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Chapter 4

THE BRITISH INTERPLANETARY SOCIETY:
THE FIRST FIFTY YEARS (1933-1983)*

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BACKGROUND

Until the mid-1920s serious scientific speculation on the future of spaceflight had been the province of individual scholars such as Tsiolkovskii, Goddard, Oberth, and Esnault-Pelterie, but then a new phase in man's extraterrestrial aspirations was opened by the formation of groups devoted to the conquest of space.¹ The first of these appears to have been the Society for the Study of Interplanetary Communication (OIMS), which was founded in Moscow in June 1924 under the chairmanship of G. M. Kramarov and included among its registered members such well-known figures as Tsander, Perelman, and Tsiolkovskii himself.² The OIMS was short-lived, passing from sight after only one year.

Three years later, in Germany, the Verein für Raumschiffahrt (VfR) was formed on the 5 July 1927 at a meeting in the Wirthaus zum goldner Zepter (Golden Sceptre tavern) in the town of Breslau.³ This society flourished; its membership, which included such celebrated pioneers as Oberth, Hohmann, Esnault-Pelterie, and von Pirquet, grew rapidly to reach about 1000 within two years. It published a journal, *Die Rakete*, which printed a wide range of articles of both popular appeal and scientific interest. Oberth succeeded Winkler as its president and then, early in 1930, its headquarters moved to Berlin, where it embarked upon a series of experiments on liquid-propellant rockets at its famous Raketenflugplatz at Reinickendorf. However, after 1929 it was forced to discontinue publication of *Die Rakete*, the membership quickly melted away, and by the end of 1933 the VfR had broken up. The decision to concentrate its resources on rocket experimentation contributed to the demise of *Die Rakete*, and the consequent lack of communication with its members was fatal to the society.

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During the short era of the VfR other rocket and space societies emerged in Austria, France, and the U.S.A., the most notable of which was the American Interplanetary Society (later renamed the American Rocket Society), which came into being on 4 April 1930. Then on Friday, 13 October 1933, at a meeting in Liverpool, a British society was formed which was to share with the American Interplanetary Society the distinction of surviving into the Space Age.^{4,6}

FORMATION

On 8 September 1933 Philip E. Cleator published in the *Liverpool Echo* newspaper an appeal for members to form a British interplanetary society. The result was disappointing, the appeal eliciting only one reply. However, one of Britain's national newspapers, *The Daily Express*, sent a special correspondent, Moore Raymond, to talk to Cleator. Raymond was an immediate and enthusiastic convert to the idea of the proposed society and secured a part of the front page of the *Express* on the following morning to publicize the proposal. This time the response was considerable and within a week Cleator was able to hold, in his Wallacey, Cheshire, home, a small meeting of enthusiasts who lived nearby. At that preliminary gathering the decision was taken to form the British Interplanetary Society, and an inaugural meeting was scheduled to be held in Liverpool on Friday, 13 October.^{7,8}

The meeting duly took place on the day specified at offices in Dale Street, Liverpool. The British Interplanetary Society (BIS) was founded, with Philip Cleator as its first President. He urged that a printed journal would be essential to the new society. This was agreed and he was asked to edit the publication. From the outset the *Journal of the British Interplanetary Society* (or *JBIS*, for short) was to be a glossy illustrated publication, at first no more than a six-page pamphlet, but by the time it had reached its last pre-war issue, Volume 5, No. 2, in July 1939, the periodical had increased to a respectable size with 28 pages, about the same as *Astronautics: Journal of the American Rocket Society*, which had an identical format (140 mm x 220 mm).

JBIS was then published at intervals of about six months and it was always recognized that such a low frequency of publication was not conducive to growth. Already in 1935 G. E. Pendray had suggested that the journals of the American Rocket Society (of which he was President), the British Interplanetary Society, and the Cleveland Rocket Society should be merged to form a single monthly publication. The estimated cost, however, proved to be too high for the BIS, so the proposal was shelved.

