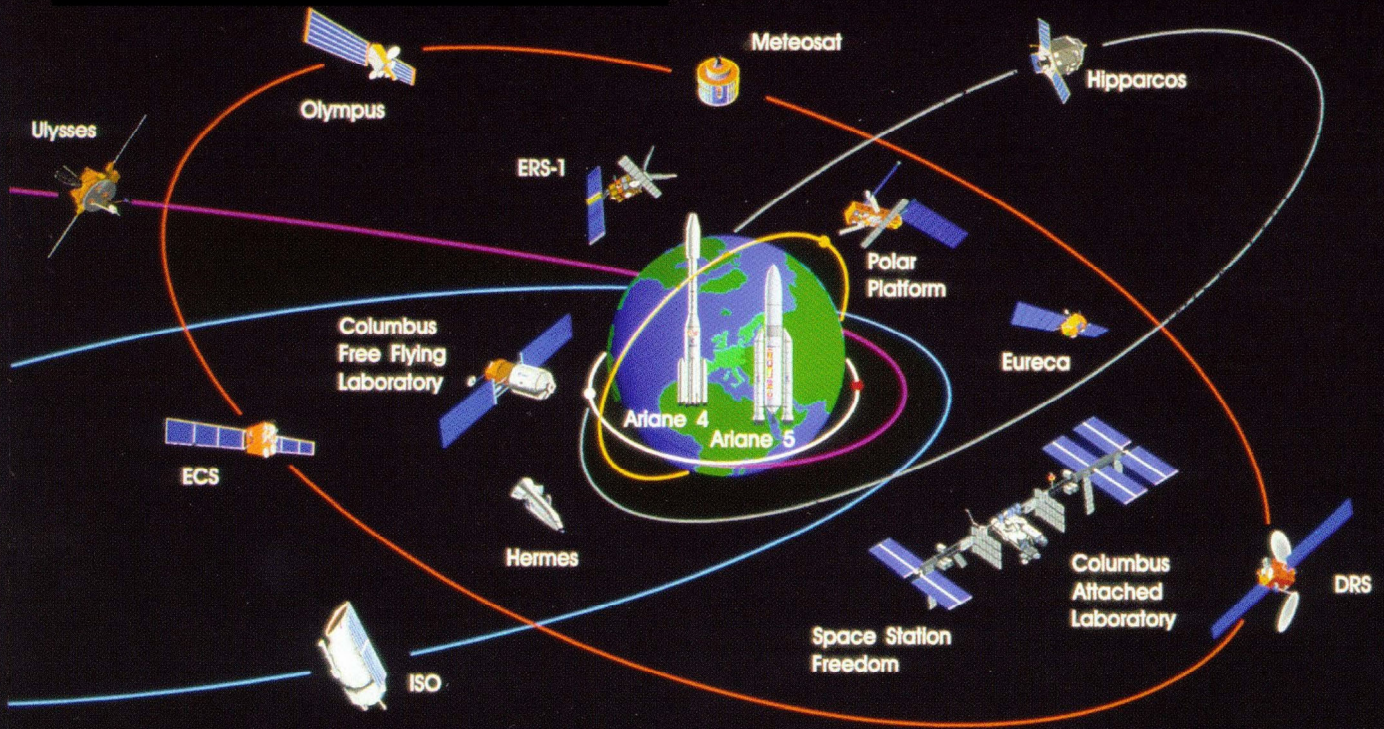




Europe in space: Edoardo Amaldi and the inception of ESRO

by Michelangelo De Maria



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Europe in space: Edoardo Amaldi and the inception of ESRO

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Dipartimento di Fisica, Università di Roma "La Sapienza"
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Europe in space: Edoardo Amaldi and the inception of ESRO[1]

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Table of Contents

1. Introduction

According to the French physicist Pierre Auger the first sketch of a European organization for space research was defined by himself and by his friend and colleague, the Italian physicist Edoardo Amaldi, during a peripatetic discussion they had in the Luxembourg gardens in Paris sometime in April 1959.[2] Shortly afterwards Amaldi wrote a famous paper, *Space Research in Europe*, which he sent to a number of influential European space scientists and

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[1] This paper is mostly based on primary sources found in the archive of Edoardo Amaldi. The Amaldi Archive, comprising several hundreds of boxes, is located at the Department of Physics, Università di Roma "La Sapienza". Work for its re-arrangement, ordering and cataloguing, started a few months ago under the direction of prof. F. Sebastiani, and is still in progress. Therefore, the numbering of boxes and folders reported in footnotes is provisory. I wish to thank dr. G. Battimelli, dr. C. Cattani and dr. L. Orlando and dr. L. Sebesta for help in locating some of these documents.

[2] Auger (1984); Krige (1992), p. 2.

science administrators.[3] This was the spark that triggered off a chain of reactions conducting to the foundation of the European Space Research Organazation (ESRO) in June 1962.

In the first part of this paper I shall analyse the nine months of incubation, from July 1958 to April 1959, which preceded the drawing up by Amaldi of his paper. The discovery of a number of important documents and letters in Amaldi's archive allowed me to clarify the crucial role played by Amaldi in conceiving, diffusing and defending among influential European scientific circles the project of realizing an "*euroluna*" (Euromoon), i.e. a satellite for scientific research jointly made and launched by Western European countries.

The project that Amaldi began to define in July 1958 sprang from political rather than strictly scientific considerations. In fact, as an active scientist, Amaldi was not a space scientist. But the International Geophysical Year, started in July 1957, had already produced the world-wide political shock of the *Sputnik* and the great scientific discovery of the Van Allen radiation belts, as a result of the first US satellite, *Explorer 1*. The space race among the Superpowers had begun, and Amaldi, as a scientific statesman, strongly believed that Western Europe should not accept to be cut out of space. As he put it, he considered it an "urgent necessity" for Western European countries to enter space. [4] The launching of one or more *Eurolune* made by a European space organization, would have had, he maintained, "a first order importance, both *moral* and *practical*, for all the countries of the [European] continent".[5]

The kind of European organization initially conceived by Amaldi was to be in charge not only of the construction of scientific satellites, but also of the development and firing of their launchers. It should comprise, therefore, both space scientists and experts in missile technology and engineering. And, more important, the planning, decision and control of its programmes should be left exclusively in their hands. Amaldi's project, in fact, was based on one main pillar: the military were to be kept out of the future European space

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[3] E. Amaldi to P. Auger, E. Amaldi to C. J. Bakker, E. Amaldi to J. H. Bannier, E. Amaldi to J. Hirsh, E. Amaldi to A. Hocker, E. Amaldi to J. Willems, E. Amaldi to F. Giordani, E. Amaldi to Broglio, all sent on 22 /5/1959, Amaldi Archive, box 212, folder 6.

[4] E. Amaldi to C.F. Powell, 6/2/1959, Amaldi Archive, box 212, folder 6.

[5] E. Amaldi to L Crocco, 16/12/1958, Amaldi Archive, *ibid.*

organization. Firstly, and this was the "moral" side of the coin, he conceived the conquest of space as a peaceful enterprise open to all mankind; therefore it should not remain an exclusive property of the military of both fields. Secondly, and this was the "practical" side, he considered the military environment as an obstacle to the best development of science, characterized by open co-operation and free exchange of ideas.

One of the founding fathers of CERN, Amaldi considered it as *the* prototype to follow, because it was a very successful example of an organization conceived and founded only "on the basis of *scientific and technical principles* and not on the basis of *political and commercial* arguments". [6] Accordingly, the new space organization was to be free from any political, industrial and military interference, like CERN.

Amaldi started to sound out a number of authoritative members of the European physics community. In particular, he got in touch with a number of top-rank high-energy physicists, members of a community with a strong group identity reinforced by the successful experience of CERN, and tried to convince them of the concrete feasibility of his project. Their answers shed light on the complex web of expectations, fears and hopes, ideological preconceptions and political idiosyncracies meandering through that community during the late '50s and early '60s. From these documents also appears their early awareness of the political and military implications of Amaldi's project, which made the application *ad litteram* of the 'CERN model' very implausible. This was due, in particular, to the foreseeable 'interface' problems with the military in the strategically relevant field of satellite launchers.

As to the best way of launching the new organization, Amaldi initially thought it sufficient to start with "a small group of experts who consider the problem with sufficient enthusiasm and can make propaganda in their own countries".[7] This group should prepare in a few months a plan of development of the future space organization and a first definition of its scientific programmes, to be later approved by Western European governments. But in February 1959 he knew from Auger that the *Comité des Recherches Spatiales* had been created in France with the task of defining a national space programme, and he immediately became convinced that such national space research committees should be founded, on the 'French model', in the other Western European countries, since they would represent the best institutional springboard for the take-off of his project. An international Confer-

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[6] E. Amaldi to J.B. Adams, 15/12/61, Amaldi Archive, box 210, folder 1; Amaldi's emphasis.

[7] E. Amaldi to P. Auger, 6/2/1959, Amaldi Archive, box 212, folder 6.

ence of delegates from national space committees would have had, in fact, much higher prestige and credibility for the founding of the new space organization than an informal meeting of a "small groups of experts". In the second part of this paper I shall describe the role played by Amaldi in establishing the *Commissione per le ricerche Spaziali,* a body of the Italian *Consiglio Nazionale delle Ricerche* (CNR), and in spreading the 'French model' in other European countries during the second half of 1959 and the first months of 1960.