The rate of growth of the BIS was quite modest by comparison with the VfR. At the end of the first three months the membership numbered only 15, and it had not quite reached 200 when activities had to be suspended at the outbreak of World War II in September 1939. At an early stage the Society attracted to its ranks the inevitable cadre of distinguished pioneers, notably Esnault-Pelterie, Pendray, von Pirquet, Perelman, Rynin, and Willy Ley, a pioneer of the VfR, who had become a Fellow of the BIS soon after its foundation.

With the growth of the BIS there was a shift in the center of gravity of the Society away from the Liverpool region towards London. This was inevitable, since a quarter of the British population lived either in the capital or within easy commuting distance. The membership in this area soon outnumbered that in Liverpool and its environs and it became increasingly apparent that there was an overwhelming case for moving the headquarters to London,^{9,10} after dissension in the Liverpool-based BIS Council had led to Cleator tendering his resignation from that body and relinquishing the editorship of the *Journal*, in April 1936.

Later in the year, at a meeting of London members at the Piccadilly offices of the Vice-President, A. M. Low, on 27 October 1936, the London Branch of the BIS was established. By this time, Society affairs were in crisis with the organization at the Liverpool headquarters rapidly falling apart. The climax was reached on 6 December at a General Meeting of the Society, the last to be held in Liverpool. The London Branch was invited to take over and the last act of the Liverpool group was the publication of the February 1937 issue of the *Journal*.

The parallel with events in the VfR, in 1929/1930, when that body transferred from Breslau to Berlin, can scarcely escape attention. The outcome for the BIS was fortunately happier.

The Liverpool period of the BIS was, perhaps, the romantic era of the Society. For the three years that it lasted it was dominated by Phil Cleator. He was President, Editor, and author. His book⁷, *Rockets through Space*, was one of the best popular publications on space travel that emerged in the interwar years, and, no doubt, stirred the imagination and interest in astronautics of many a newcomer to the subject. That the BIS survived those first delicate years from its birth was due largely to the fact that Cleator spared no effort to publicize it, nor in his drive to recruit new members. In the end, at Liverpool, his domination was resented and this led to his resignation from the presidency.

MOVE TO LONDON

With the move to London, A. M. Low (Vice-President) stepped up to take over as the second President of the BIS. The Liverpool connection was not entirely severed for, with good grace, Cleator and L. J. Johnson (hitherto Honorary Secretary) accepted the positions of joint Vice-Presidents.

The transfer to the capital naturally produced some interruptions in Society affairs and in this respect publication of the *Journal* suffered most, with the December 1937 issue appearing well into 1938 and there being no issue bearing a 1938 dateline. In fact, only three issues of the *Journal* were to emerge from London in the two-and-a-half years that remained before war interrupted the functioning of the Society. By way of compensation, these London publications were of much greater substance technically than their Liverpool predecessors.

One of the first actions in London, under a revised constitution, was to set up a Technical Committee with a Research Director. The BIS was seeking an appropriate role in the development of space travel and with this Committee it soon

found one. Many members still thought enviously of the VfR and its Rakettenflugplatz and of pursuing an experimental program to develop the hardware of rocketry. But this was not realistic. An objective appraisal of the situation was bound to show that the development of rocket engines and vehicles was far beyond the capabilities of any spaceflight society. In reality, the experimental activities of the VfR and of its American successors contributed nothing of significance to rocket technology. They were little more than games, the real business calling for resources that could only be provided by government agencies or large industrial organizations with well-funded research institutes. It is important in stressing this fact that one should not denigrate the work of the VfR, however, because the activities of the Rakettenflugplatz brought the rocket to the attention of people who were to have at their disposal the resources that were needed to pursue the matter in earnest. Moreover, even if that activity did not lead to any notable achievement in launching rockets, it was successful in launching the careers of future rocket engineers of the caliber of von Braun. Nevertheless, by the late 1930s the game had been played and experimentation in rocketry had moved on to a higher plane and was not an option open to the BIS.