Another early problem, strictly connected to the previous one, which Amaldi and his fellow scientists involved in the space project had to face was the identification of a suitable institution that could play the same role as UNESCO in the case of CERN. Different candidates —UNESCO itself, EURATOM, NATO's Science Committee, NATO's Advisory Group for Aeronautical Research and Development (AGARD)— were discarded as too "politicised". Two informal meetings of a small number of European scientists took place in Nice (January 1960) and in Paris (February 1960). Finally, in April 1960, with the "enthusiastic" adhesion of the British space scientists, the Royal Society became the institutional cradle of the project. This new framework represented a dramatic change in the external 'visibility' and credibility of the project, finally allowing its official start.

Soon after the first Royal Society meeting, Amaldi stepped aside from the European space scenario. In the last part of this paper I will give a tentative explanation for his abrupt withdrawal and, at the same time, I will describe the important role played by Amaldi in mobilising the cosmic-ray physicists of a number of Italian Universities and in starting the first national space programme. Finally, I will describe the lost battle conducted by Amaldi in the fall of 1961 against ELDO and in defence of the scientific 'purity' of ESRO, analysing the reasons of the defeat of his orthodox "CERN model".

2. Amaldi's dream of "a Euroluna before 1965" takes shape

Edoardo Amaldi started to reflect on the possibility of developing an adequate activity in Europe in the field of satellites and launchers towards the end of July 1958, after a conversation he had at the physicist Giorgio Salvini's home in Rocca di Papa[8], a small town near Rome, with his old friend Luigi Crocco. Crocco was at that time professor of "Aerospace

[8] Salvini was at that time professor of "Experimental Physics" at the University of Rome, and director of the 1 GeV electro-synchroton project at the National Laboratories in Frascati.

Propulsion" at the Department of Aeronautical Engineering, Princeton University, and an expert in rocket propulsion. [9]

Amaldi believed that the conquest of space should not remain an exclusive prerogative of the Superpowers, and got convinced that "if the European experts in the field of launchers and satellites begin to move immediately, in 1965 they will be able to give, beside the American and Russian groups, a quite substantial contribution to the study of space problems". The development of satellites and launchers was evidently not on the scale of small countries like Italy, for both technical and economic reasons, and could only be faced on a European scale "like it had been done for the problem of big particle accelerators with the creation of CERN".[10]

With this idea in his mind Amaldi started to move immediately in search of allies. First, at the end of July 1958, he wrote to his colleague Luigi Broglio, one of the few Italian experts in rockets, who was at that time director of the Institute of Aeronautical Engineering at the University of Rome "La Sapienza" and a colonel of the Italian Air Force.

As Amaldi later put it, Broglio expressed initially "a substantial agreement on the theoretical formulation of the problem but also a noteworthy skepticism regarding the feasibility of a concrete project".[11] In fact, Broglio agreed with Amaldi that the development of launchers and satellites was an objective of so complex a realization that could not be reached but through co-operation with other nations, and considered Amaldi's initiative worth of attention "both for its important scientific aspects and for its high moral effects". However, he expressed all his doubts about the difficulties that could arise in reaching an international agreement in a field where "military interest is highly pre-eminent, particularly in the case of an extra-military management".[12]

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[9] Crocco had been also scientific consultant of the FIAT Company and of NATO's Advisory Group for Aeronautical Research and Development (AGARD); for more information on AGARD see note 23.

[10] Note 5. Amaldi was not the first to think to the creation of a European Space Organization modeled on CERN. As early as December 1957 J. Blamont had advanced the same plea; see Krige (1992), p. 8.

[11] Note 5.

[12] L. Broglio to E. Amaldi, 28/8/1958, Amaldi Archive, box 248, folder *Corrispondenza con Broglio, 1958-1961.*

After Broglio's rather cold reaction, Amaldi decided to discuss his idea with a number of colleagues in the international physics community, and in particular with some of his old allies in the battle for the creation of CERN.

Early in September 1958 Amaldi, then in Geneva, discussed his project with his old friend Isidor Isaac Rabi. Rabi was one of the most important physicists of the Los Alamos generation who had contributed to shape the U.S. security and scientific policy during the late 1940s and early 1950s, serving on key scientific advisory committees of both the Defense Department and the Atomic Energy Commission, and as a consultant at the Brookhaven National Laboratory.[13] But, even more important to Amaldi, Rabi had played a crucial role in the foundation of CERN as a US delegate to UNESCO.[14]

Rabi considered very favourably Amaldi's project and declared that, should Amaldi's initiative be developed, he would do everything possible to assure the support of the U.S. Moreover, in his quality of delegate of the U.S. Government in the Scientific Committee of NATO, Rabi suggested that this agency could initiate the project. But Amaldi strongly dissented on this last point, for reasons that we shall clarify later.

In the following months Amaldi kept moving on in his quest of support among his *confrères*. In November 1958, he discussed the issue at CERN with H. S. W. Massey, an acknowledged authority of space research in Britain, who was soon to become the powerful chairman of the British National Committee for Space Research (BNCSR), set up by the Royal Society in December 1958.[15] As Amaldi later commented with Crocco, Massey was "rather sceptical. But this is the normal British attitude in front of any continental initiative".[16]

Amaldi did not surrender in front of the cold reaction of Massey, and early in December 1958 met at CERN Francis Perrin, one of the most influential leaders of the French physics community. Perrin enthusiastically endorsed Amaldi's project and even pro-

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13 Kevles (1978), pp. 368 and 376-377.

14 Pestre in Hermann, Krige, Mersits and Pestre (1987), pp. 82-89.

15 Massey & Robins (1986), p. 62.

16 Note 5; cf also E. Amaldi to P. Auger, 6/2/1959, note 7; informing Auger of his colloquy with Massey, Amaldi commented "*Massey en bon anglais s'est démontré plutôt sceptique*".

mised him "to find some authority in the field of launchers in France to propagate [Amaldi's project] and to put the foundations of a provisory organization".[17]

After this first tour of contacts, on 16 December 1958 Amaldi wrote to Crocco in Princeton in search of advice and help. On this occasion he worded for the first time an already full-fledged conception of the main features of the future European space organization, a conception where his strong Europeanistic political feelings were intertwined with his vision of scientific research as a free and peaceful international enterprise.

First, as to the membership of the future space organization, according to Amaldi, besides the six countries of EEC, at least Great Britain and the Scandinavian countries were to be co-opted. As to Great Britain, Amaldi, who had in mind Massey's sceptical reaction and well remembered the British early reactions in the case of CERN, [18] remarked that "at first England would limit herself to send some observers and probably would offer some opposition, but certainly she would end by giving an essential contribution from the moment the project begins to assume a concrete aspect".

Amaldi thought it sufficient to start with a small group of experts from the main countries of continental Europe —at least from France, Germany and Italy— who should prepare in a few months a plan of technical development for the future organization containing: a) a well-defined aim, "so high to be comparable with the goals prefixed by the USA and the USSR in this field and to justify the European character of the enterprise", b) an evaluation of the specialized staff needed, and c) a realistic schedule of times. This programme should then be approved by Western European governments, giving birth in this way to a European space organization with an adequate budget. Amaldi underlined a first difficulty for the creation of the new organization: while, in the case of CERN, UNESCO had played the role of its "mother and wet-nurse", he did not know which international agency could play the same role for the future space organization. However, one thing he thought for certain, the Science Committee of NATO, as suggested by Rabi, could not be "its best mother". In fact, he considered "absolutely essential" (Amaldi's underlining) that the future Organization "had not a military character and no connection with whatsoever military agency". [19]

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[17] Note 5; cf. also note 7.

[18] Pestre in Hermann, Krige, Mersits and Pestre (1987), pp. 169-174. See also note 5.

[19] Note 5.

Amaldi's position against any form of co-operation or, better to say, 'contamination' with the military in pure science, always crystal-clear through his entire life, was rooted in his conception of scientific internationalism. The new space organization was to be "purely scientific" and "open, like CERN, to all forms of co-operation both inside and outside the member countries". In order to fully understand Amaldi's views on the relations between science and the military we should not forget his active engagement in those years in the *Pugwash* movement.[20] But Amaldi's ideas were not naively pacifist. He thought, in fact, that an organization free from any military influence, like the one he had in mind, would determine in all the member countries the strengthening of their scientific and technical structure, which "would evidently produce great benefit also in the military sector [...] but would not make the realization of its programme more difficult and complicated, as it would happen if the military, directly or indirectly, were its masters".

As to the scientific programmes of the future organization, Amaldi thought that its initial projects should include both the construction of common European laboratories "to resolve the problems of major importance", and a programme of "collateral researches to be done in the participating countries". As for the specialized personnel needed, Amaldi was convinced that the future organization "would attract the brightest part of the young generation and make possible the recovery of scholars who work outside Europe". [21]

In conclusion, Amaldi asked Crocco to become one of the "activists" of his project and to let him know the names of "the most competent and open people of the [space] field in Italy, France, Germany, England and the Scandinavian countries". Amaldi did need to know the name of some experts also from Italy, since Broglio still appeared to him "too sceptical to enter this track at least now", and he himself, not being an expert in the field, wanted to limit his contribution to "the launching of the idea in this moment, and —a few years later, if the idea had borne fruits— to the collection of the data obtainable with this kind of activity".[22] He also asked Crocco to send him the address of Theodore von Karman, who in 1952 had founded the NATO's Advisory Group for Aeronautical Research and Development (AGARD).[23] According to Amaldi, in fact, "a man of his authority, if

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[20] A rich documentary evidence about Amaldi's activities in the *Pugwash* movement during the years 1958-1961 is in Amaldi Archive, boxes 242, 245 and 263.

[21] Note 5.

[22] *Ibid.*

favourable, could exert a noteworthy influence". It should be remembered that early in 1958 von Karman had proposed to launch a NATO satellite for peace as an answer to the *Sputnik*, but von Karman's idea was finally dropped because the U.S. State Department objected that NATO was a military organization and "peace satellites were not its business".[24] Sending his best wishes for Christmas to Crocco, Amaldi included also that of "a *Euroluna* before 1965".[25]

Crocco consented to Amaldi's ideas "with much interest and enthusiasm". He shared Amaldi's view that a non-military organization would represent the best solution "from both a diplomatic and a scientific point of view"; however, he warned Amaldi of the risks and difficulties that the realization of his project would meet, stressing how an automatic application of the "CERN model" to space was a pious illusion, because of the structural and political differences between the two cases.

A first problem to face was the military presence in the field, as testified by the case of NASA. In fact, its foundation, provoked by the "Sputnik psychosis", did not take place "without considerable intestine fights, because everything done so far in the field of missiles, big rockets and satellites [...] has been realized by the military or under their patronage", and the corresponding technology was "private property of the military". [26]

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[23] von Karman had started to think of using NATO "as a 'pilot plant' to test out the feasibility of international scientific co-operation" immediately after the birth of NATO in April 1949. After a long gestation, AGARD was founded in February 1952. Its scientific activities were focused only on "unclassified items", which gave AGARD, according to von Karman, "greater freedom in the selection of scientific projects" and allowed AGARD scientists "to meet on an easier basis with scientists of other nations". AGARD's activities were initially focused on defense research: in 1956 AGARD was asked to study the technical requirements of a NATO's light fighter plane for low-flying night strike and reconnaissance missions without a prepared runway for take-off. Italy's FIAT Company was finally recommended for the first generation plane. The director of FIAT Aviation, ing. Giuseppe Gabrielli, was the brother-in-law of Crocco and a close friend and a former student of von Karman at Aachen. As we shall see, following the suggestion of Crocco, Amaldi met Gabrielli in January 1959 to sound out the disposition of FIAT towards his project from an industrial point of view.; see von Karman (1967), chapters 40-42.

[24] von Karman (1967), pp. 323-339.

[25] Note 5.

[26] L. Crocco to E. Amaldi, 2/1/1959, Amaldi Archive, box 212, folder 6; the quotations which follow are from the same letter. "When NASA, for instance, tried to absorb the group of missile experts of the Army captained by von Braun -stated Crocco- the reaction of the military was extremely violent and ended up with the victory of the Army"; *ibid.*

The situation was even more difficult in Europe, where all the work done so far in the field was of military nature, "closed in the secret barriers of each nation". It was not a question of "winning the battle against the military in one single country, but in each European country, and the failure in one country is sufficient to compromise the entire initiative". Therefore the space case was much more complex and delicate than that of CERN, since research in high energy physics was "a pie where the military did not yet put the finger". A second problem raised by Crocco was the cost. Europe was poorer than the United States and even if costs in Europe were lower than in the USA and one could always "substitute at least in part the brute force of money with the less ostentatious but more penetrating force of the brain", it was impossible to realize so ambitious a project, regarding the construction of both satellites and their launching systems, without the expenditure of "enormous quantities of money". Moreover, the organization conceived by Amaldi was centred on scientific research and did not imply immediate "utilitarian fall-outs in the civil field"; therefore, it was not at all an easy task "to convince a number of Parliaments of the necessity of spending *huge* amounts of money only for science and prestige without a utilitarian perspective" [Crocco's emphasis] .

As to the applicability of the CERN model, Crocco warned Amaldi, not only would the "Euromoon project" require much more complex structures than CERN, but while in the case of CERN "the laboratories constitute *an end in itself*, in the case of the *eurolune* they represent only the means, and a very expensive one, for the development and testing of the prototypes". A last problem was the staff. According to Crocco, it was not at all easy to find a good number of specialists in the field in Europe. A possible short cut, to which it would be necessary to resort "with some sacrifice for the European pride", was to launch and develop the European programme with the help of some US experts; but this implied not only the approval of the U.S. Government but also "its desire of supporting Europe in this enterprise with the transfer of people and technical secrets".

As for his direct involvement in Amaldi's project, Crocco proffered to take contacts with von Karman, Hugh Dryden, scientific director of NASA and "very influential also in Europe", and James F. Killian, president of M.I.T. and scientific advisor of the President Eisenhower, to sound out the US reactions to the idea. In particular, according to Crocco, von Karman, "if convinced, would represent a great power not only for Europe but also in relation to the US". He also suggested that Amaldi contact Maurice Roy, director of the *Office National d'Etudes et de Recherches Aéronautiques* (ONERA), who exercised "a sort of dictatorship on the developments of scientific research in aeronautics in France", and his

brother-in-law Giuseppe Gabrielli, director of the FIAT Aviation, to sound out the reactions of Italian industrial circles.

Amaldi considered Crocco's proposal to talk to von Karman "very useful", but at the same time he kept defending stubbornly the two main pillars of his initiative. First, he maintained, the future organization should keep "a real European character" and therefore it should not appear, at least in the beginning, as "a suggestion coming from the US". Second, it should have only "a peaceful character". "To those who worry about the European defense —he maintained— it should be answered that once the techniques of satellite launching were known in Europe, correspondingly the military structure of each country would automatically result strengthened".[27]

At Amaldi's request, Crocco had a long conversation with von Karman in New York on 27 January 1959, and immediately reported to Amaldi about its contents. Firstly, von Karman wanted to inform Amaldi that AGARD was already trying to develop a similar project, "although on a smaller scale". A provisional plan provided for the launching of Euromoons, entirely designed and developed in Europe, with U.S. launchers supplied by NASA; control systems would probably be European. Secondly, von Karman too perceived "the weakness of an initiative based on military or paramilitary organizations" and agreed with Amaldi that, in principle, to get rid of the military and not to depend on the U.S. launching systems were "desirable" objectives; however, he believed that European autonomy in space "could only follow a first initiative [in co-operation with the US] that would not entail enormous expenses" for Europe. "It seems to me —Crocco commented— that the AGARD solution, possibly supported by a civil committee, would have the advantage of breaking the ice, creating an interest and paving the way for more independent enterprises". But Amaldi was not convinced by von Karman and Crocco's arguments in favour of the AGARD solution, and soon dropped their suggestion, as he had done with Rabi's proposal, since the European involvement with the US was incompatible with "the real European character" of the future space organization.[28]

During the same days, Amaldi had to defend the 'European purity' of his project in face of the proposal advanced by Cecil Frank Powell for extending co-operation in space to the Soviet Union. Powell was an acknowledged leader of cosmic-ray physics in Britain

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[27] E. Amaldi to L. Crocco, 9 /1/1959, Amaldi Archive, box 212; folder 6.

[28] L. Crocco to E. Amaldi, 27 /1/ 1959, *ibid.*

and Nobel prize winner in 1950 for the discovery of the π meson, and at that time was a member of CERN's Scientific Policy Committee.