But there was an option open to the Society and this lay in the conduct of technical assessments and conceptual design studies. Such activities were and are an essential feature of the development of all technology. The BIS Technical Committee chose to follow this course and embarked upon its now famous lunar spaceship study. The object of the exercise was to produce a conceptual design of a vehicle of modest initial mass (1000 tons) which would be capable of placing a 1 ton payload including two astronauts on the surface of the Moon together with sufficient propulsion capacity to return that payload into the hyperbolic orbit intercepting the Earth atmosphere. Aerodynamic braking and parachute descent would take care of the safe descent of the astronauts to the surface of their home world.

In order to achieve the necessary payload ratio, the BIS study group adopted a principle of continuously discardable structure in which the propulsive stages of the vehicle were subdivided into about 2500 small units, each made up of a rocket engine and propellant. Sufficient of these would be fired at any time to provide the required thrust and each would be jettisoned immediately. Since no restart would be required in most of these units the advantage of using solid-propellant motors was recognized. The BIS group referred to this form of construction as their "cellular" design. In fact it was the principle which Goddard had conceived 20 years earlier in his famous paper "A Method of Reaching Extreme Altitudes".

In this particular aspect of the lunar vehicle concept the BIS designers (and Goddard, for that matter) turned out to be quite wrong. They did not anticipate the enormous advances that would be made 15 to 20 years later in structural design and in the development of very large rocket engines of high thrust/mass ratio. However, they were designing as close as possible to the state of the art at that time, when even their relatively small 100,000 HP (75,000 kw) solid-propellant motors represented a significant extrapolation in the technology. At least it can be said that the BIS group recognized the value of high-performance solid-propellant motors in spaceflight, when continuous single-burn programs were to be involved.

If the main propulsion features of the BIS Lunar Spaceship turned out to be far from the mark, then in many other respects the opposite was true. The study group, for example, appreciated the requirement of inertial navigation devices and, indeed, proposed some experimentation on these. However, it was in the matter of the lunar landing and subsequent return from the lunar surface that they showed their clear understanding of the problem and its solution. In particular, they sketched out the main requirements of the lunar landing vehicle. The intervention of the war prevented the filling-in of detail, but in the immediate post-war years R. A. Smith updated the lunar landing vehicle concept and his design (August 1947) anticipated the Apollo Lunar Excursion Module in every essential feature, including the use of the base section as a launching platform.

WORLD WAR II

On 3 September 1939 Britain entered World War II, and the BIS Council, recognizing the impossibility of continuing to function effectively in the metropolitan area, decided to suspend operation of the Society for the duration of hostilities. It was the end of the pre-war era of the BIS that had extended over six years. In just that length of time the VfR had been born, had risen swiftly to glory, and then faded suddenly from sight. The BIS had a much more modest entry into the world of astronautics and its progress to maturity had been slower and far less spectacular. But by 1939 it had been set on a sound course that was to take it surely in the right direction.

During the war years some members of the BIS maintained communication and also established contact with other fledgling astronautical societies in Britain.¹¹ Towards the end of the period of hostilities two of these had come together to form a group called the Combined British Astronautical Society (CBAS) whose leaders then expressed an interest in merging with the older BIS.

REAWAKENING AND GROWTH

On 13 June 1945 the BIS re-emerged from its six-year hibernation with an informal meeting convened by A. M. Low at the Royal Automobile Club in London. Only three of the old Council, namely, Low, Cleator, and R. A. Smith, were present, so an emergency committee of these three and seven other members present was appointed to act for the Council. The main decision taken by the emergency committee was that the BIS should be incorporated and its constitution revised to conform with the legal requirements for this. L. J. Carter undertook to draft a revised constitution. The implementation of the decision was overtaken by events, for on 25 September representatives of the BIS and CBAS met and agreed to merge to form an enlarged British Interplanetary Society, which should then be incorporated. Carter continued with his appointed task, preparing the Memorandum and Articles of Association. These were completed and then approved at a further meeting of representatives of the merging groups and on 31 December 1945 the British Interplanetary Society received the certificate of registration as a company limited by guarantee and having no share capital.