Powell too hit the military note, expressing his fear that "if you attempt to make satellites in Western Europe without military support, you will be a long way behind", and proposed to Amaldi "to establish on an international scale the kind of co-operation which you had visualized for Western Europe.[...] What is required here is a genuine international co-operation involving world resources". In particular, Russian scientists should be in from the very start, Powell maintained, and he was ready, if Amaldi agreed, to speak with a number of them in Moscow where he was going a few weeks later, "entirely unofficially, without committing anybody to anything".[29]

This time Amaldi had to defend his peculiar conception of a scientific internationalism limited only to Western European countries. First, he maintained, international collaboration of the kind envisaged by Powell "should take place at a different level from that which I considerer as an *urgent necessity* for the European countries". This was for Amaldi both "a matter of principle and of feasibility". Again he used the CERN case as the model; "CERN —he argued— has been built in spite of the existence of the Radiation Lab. or Brookhaven National Lab., and Dubna has been built in spite of the existence of all the above mentioned laboratories". In the same spirit, he believed, Europe should have its own European organization for space research, "a purely scientific organization which collaborates with any other similar organization in the world". As to the difficulties of collaboration with Russia, Amaldi reminded Powell that when the first steps were made to establish CERN, *Pravda* had written that "CERN was made by the USA in order to teach German scientists —in particular Heisenberg— to make atomic bombs against USSR"; and in that case Amaldi, too, had been put "on the list of war mongers". In conclusion, according to Amaldi, so large an organization "including all the nations of the world" was not "desirable", not only because Europe was not yet "prepared for such a big enterprise", but also because, in line of principle, it should be avoided to have "a single Directorate of [space] research in all the world which decides the general lines of attack of scientific problems". Moreover, a world-wide organization could not work from a practical point of view; again CERN came in as the model to follow: its functioning would be

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[29] C.F.Powell to E. Amaldi, 2 /2/ 1959, *ibid.*

"almost impossible" if in its Council would seat the delegates of 30 or 50 nations instead of 12. "12 are quite enough, even too many", Amaldi concluded.[30]

Apparently, in his first round of consultations with his colleagues, Amaldi found a quite unanimous chorus of warnings against the possibility of directly applying the CERN model to space. First, as for the launcher problem, a certain amount of involvement with the military seemed to many unavoidable at least in an initial phase, if only because they already controlled the field. Second, Amaldi's Europeanistic choice was also criticized with different arguments: the difficulty for Europe alone to fill the technological gap with the superpowers; the "huge amounts of money" required, or the defense of a genuine, world-wide "scientific internationalism". But Amaldi remained stubbornly stuck to his original idea and was soon to be rewarded, finding the right man with whom to push forward his project: Pierre Auger, French cosmic-ray physicist and Amaldi's old friend. Amaldi and Auger had been the captains of the so called "Franco-Italian front" during the early battles for the foundation of CERN.[31] This time the successful team of the two scientists was ready to go back in action for space.

3. *Amaldi's "dream" takes off: the Franco-Italian alliance and Auger's Comité des Recherches Spatiales as a model for Europe*

Early in February 1959, Amaldi was informed in Paris by Perrin that Pierre Auger "was interested in the same problems". Back in Rome, Amaldi immediately wrote to Auger in order to see "how one could start". He briefly informed Auger of his previous contacts and made explicit the "essential points" that should characterize the future organization: firstly, it "should be only civil and with a strictly scientific character, without military links or problems of secrecy in general"; secondly, it should comprise "a sufficiently large European basis, possibly like CERN".

According to Amaldi the first problem to resolve was that of identifying an international organization which could play the same institutional role as that played by UNESCO for the foundation of CERN. This organization should "appoint a group of experts", who should first work for the establishment of a provisional organization and later

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[30] E. Amaldi to C.F. Powell, 6/2/1959, note 4; C.F. Powell to E. Amaldi, 20/2/1959, *ibid.*

[31] Pestre, in Hermann, Krige, Mersits and Pestre (1987), chapter 4.

move to the constitution of the definitive one. The problem was, therefore, that of finding a group of experts who "consider the problem with sufficient enthusiasm and can make propaganda in their own countries". It was sufficient to start with two or three "trustworthy" experts in France, Germany and Italy, "and the others would follow in their turn". In this way, Amaldi maintained, "in a period of about seven years one could obtain substantial results".

Amaldi also informed Auger of the Italian situation: first, Broglio, finally convinced by Amaldi, was ready to be the expert on behalf of Italy; second, he had contacted a number of FIAT managers, "who would be very interested to collaborate in this project from an industrial point of view". Finally, Amaldi asked to meet Auger soon because the problem was "pressing"— possibly by the end of February in Paris.[32]

No evidence has been found if this first meeting of the two scientists in Paris really did take place. What we know for certain is that Auger immediately became very interested in Amaldi's project, and informed him that early in January that year a Committee for Space Research (*Comité des Recherches Spatiales*, CRS) had been created in France with the task of establishing a national programme of research in space and the high atmosphere; Auger had already chaired its first three sessions and was soon going to be elected as its president.

Amaldi, who had initially conceived a more 'artisanal' start based on the enthusiasm of "a few experts", immediately became convinced that the foundation of national space committees in the various European countries, on the model just established in France, would represent the correct institutional frame for a more official take-off of European cooperation in space. He thought that the same should be done at least in Italy and in Germany, and subsequently the three national commissions should vote in favour of the setting up of a European organization. This, he maintained, was "the only way of facing the problem adequately".[33] Therefore, early in March 1959 Amaldi asked Auger to send him

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[32] E. Amaldi to P. Auger, 6/2/1959, note 7.

[33] E. Amaldi to B.N. Cacciapuoti, 18/3/1959, *ibid.* Cacciapuoti was the Councillor for Scientific and Nuclear Affairs of the Italian Embassy in Washington D.C., who kept Amaldi informed of the initiatives by the United Nations for the peaceful use of outer space; cfr. B.N. Cacciapuoti to E. Amaldi, 12/3/1959, *ibid.*

"as soon as possible" some general information on the French CRS, its composition and first programmes.[34]

Auger immediately sent the information required by Amaldi, asking him "to observe some discretion", since the press had not yet been informed, and "to use them confidentially, if it was needed to create a similar body in Italy". He gave Amaldi the list of the members of the French space committee and a copy of its institutive decree, dated 7 January 1959.[35]

In this way Amaldi learned that the French committee had defined a two-phase programme. A "minimum programme", which foresaw a budget of about 2 billion French francs for researches with instruments to be put on top of sounding rockets and which regarded a) satellite observation, both optical and radio; b) solar studies; c) studies on the transmission properties of high atmosphere, up to the infrared wavelength; d) studies on the composition of primary cosmic rays. And a "more ambitious and much more costly" programme, including the launching of satellites, and, possibly, solar and lunar probes. Auger stressed that one could try to found an international action on this second extended programme, whose realization "required an effort exceeding the one that could be made by a single European country". But he also threw some cold water on Amaldi's sense of urgency since he did not think that time was ripe for an immediate start at a European level. "Up to now —he stated— it is not a question of any international action besides the representation of France in COSPAR[36] and in the new Space Committee of the United Nations (which did not yet meet)". As to the launchers, Auger went on, the French commission had not yet considered the problem, since there already were several categories of French rockets that could immediately be used for space research, while the realization of new, more powerful launchers "evidently depended in part on the military programme and also on the attitude of the French government towards a satellite programme". Evidently, Auger and the French space scientists had no direct interest in building their own launchers and considered the presence of the military in space with much greater realism than Amaldi — if only because they were already there and, therefore, getting rid of them would be anything but easy.

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[34] E. Amaldi to P. Auger, 5/3/1959, *ibid.*

[35] P. Auger to E. Amaldi, 12/3/1959; E. Amaldi to P. Auger, 18/3/1959, *ibid.*

[36] The Committee on Space Research (COSPAR) had been set up by the International Council of Scientific Unions during the International Geophysical Year.

According to Auger's recollections[37], the two physicists met in Paris sometime in April that year and during a peripatetic conversation in the Luxembourg gardens discussed how to shape and launch a European organization on space research. Shortly after that meeting Amaldi wrote the first draft of his well-known paper, *Space Research in Europe*, explicitly "prepared to give a start to the discussions on the creation of the European Organization for Space Research", and on May 22 sent ten copies each to a small group of influential colleagues in Europe, so that they could "diffuse it" in the European scientific community.[38] The content of this paper and its implications have been thoroughly analysed by John Krige.[39] Here we limit to stress that Amaldi had the same bees in his bonnet as ever: a) the creation of a European space organization, "pooling the resources of, say, *ten European Countries*", was "*essential and urgent*" in order to fill the scientific, technological and industrial gap with the Superpowers; b) the proposed European Space Research Organization "should have no other purpose than research and should, therefore, be *independent of any kind of military organization and free from any Official Secrets Act*" [Amaldi's emphasis].[40]

As to the programmes of the future European space organization, Amaldi, influenced by what he knew from Auger about the French space programme and treasuring up CERN's early two-phase programme, envisaged a two step programme: a minimum one to be accomplished in three to four years, centred on the solution of "a standard problem of the kind already solved by the USSR and the USA", which would be useful for the training of scientific and technical personnel, the development of new techniques and the growth of an European space industry; and a second, more ambitious one, "requiring a much larger effort over a greater number of years, for instance six or seven", which should be "comparable with the greatest enterprises undertaken simultaneously by the United States and the Soviet Union".[41] For the procedure to follow in view of the creation of such an organization, Amaldi, after the example of the French CRS, envisaged the setting up of "national commissions to examine the problems of space research". These commissions,

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[37] Auger (1984); Krige (1992), p.2.

[38] Note 3.

[39] Krige (1992), pp. 2-10.

[40] E. Amaldi, *Introduction to the Discussion on Space Research in Europe*, 30 April 1959, pp. 3-5, Amaldi Archive, box 212, folder 6.

[41] *Ibid.*, pp. 5-6.

composed of experts in launcher and satellite technology on the one hand, and on the other of space scientists, could then compare and discuss their proposals at an international conference, "so as to work out a detailed programme for submission to the governments of the countries concerned". [42]

No sooner said than done: one week after the forwarding of his paper, Amaldi took with Broglio the initiative of meeting the President of the Italian *Consiglio Nazionale delle Ricerche* (CNR), Francesco Giordani, to discuss with him the creation, inside the CNR, of a commission on space research. The Italian *Commissione per le Ricerche Spaziali* (CRS) was officially constituted by the CNR early in September 1959 (quite an unusual speed in comparison with the notorious slowness of Italian bureaucracy), with the task of assessing "the national capabilities" in this field and with the aim of reaching a "collaboration among European nations in order to realize a common programme of work". Broglio was its President and Amaldi was one of its seven members.[43] Ten days later the members of CSR met with Hugh L. Dryden to be informed of NASA's space flight projects and to discuss, for the first time, possible forms of co-operation.[44]

But let us go back to the maturing in the European scenario. Amaldi's paper, distributed in some 70 copies all over continental Europe (in fact no copy of this paper was sent to the British) started to exercise its maieutic role: the first answers and comments were not slow in coming, showing in general an increasing sympathy towards his project.

The first reaction among the recipients of Amaldi's paper came from Jean Willems, an influential member of the CERN "lobby"[45], who was president of Belgium's *Institut*

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[42] *Ibid.*, p. 7.

[43] F. Giordani to E. Amaldi, 5/9/1959; E. Amaldi to F. Giordani, 8/9/1959, L. Broglio to E. Amaldi, 17/9/1959, Amaldi Archive, box 248, folder *Ricerche spaziali- Corrispondenza con Broglio 1958-1961*. The other members, besides Broglio and Amaldi, were Mario Boella, professor of 'Electrical Communications', Polytechnic of Turin; Nello Carrara, professor of 'Electromagnetic Waves', University of Florence; Corrado Casci, professor of 'Motors for Aeromobiles', Polytechnic of Milan; G.Puppi, professor of 'Physics', University of Bologna; Guglielmo Righini, professor of 'Astronomy', University of Bologna.

[44] L. Broglio to E. Amaldi, 17/9/1959, Amaldi Archive, box 248, folder *Ricerche spaziali- Corrispondenza con Broglio 1958-1961*.

[45] For the definition of CERN "lobby", see Pestre, in Hermann, Krige, Mersits and Pestre (1990), chapter 7. The members of this "lobby" were "administrators who saw themselves not simply as representing their national governments at CERN but also as representing CERN before their national governments"; Krige (1992), p. 8.

Interuniversitaire des Sciences Nucléaires. Making explicit reference to Amaldi's "important" paper, he informed Amaldi of the state of the art in Belgium: a working group on space matters, chaired by Willems himself, had been just created inside the *Centre National d'Etudes et de Recherches Aéronautiques*, whose Secretary General, M. Freson, was a member of the Belgian delegation to the CERN Council. The activity of this group was just starting but "no result could yet be credited to it". Another organization, the *Centre National de Recherches Spatiales*, had also been founded, but also in this case work was just starting. The situation in Belgium, according to Willems, was not "a big thing", but the scientists involved presented a "patent interest" in Amaldi's project. "What should be next? —he concluded— I believe that we should turn to you to know more".[46]

A second important feed-back came to Amaldi from another member of the CERN "lobby", Jan H. Bannier, who was the Dutch delegate at the CERN Council, chairman of the CERN Finance Committee and director of the Netherlands Organization for the Advancement of Pure Research (ZWO).

After receiving Amaldi's paper, Bannier met Amaldi at CERN and immediately became convinced of the concrete feasibility of his *Euroluna* project. Back home, he started to discuss the matter with a number of "pre-eminent scientists", in particular with J.F. Koksma, General Secretary of the Royal Netherlands Academy of Sciences, and with H. C. van de Hulst, the Dutch radio-astronomer who was Chairman of COSPAR. Although no definite conclusions were reached during these discussions, Bannier informed Amaldi, "the general impression was one of great interest in your plans". [47]

Bannier also touched on the delicate problem of finding an institutional framework for the future organization. First, he was not sure that UNESCO could play the same role as it had done in the case of CERN since he doubted that professor J. F. Kovda, Auger's successor as director of UNESCO's Department of Natural Sciences, would be willing to undertake this task. "It may be difficult for him as a Russian —he maintained— to assist in the creation of a Western European Organization; [...] he would probably prefer a more universal task". In alternative, since COSPAR had decided to organize a symposium on space research in Nice in January 1960, he suggested asking the Western European

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[46] J. Willems to E. Amaldi, 22 June 1959, Amaldi Archive, box 212, folder 6.

[47] J.H. Bannier to E. Amaldi, 24 July 1959, *ibid.*

members of the COSPAR Symposium "to extend their stay in Nice with one day for discussing your plan".

He finally informed Amaldi that in his country he had not yet thought it wise "to bring the matter up to the Government level" since a national committee on space research had not yet been constituted. However, if an official invitation to a European meeting of space scientists to discuss the creation of a European organization for space research were sent, "it would be not so difficult to create such a committee" in the Netherlands. In conclusion he proposed to Amaldi to use the acronym of EROS (European Research Organization for Space), as "a nice abbreviation" for the future organization.[48]

Amaldi stressed that he too had initially thought that "UNESCO could be a very suitable mother", but that he had not pushed this idea further, because "after consultation with various friends" he had reached the conclusion that "it is highly improbable that Mr. Kovda supports the creation of a Western European Organization". Therefore, Amaldi agreed with Bannier to discuss the matter at the January COSPAR meeting in Nice. As for the approach to follow vis-à-vis national Governments, Amaldi pragmatically envisaged a double phase strategy: firstly, one should convince "many people in each of our countries of the importance and feasibility of such an enterprise", and only later on, after a few months, "start an action at Government level". Finally, he informed Bannier that he was still waiting for an answer from Germany, and expected that it would arrive soon. Moreover, he was "trying to get Switzerland in the play". "EROS —he concluded— sounds very nice".[49]

Early in December 1959 the French version of Amaldi's paper was finally published; it was supplemented by very favourable comments from a number of influential European scientists. Among them, needless to say, Auger, Bannier and van de Hulst. The latter, on behalf of COSPAR, stated that "if the project proposed by Amaldi [...] proves feasible and a Western European body will emerge, engaged in some form of space research, COSPAR will gladly extend to this body the same assistance for exchange of

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[48] *Ibid.*

[49] E. Amaldi to J.H. Bannier, 30/7/1959, *ibid.*

plans and scientific information which it already provides to other countries that conduct scientific experiments with sounding rockets and space vehicles."[50]

In the meantime, the Italian CRS in its second session held on 14 December 1959, following the proposal of Amaldi and Broglio, unanimously approved the project of creating a European space organization. The next day Amaldi informed Auger of the Italian news and suggested to him to organize a meeting in order to start a public discussion on the occasion of the COSPAR Conference to be held in Nice next January. Amaldi, who could not take part in the meeting, informed Auger that "the Italian point of view would be well exposed by Broglio".[51]

From the correspondence previously quoted, it emerges that Amaldi, with the help of Auger, was very active during the second half of 1959 in organizing the start of his project. He kept mobilizing his extended network of personal and scientific relationships, in particular the CERN "lobby", pushing for the creation of national space commissions both in Italy and in other European countries after the 'French model', and tentatively identifying COSPAR as a possible institutional "mother" of the future organization. Finally the time was ripe to cast the space dice.

4. First public discussions of Amaldi's project: the British enter the field

Amaldi's project was discussed in public for the first time at the occasion of the first general assembly of COSPAR, held in Nice from 9 to 16 January 1960. There Auger examined with a number of European colleagues the possibility "of creating a European space institute, quoting CERN as an example of success", [52] and he immediately informed Amaldi in detail of the main events and decisions taken there.

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[50] Amaldi (1959). Van de Hulst's comment is in *ibid.*, p. 9. The quote is taken from a slightly different English version, *Comments on Amaldi's paper submitted to l'Expansion Scientifique by professor Van de Hulst, president of COSPAR*, 11/12/1959, NCSP/61(60), Amaldi Archive, box 248.

[51] E. Amaldi to P. Auger, 15/12/1959, Amaldi Archive, box 212, folder 6. Amaldi could not be present at the Nice meeting because during the same period he had to attend a CERN meeting in Geneva and a meeting of EURATOM in Bruxelles.

[52] Krige (1992), p. 10.