L. J. Carter was appointed Honorary Secretary of the Society, an office which was eventually discontinued to give way to the post of Executive Secretary. To the enormous benefit of the Society, this incumbancy has remained in his capable hands since that time. The new Council consisted of twelve members, including a Chairman, and eventually a Vice-Chairman. There were no officers other than a Technical Director (a continuation of the pre-war post of Research Director). The office of President was allowed to lapse and was not re-introduced until 1960 (Table 1). In the interim, the Chairman of the Council acted in the presidential capacity and, retrospectively, the Council Chairmen between 1946 and 1959 are now rightly regarded as past BIS Presidents.

Table 1
PRESIDENTS OF THE BRITISH INTERPLANETARY SOCIETY

| PRESIDENT | PERIOD OF OFFICE |
|-----------------------------|------------------|
| P. E. Cleator | 1933-1936 |
| A. M. Low | 1937-1939 |
| E. Burgess ^a | 1946 |
| A. C. Clarke ^a | 1946-1947 |
| A. V. Cleaver ^a | 1948-1950 |
| A. C. Clarke ^a | 1951-1953 |
| L. R. Shepherd ^a | 1954-1956 |
| R. A. Smith ^a | 1956-1957 |
| L. R. Shepherd ^a | 1957-1960 |
| W. R. Maxwell | 1960-1963 |
| M. N. Golovine | 1963-1965 |
| L. R. Shepherd | 1965-1967 |
| W. R. Maxwell | 1967-1970 |
| G. V. Groves | 1970-1973 |
| K. W. Gatland | 1973-1976 |
| G. V. Groves | 1977-1979 |
| G. V. E. Thompson | 1979-1982 |
| A. T. Lawton | 1982- |

^a In the period 1946-1960 the most senior officer of the Society, although undertaking the duties of President, was known as Chairman of the Council.

For a few months after its incorporation the Society was limited to publishing a duplicated *Bulletin*, but as membership grew it became possible to have this publication printed. Publication of a printed *Journal* was also resumed and an *Annual Report* was supplied to members. For a year or two all three periodicals appeared, until it was decided to concentrate the Society's efforts on the senior publication. So the *Bulletin* and *Annual Report* were dropped, after a useful but rather short existence.

The journals now being issued were much more professional publications than the pre-war issues, both as regards content and production, and their standard has continued to improve. Mathematical papers on subjects such as interplanetary flight and rocket combustion began to appear. An important source of contributions to the *Journal* was the series of monthly lectures organized by the Society, held first at the St. Martin School of Art and later at Caxton Hall, Westminster, but many

others were specially written for publication. Only a few papers can be mentioned here: "The Atomic Rocket", by L. R. Shepherd and A. V. Cleaver, "Interplanetary Man" by Olaf Stapledon, "Orbital Bases" by H. E. Ross (dealing with the establishment and design of spacestations), "Lunar Spacesuit" by H. E. Ross, "Perturbations of a Satellite Orbit" by Lyman Spitzer, and "The Man-Carrying Rocket" by R. A. Smith. The latter was a proposal for converting a captured V2 rocket to carry a man, to enable the first manned sub-orbital spaceflights to be made. In addition to being presented to the Society as a paper these proposals were put formally before the Air Ministry, but no action resulted. More than a decade was to elapse before Shepard and Grissom made such flights with a Redstone rocket in the U.S.A. Of course their flights were less hazardous than that envisaged by Smith but volunteers were available to make the attempt and the dangers are of much the same magnitude as in crossing the ocean single-handed in a rowing boat or a barrel--almost commonplace voyages today!

A series of composite papers presented by K. W. Gatland, A. M. Kunesch, and A. E. Dixon in 1950-51 "Initial Objectives in Astronautics", "Orbital Rockets", and "Minimum Satellite Vehicles" considered useful astronautical projects,¹² short of manned spaceflight, which could be accomplished with the then existing rocket propellants and engineering practice. The third paper had four schemes for vehicles which should be able to put into orbit around the Earth minimum satellite payloads capable of providing useful scientific information. A connection has been traced from this work to the first U.S. artificial satellite.¹³

In the immediate post-war years the pursuit of technical assessment was continued, with a Technical Committee under a Technical Director. Study Groups dealing with various aspects of spaceflight were set up and these met from time to time. However, there was no single project, such as the pre-war Lunar Spaceship, on which attention could be focused and the work of the groups gradually evolved into efforts of individual enthusiasts or of partnerships of two or three people who pursued their favored topics without direction. Eventually the need for a technical committee and director disappeared because undirected ventures were proving to be highly fruitful in producing original *Journal* papers.