From Auger's letter to Amaldi we learn that two distinct meetings took place there, both convened by Auger. At the first one Auger, following the indications of Amaldi, convoked representatives of "those countries which have organized a national commission in this field", i.e. Belgium, France, Italy, the Netherlands, Sweden and the United Kingdom. However, in the second one "both Germany and Switzerland asked to join, hoping to have very soon their own committees".[53]

But the real novelty in Nice was represented, contrary to Amaldi's early expectations, by the enthusiasm with which the British sponsored the project. As Auger synthetically put it, "the British (Massey) were very enthusiastic about a European collaboration and all the others have followed". Massey, indeed, played a major role in defining the possible programmes of the future organization. He too suggested to the scientists attending the Nice meeting that the future European space organization should have a "near programme" and "a more ambitious, distant programme [...] like for CERN". The near programme, according to Massey, should include studies on the properties of high atmosphere (ionization, turbulence, temperature), on radiation (cosmic, van Allen and X-rays) and astrophysics. For the realization of this programme he envisaged the use of medium-range rockets (200-500 km) and sounding balloons up to 30-40 km. As for the more "ambitious" long-term programme, Massey informed his scientific *confrères,* "Great Britain was soon to decide the construction of big launchers of the kind of ICBM, with a range of some thousand kilometers and a launching capability of (not too heavy) satellites". Therefore, he suggested, the future European organization, "if she had at her disposal some budgetary funds, [...] should encourage Great Britain in her national programme and induce her to decide the construction of these launchers (this in a few months to come)".[54] As a matter of fact, this was the first unofficial and veiled announcement that Great Britain was soon going to cancel *Blue Streak* as a military weapon and was reflecting on its possible recycling as the first stage of a civil heavy satellite launcher.[55] As to the next moves to be undertaken, Auger informed Amaldi that the scientists convened at the Nice meeting had decided to contact the various European national space committees in order to organize a more formal meeting, i.e. "a meeting of

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[53] P. Auger to E. Amaldi, 26/1/1960, Amaldi Archive, box 270, Folder *Spazio Europa - Corrispondenza e Relazioni, 1960-1962.*

[54] *Ibid.*

[55] De Maria & Krige (1992), p. 111.

delegates in charge of establishing programmes and administrative mechanisms (funding included)", to be held in Paris on 29 February.[56]

The meeting, held at Auger's home in Paris on 29 February 1960, was attended by eight scientists, all of them covering important roles as science administrators, from Belgium, France, West Germany, Italy, the Netherlands, Sweden, Switzerland and the United Kingdom.[57] On that occasion Amaldi informed his colleagues of the initiatives taken by the Italian *Consiglio Nazionale delle Ricerche* and by the Italian Air Force to promote a national space programme. It comprised, by the end of 1960, the launching of a few sounding rockets up to 200-250 km, for the study of primary cosmic rays both with G-M counters and with emulsions. In his report Amaldi informed his colleagues that "a number of Italian authorities, as well as exponents of Italian industry have also exposed unofficially a favourable opinion on the European collaboration in space research".[58]

Besides Amaldi's report, no direct documentary evidence has yet been found on the reports presented by the other scientists and on the discussions that took place at Auger's home. But we know for certain that the British started to take the lead of the European space project. An enthusiastic Massey, in fact, suggested that "it would be useful at this stage if United Kingdom laboratories participating in the [British] space science programme could receive research workers from Western European nations". [59] He also proposed the constitution of a more formal body to continue the discussions on Western European co-operation, and offered to ask the Royal Society's NCSR, which he chaired,

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[56] Note 53.

[57] The list of scientists invited by Auger to the meeting in Paris is in P. Auger to E. Amaldi, 16/2/1960, *ibid.* They were, besides Amaldi and Auger, J. Bartels, *Geophysikalisches Institut*, Göttingen, Germany; E. A. Brunberg, Royal Institute of Technology, Stockholm, Sweden; A.J. Houtermans, University of Bern, Switzerland; H.S.W. Massey, University College, London, chairman of the British NCSR; M. Nicolet, director of the *Centre National de l'Espace*, Bruxelles, Belgium; J. Veldkamp, Royal Dutch Meteorological Institute, De Bild, Netherlands, who was the secretary of the Netherlands Committee of Geophysical and Space Research; S. Rosseland, chairman of the Norwegian Space Research Committee. Rosseland could not attend the meeting; for more information on that meeting; see also Krige (1992), pp. 10-11.

[58] Amaldi's report is a typewritten document entitled *Meeting held at prof. Auger's house the 29th of February 1960*, Amaldi Archive, box 248, folder *Spazio Europa - Corrispondenza fino al 1961*.

[59] W.V.D. Hodge to E. Amaldi, 30 March 1960, *ibid.*

"to consider issuing an invitation to a meeting in London in late April, with the aim of setting up a recognized Committee or a working group".[60]

Back in London, Massey reported to his colleagues of NCSR on the informal meetings held in Nice and Paris and convinced Sir William Hodge, Physical Secretary of the Royal Society, "to take the initiative" in calling the next meeting of European scientists to take place at the Royal Society on 29 April 1960. Hodge wrote immediately to the group of scientists who had attended the meeting in Paris, offering the services of the Royal Society for "the constitution of a more formal body"; he also suggested that "this should be done in co-operation with COSPAR, where it might be regarded as a regional working group on space research".[61]

The choice of the Royal Society as the convener of the next meetings represented a dramatic change: it finally offered a prestigious institutional framework for the take off of the European scientific co-operation in space. The "mother" of the future organization had finally been identified.

In the meantime, Amaldi had played an important role "to get Switzerland in the play". Three weeks after the Paris meeting, Paul Scherrer, professor at the *Physikalisches Institut* of Zurich and an influential member of CERN's Scientific Policy Committee, informed Amaldi that he was soon going to meet the President of the Swiss confederation, Max Petitpierre, "in order to discuss the problem of the Swiss participation at Amaldi's project of a European collaboration in space research". "I believe - he continued - that President Petitpierre is very much in favour of such a collaboration", and asked Amaldi to be informed on "how far the contacts of UNESCO and other international organizations have given positive results, and which countries will probably join such a common effort".[62]

Amaldi gave Scherrer the information required and suggested to him to follow his old recipe: in Switzerland, like in any other European country, a national committee for

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[60] Massey & Robins (1986), p. 110.

[61] Note 59.

[62] P. Scherrer to E. Amaldi, 21/3/1960, Amaldi Archive, box 212, folder 6. Scherrer had been the Swiss delegate to both sessions of the UNESCO conference where CERN was launched (Paris, 1951; Geneva, 1952); he was also the Swiss delegate at the CERN Council and an influential member of CERN's Scientific Policy Committee.

space research should be established and a delegate of it should participate in the future meetings. "The idea —he concluded— is to start immediately with some work with balloons and sounding rockets". [63]

Amaldi's recipe was immediately applied by the Swiss: also in consequence of Scherrer's meeting with president Petitpierre, a first meeting of Swiss scientists interested in "a possible formation of a European non-military research co-operation [in space] as suggested by professor Amaldi" was convened by the Swiss National Foundation. On that occasion a provisional committee on space research was founded and Marcel Golay, director of the Astronomical Observatory in Geneva (who had already taken part in the Nice meeting) and professor F. G. Houtermans, of the *Physikalisches Institut* of Bern University, were mandated to attend, as observers for Switzerland, the London meeting to be held the following April.[64]

The "Western European Space Research Meeting" duly took place at the Royal Society, London, on 29 April 1960. The Secretary of the Royal Society, Sir William Hodge, took the chair in the "unavoidable absence" of Sir Harrie Massey who was visiting Australia. The meeting was attended by delegations of scientists and science administrators from ten different countries. Amaldi and Broglio were the Italian delegates. First, the delegates reported on their national projects and activities. Amaldi, on behalf of Italy, reported on the space research work that various University groups "were commencing" to do in Italy. Moreover, he informed his colleagues, the Italian CRS had reached an agreement with NASA regarding the purchase of sounding rockets. Italy, indeed, had very few crumbs to pool in the plate of a joint European space effort, especially in comparison with the big pie offered by the British national space programme. [65]

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[63] E. Amaldi to P. Scherrer, 26/3/1960, *ibid.*

[64] F.G. Houtermans to W. Hodge, 13 April 1960, NCSP/68 (60), Amaldi Archive, box 248, folder *Spazio Europa -Corrispondenza fino al 1961.*

[65] The minutes of the Royal Society meeting are in NCSP/80a (60), *ibid.*; the French space programme is briefly reported in NCSP/79 (60), *ibid.*; the British space programme is described in the document NCSP/62(60), *ibid*; another document signed by Massey: *Plans for First British Scout Satellite Experiments*, 2 Feb 1960, gives us an early and accurate report of the U.K. - NASA first co-operative project in space research that brought to the *Ariel* satellite programme; see also *British Rocket research in Upper Atmosphere*, NCSP/3a (59); for the Swedish space programme see *Preliminary Swedish Space Research Programme*, NCSP/54(60), ibid.; as to West Germany's early programmes, see *German Report on Space Research 1958-59*, NCSP/66(60), *ibid.*

At the Royal Society meeting different areas of co-operation were also identified for a joint European effort; they regarded, in particular, a) the exchange of scientific and technical personnel; b) co-operation in satellite tracking; c) co-operation in rocket development; d) co-operation in artificial satellite experiments. [66]

The most important issue at stake, however, regarded the European launcher. Sir William Hodge sounded out the European propension to using a heavy satellite launcher based on the British *Blue Streak* as its first stage. He asked the delegates to indicate also "the possible order of contribution" of their countries, pointing out that some £65 million had already been spent by the British government on *Blue Streak*, and, therefore, "it would be best to take advantage of the work and the money already expended, rather than to waste it and develop a launching vehicle from the beginning once again". After discussion the scientists convened at the Royal Society meeting agreed that *Blue Streak* represented "the best possible solution to the problem of finding a suitable launching vehicle for a European satellite". One of the few partially dissonant voices came from Amaldi, the most coherent advocate of the CERN 'orthodox' model of international co-operation. He announced that the Italian government would look favourably on the use of part of its contribution for the further development of *Blue Streak* "provided that *Blue Streak* really became an important part of a common integrated European project". [67]

The group of scientists who met at the Royal Society could not reach any organizational or operative conclusion, also because of their lack of formal power to do so. In the final resolution, however, they identified the possible areas of a joint European effort in space research: ionospheric studies, meteorology of the upper atmosphere over the region of Europe, studies of Arctic phenomena, optical and radio astronomy. Moreover, they concluded, a co-operative European effort should include "the placing into orbit of artificial satellites by a launching vehicle developed and financed co-operatively". Finally, the delegates chose Auger as their Secretary and entrusted him with the duty of organizing a second meeting, within two months, of official delegates "representative of their national authorities and empowered to create a Preparatory Committee for the establishment of

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[66] NCSP/80a (60), pp. 6-7, *ibid.*

[67] *Ibid.*, pp. 9-10. For more details on the Royal Society meeting see Krige (1992), pp. 11-15.

plans for an extended European collaboration in space research".[68] Amaldi's dream, apparently, had started to materialize.

Contrary to the initial expectations of the scientists convened at the Royal Society, the gestation of ESRO revealed itself much more complex and full of obstacles. John Krige has thoroughly analysed the chain of events that led, first, to the formation of the European Space Research Study Group, GEERS (*Groupe d'Etude Européen pour la collaboration dans le domaine des Recherches Spatiales*), at the meeting of delegates convened by Auger in Paris on 23 and 24 June 1960, and, finally, to the constitution of the European Preparatory Commission for Space Research (COPERS) by the intergovernmental conference held at CERN in Meyrin (a suburb of Geneva) from 28 November to 1 December 1960. In the meantime, a main change in the initial project took place: while the scientists convened in April 1960 at the Royal Society meeting thought of creating "*one single organization* dedicated to the development of launchers and to the placing of satellites in orbit", seven months later, at the Meyrin conference, the question of a European launcher was 'de-coupled' from space research and not included in the tasks of COPERS.[69]

The reason for this change was political: on 13 April 1960 the UK government had, in fact, decided to stop the development of *Blue Streak* for military purposes. During the summer of 1960 the British had sounded out the French government through diplomatic channels on its willingness to share space technology and to co-operate in a joint project to build a heavy satellite launcher, "for exclusively peaceful purposes", using *Blue Streak* as a first stage. Several high-level technical meetings and political negotiations followed between the two governments, and by November it had become clear that "France was willing to associate itself with the British government in a proposal to other European states that a study be made of the technical and financial possibilities of building in Europe a rocket system able to put heavy satellites in orbit". The long and tortuous gestation of the European Launcher Development Organization (ELDO) had begun, promoted by much more powerful actors than the scientists initially convened by Amaldi and Auger — i.e. political, industrial and military circles. They were spokesmen of political, strategic and industrial interests quite distant from those of the European space scientists, and were not at all inclined to leave the construction of space launchers under the scientists' control.

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[68] European Space Research Meeting, *Resolutions*, 29 April 1960, document attached to NCSP/80a(60), *ibid.*

[69] Krige (1992), pp. 16-32; quote from p. 16.

Therefore, the Meyrin delegates, under the pressure of their French and British colleagues, were forced to "distance themselves from the [launcher] issue [...] and to narrow the scope of 'their' space organization accordingly".[70]

Soon after the Royal Society meeting of April 1960, Amaldi stepped aside from the European stage and no longer participated in any other European meeting, leaving to Broglio the role of Italian delegate. He focussed his efforts mainly on the development of a national space programme. However, as we shall see, he continued to follow the development of his creature closely, ready to return, if necessary, to the European arena, in stubborn defence of the 'purity' of the CERN model.

5. Amaldi's role in the development of a national space programme in Italy and his lost battle against ELDO

A relevant question which needs to find an answer is why Amaldi, after playing a so crucial role in the promotion of a European space organization, decided, towards the middle of 1960, to leave the forefront of the new space organization. Answering a group of CERN physicists who in February 1961 "earnestly" wished Amaldi "every success" in his "continued efforts" to establish a European space research organization,[71] he disappointed his colleagues' expectations, informing them that since a few months he had not taken "any direct interest" in the new developments. "It is really impossible —he concluded— to do too many things!"[72]

Amaldi was certainly very busy as a science administrator both abroad and at home. He was a member of the Scientific and Technical Committee of EURATOM (he had been President of this Committee in 1958-59); moreover, he had been President of the Scientific Policy Committee of CERN in 1958-60 and in 1961 he became a vice-president of the CERN Council. In Italy he had been director of the Rome division of the *Istituto Nazionale di Fisica Nucleare* (INFN) until 1960, and then president of the INFN up to 1965, which was quite a full-time job; he had been also director of the Physics Institute of

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[70] Krige (1992), pp. 25 and 27-28; see also De Maria and Krige (1992), pp. 113-114.

[71] K. Johnsen, C.A. Ramm, A. Schock, C.J. Zilverschoon to E. Amaldi, *An informal note on a possible type of European organization for space research*, 8/2/1961, Amaldi Archive, box 270.

[72] E. Amaldi to K. Johnsen, C.A. Ramm, A. Schock, C.J. Zilverschoon, 20/2/1961, *ibid.*

the University of Rome up to 1960 and in the same year he became member of the Board of Directors of the *Comitato Nazionale per l'Energia Nucleare* (CNEN). But his numerous official engagements cannot explain alone Amaldi's estrangement from the European space project during the second half of 1960.

More importantly, it should be taken into account that Amaldi had never been involved in space science; as an active scientist he had focused his interests mainly on high energy and nuclear physics, his early interests in cosmic-ray physics apart. As we have seen, he elaborated his space project mainly on the ground of political and "moral" considerations, making use of his experience as a science administrator both at CERN and in his post-war "reconstruction" of the Italian physics community.[73] As we have previously said, as early as December 1958 he had already anticipated his plans to his friend Crocco: not being an expert in space science, he wanted to limit his initiative simply to "the launching of the idea", i.e. to identify and 'mobilize' European "experts" who could push forward his project with competence and "enthusiasm", and eventually "a few years later, if the idea had given its fruits, to participate in the collection of data obtainable with this kind of activity".[74] And this was exactly what he did.

But in Italy Amaldi did not remain idle. From autumn 1959 onwards he started to organize, under the aegis of the recently instituted CRS, Italian cosmic-ray physicists and astrophysicists from the universities of Rome, Turin, Bologna, Milan, Florence and Parma, in order to define a national programme of space research. A few months later, in February 1960, Amaldi could inform his colleagues attending the meeting at Auger's house that for the financial year 1 July 1959-30 June 1960 the CRS had obtained 300 million Italian lire[75] from the Italian Air Forces for the purchase of sounding rockets and equipment for tracking and telemetering, "plus technical services for about 200 million lire", and the free use of the facilities for the firing of sounding rockets from the military base of Salto di Quirra in Sardinia. Moreover, the Italian CNR had allocated another 300 million lire for the construction of scientific instrumentation to be placed in the rockets.[76]

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[73] E. Amaldi, *The Years of Reconstruction*, Scientia, 114 (1979), 51-68 and 439-451.

[74] E. Amaldi to L. Crocco, 16/12/1959, note 5.

[75] 300 million lire corresponded to about 190.000 $, at 1960 exchange rates.

[76] Note 58.

As early as May 1960, the Italian cosmic-ray physicists, under the guidance of Amaldi, had already started to work on an articulated programme of space research, involving the launching of both sounding balloons and rockets. The experiments planned regarded: 1) study of the neutron component of cosmic rays with emulsions (Universities of Rome, Bologna and Parma); 2) measurement of neutronic intensity after large solar flares as well as in undisturbed conditions (Rome and Bologna); 3) measurement of the total ionizing radiation of cosmic rays as a function of height (Bologna); 4) measurement of gamma and X-rays in coincidence with the occurrence of higher solar activity (Rome and Bologna); 5) measurement of the charge spectrum of heavy primaries (Rome and Parma); 6) measurement of X-ray and electron intensity (Rome); 7) measurements of the intensity of X-rays in the region 1-100 Å and of the radiation intensity between 1100 Å and 1345 Å (Florence and Bologna).[77]

The rapid development of a fully-fledged national programme on space research was not only due to Amaldi's initiatives, but also to Broglio and his engineers, who in the same period started to develop an ambitious national civil programme on rockets. In December 1959 Broglio announced that some 5 to 6 bi-stage sounding rockets would be launched between 1 July 1960 and 30 June 1961 by the *Comitato Razzi and Missili* of the Italian Ministry of Defence in collaboration with CNR.[78] In April 1960 Italy signed an agreement with NASA for a sounding rocket programme in order to investigate high altitude winds using sodium 'clouds'. The first (secret) successful launching of a *Nike* sounding rocket, entirely built by the Italian corporation BPD on US licence, took place from Salto di Quirra on 9 July 1960; on 12 January 1961 Broglio's group launched its second *Nike* sounding rocket. By May 1961 the *San Marco* project officially began and preliminary designs of the first Italian satellite were started; moreover, a number of Broglio's engineers received on-the-job training at NASA's Goddard Space Flight Center in launching techniques, radar acquisition and satellite assembly.[79]

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[77] E. Amaldi, *Preliminary Research Program of the Italian Universities on Energetic Radiations at very high Altitudes*, 15/3/1960, Amaldi Archive, box 248, folder *Spazio Europa- Corrispondenza fino al 1961*; see also *Programma di ricerche sulle radiazioni e sui campi magnetici in alta quota (1960-1961)*, 7/5/1960, *ibid.*

[78] *Il Corriere della Sera*, 18/12/1959.

[79] "San Marco Satellite to probe Air Density", *Aviation Week & Space Technology*, (26/8/1963), 76-81.

On 31 August 1961 the Italian government approved the triennial space programme for 1961-1963 presented by the president of CNR, Giovanni Polvani and by Broglio, who attended the Ministerial meeting. The programme included: a) the launching, within two years, of an Italian satellite with a useful payload of 100 kg by a vector purchased abroad; b) the realization of a mobile near-equatorial launching platform to be anchored offshore the coasts of Somalia.[80]

On 18 September 1961, at the meeting of the CRS Broglio informed Amaldi of the recent developments of the Italian space programme. Moreover, he asked Amaldi to set up as soon as possible, with the Italian cosmic-ray physicists interested in space research, a programme of experiments to be put on board the first Italian satellite. Broglio, in fact, was leaving for the Unites States on 30 September to meet NASA officials in order to define in detail the collaboration between Italy and the USA in the *San Marco* project. Amaldi immediately wrote to his colleagues and convened a meeting which duly took place at the University of Rome on 25 September 1961.[81] Four groups from the universities of Bologna, Milan, Rome and Turin, for a total of 28 physicists, attended the meeting. There they defined a number of ambitious experiments to be put on board "small satellites".[82]

By October 1961, Broglio reached an informal agreement with NASA for the launching, within two years, of an Italian satellite by a US *Scout* booster from an Italian near-equatorial sea platform. Thus for Italy the problem of finding satellite launchers for space research was resolved by NASA's generous offer of co-operation.[83]

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[80] *Il Corriere della Sera*, 1/9/1961.

[81] E. Amaldi to G.P. Puppi, G. Occhialini, C. Castagnoli, A.M. Conforto, 18/9/1961, Amaldi Archive, box 210, folder 1.

[82] *Verbale della riunione tenuta a Roma in 25 Settembre 1961 presso l'Istituto di Fisica dell'Università, ibid.* See also *Notes for Prof. Broglio on a preliminary draft of an Italian program on space research*, September 1961, Amaldi Archive, box 248. The list of experiments defined in that meeting included: 1) measurements of the flux, energy spectra and the sign ratio of primary cosmic ray electrons; 2) study of heavy primaries; 3) study of mass spectrum of low energy particles in the Van Allen belts; 4) study of energy spectrum of electrons in the Van Allen belts and ionospheric layers; 5) study of neutrons; 6) study of solar gamma rays; 7) study of magnetic fields; *ibid.*

[83] The official agreement on the *San Marco* project was signed on 5 September 1962 by the US Vice-President Lyndon B. Johnson and by the Italian Foreign Minister Pietro Piccioni; see note 79. More details on the inception of the *San Marco* project are in two interviews respectively with L. Broglio (22 June 1992) and with C. Buongiorno (23 June 1992) made by dr. L. Sebesta in the frame of the ESA History Project, European University Institute, Florence.

During the same period, the problem of the European launcher became a burning question in Italy. In February 1961 a top-level intergovernmental conference was called by France and Britain in Strasbourg; there the setting up of a European organization for the development of a three-stage satellite launcher (the first built by the UK, the second by France and the third as well as a series of test satellites by other member states) was discussed[84] and in the following months several high-level political and technical meetings took place in the capitals of Western European countries in order to further refine the political, technical, financial and organizational aspects of the project.

On 29 September 1961 a meeting took place at the Rome headquarters of the Ministry of Foreign Affairs between an Italian delegation and an Anglo-French top-level technical delegation on the "*Blue Streak* project", as it was called in those days. Both Amaldi and Broglio, on behalf of CRS, participated in this meeting. Amaldi, reporting the unanimous opinion of the Italian CRS, sharply criticized the project. Firstly, the proposed European collaboration started on the wrong footing: *Blue Streak* had been already developed by the British, therefore it could be built "*only* by British industries"; the same was true for the second stage already developed by the French. Consequently, industries of other European countries, Amaldi argued, "are excluded from the most important and essential part of the project". Again he suggested CERN as the prototype which was to be followed: there "researchers and technicians of *all* the member countries collaborated from the very beginning in fixing the scientific programme, deciding the kind of machines to be built, and planning, designing and testing them together". Secondly, the "general organizational scheme" of the project was unsatisfactory: the splitting of so complex a project into different parts to be realized in different countries was going to create great difficulties; the fact that the work groups coincided with different national groups "was wrong with regard to both the international collaboration and the efficiency of the organization".[85] In support of Amaldi's intervention, Broglio too tapped the same keys: even accepting the British "realistic thesis" about the necessity of taking into account the work already done on *Blue Streak*, it nevertheless seemed "hard to eliminate the difficulties of an effective technical co-ordination between the various stages". Moreover, he concluded, the various

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[84] ELDO (1966); De Maria & Krige (1992).

[85] Document entitled "*intervento del Prof. E. Amaldi alla riunione che ha avuto luogo al Ministero degli Esteri il 21/9/61 con la Missione tecnica Anglo-Francese per il progetto Blue Streak*", Amaldi Archive, box 248, folder *Spazio-Europa, Corrispondenza con Broglio, 1958-1961*. See also E. Amaldi to L. Broglio, 27 Sept. 1961, *ibid.*

tasks would be assigned "not on the basis of a criterion of joint participation on an equal foot, but according to decisions adopted by the promoters of the project without previously consulting the others".[86]

In the following weeks Amaldi, in concert with Broglio, decided to raise the issue of the *Blue Streak* project at a European level, in order to defend the orthodox application of the "CERN model" to ESRO and to mobilize an international front of scientists against the ELDO project. Thus he wrote to his old friends of the CERN 'lobby', J. B. Adams, director of the CERN proton-synchroton division from 1954, and François de Rose, president of the CERN Council and head of the French delegation at the Meyrin conference.[87]

Amaldi's negative reaction to ELDO is useful to identify the first symptoms of an early disenchantment among European space scientists for the negative and unexpected features that were characterizing the new space Organization.

"When the idea of a European Space Research Organization arose- Amaldi wrote to his friends- everybody thought of something like CERN". The new organization had to be responsible not only for "planning and carrying on the research program", but also for "providing the necessary vehicles". But what happened, according to Amaldi's reconstruction, was completely different: at a certain point, "on suggestion of the British authority" it was decided to create an organization "endeavoured of [sic!] only the research programme" and, therefore, "bound to buy the vehicles on the market". At the same time, the Anglo-French proposal for the construction of a satellite launcher with *Blue Streak* as the first stage was advanced to various European governments, and thus "politicians" and "commercial people" entered the frame. Since then, maintained Amaldi, "COPERS has made only minor progress because it waits for decisions about the creation of ELDO". Therefore, ESRO, even before being officially born, seemed to him already "a parasitic organism (in the biological sense)" which would fix its scientific programme so that it could fit the vehicles "decided by commercial people and imposed on it by politicians". And this was far from the type of organization originally conceived by Amaldi and his CERN colleagues on the only basis of "*scientific and technical principles* and not on the basis of *political and commercial* arguments" [Amaldi's emphasis]. "I am very much

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[86] *Verbale della riunione che ha avuto luogo al Ministero degli Esteri in data 21 corrente per il progetto Blue Streak*, 21/9/1961, Amaldi Archive, box 210, folder *Blue Streak*.

[87] E. Amaldi to J. B. Adams (copy to F. de Rose), 15/12/1961, Amaldi Archive, box 210, folder 1.

against the type of organization that is now in preparation —he concluded— because it represents a step in the opposite direction of that made with the creation of CERN". [88]

As for the Anglo-French launcher proposal, he identified a number of features which made it "undesirable": cost, time-scale (and the related fact that the launcher would be obsolete when completed), and the decentralization of the construction of the various stages. "Any responsible person —Amaldi commented— sees the difficulty of matching three stages and the satellite made in four different countries and can easily foresee that disputes will arise if these do not fit well together".[89]

Amaldi and Broglio lost their battle against ELDO and in defence of the 'scientific purity' of ESRO. Other driving forces, industrial and political circles and no longer the scientists, and different motivations, from political prestige to possible high technology feed-backs for its national industry, determined the decision of the Italian government to join ELDO. On 30 April 1962 the ELDO convention was signed by six European countries, Belgium, France, West Germany, Italy, the Netherlands, the United Kingdom, and by Australia. Two months later the ESRO convention was signed by ten European countries, neutrals included. Needless to say that Amaldi's prophecies on ELDO were punctually fulfilled.[90]

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[88] *Ibid.*

[89] *Ibid.* See also De Maria and Krige (1992), pp. 110 and 120.

[90] De Maria & Krige (1992).

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