FOUNDATION OF THE IAF^{14,15}

While the BIS was consolidating its position in the UK and also attracting many overseas members, a number of astronautics and rocket societies were being established in other countries. By 1950 the BIS was in touch with bodies in Argentina, Denmark, Germany, Canada, and the U.S.A., including the pre-war American Rocket Society. In the Federal German Republic, three autonomous groups made up the Gesellschaft für Weltraumforschung (GfW). Close contact existed between the British society and the Stuttgart GfW, when in June 1949 the Board of Directors of the Society passed a resolution calling for an international meeting of all societies concerned with rockets, interplanetary travel, and space research, in order to foster friendly relations and the exchange of information and to explore the pos-

sibilities of forming an international astronomical association. The GfW communicated this resolution to other societies and asked the BIS if it would be prepared to hold the proposed meeting in London. The resolution was well received by the BIS Council and a reply indicating its broad agreement was sent to the West German society.

Correspondence developed between the GfW, the BIS, and the Groupement Astronautique Français on the proposed international association and the meeting of the various national societies that would form it. The BIS considered that two years would be required to set up a full-scale London conference, but M. Alexandre Ananoff, the President of the French group, indicated that he would be able to organize a preliminary meeting in Paris. This Paris meeting was held on 30 September - 2 October 1950. It was limited to a large public meeting on the first day and small business meetings of the societies' representatives on the other two days. The public meeting was impressive, being held in the Richlieu Grand Amphitheatre of the Sorbonne with about 1000 people in attendance. H. Mineur, Director of the Institut d'Astrophysique, presided and many distinguished public figures were present. This type of opening meeting was to form the pattern for subsequent Congresses.

The business meetings were held at the French Aero Club and were confined to the official representatives of eight participating societies and four independent observers. They were (in addition to Ananoff): Tabanera (Sociedad Argentina Interplanetaria); Cap, Rückert, Schmiedl (Oesterreichische GfW); Hansen (Dansk Interplanetarisk Selskab); Brugel, H. H. Koelle, Loeser (GfW, Stuttgart); Jungklass. Oesterwinter (GfW, Hamburg); Mur (Agrupación Astronautica Española); Hjerstrand (Swedish Society in process of formation); Burgess, Clarke, Cleaver, Humphries, Shepherd (British Interplanetary Society). The independent observers were Frau Dr. Bredt, Engels, Nebel, and Sängner, providing a nostalgic link with the old VfR.

These plenary meetings did not establish the international association, but at the end six points were resolved unanimously:

1. That such a body should be created.
2. That it should be inaugurated at a Congress to be held in London in 1951;
3. That in the interim, representatives of the individual societies should correspond, to exchange views and proposals relating to the proposed astronomical federation.
4. That the British Interplanetary Society, which would organize the 1951 London meeting, be charged with the task of co-ordinating the proposals submitted.
5. That the functions and constitution of the proposed international body should be worked out well in advance of the London meeting and should form the basis for the discussions at the plenary sessions, leading to an agreement to inaugurate the international organization.
6. Pending the setting-up of the international body, Dr. Eugen Sängner would preside over a provisional committee consisting of the leaders of the delegations present at the Paris meeting.

In the intervening year there was a considerable exchange of correspondence, most of it between the Stuttgart GfW and the BIS and indeed it owed much to the efforts of Guenter Loeser of the BIS that the British society was able to circulate a draft Constitution of the IAF in May 1951, four months ahead of the Conference.

The Second International Astronautical Congress was held in London during the week commencing 3 September 1951 with the BIS acting as host. It should be noted that the Congresses are numbered from the Paris meeting and that consequently the Congresses predate the International Astronautical Federation (IAF) by one year, a fact that is not always appreciated. The venue was Caxton Hall, Westminster, which by this time was being used extensively by the BIS for its various meetings. Some 40 overseas visitors were present at the Congress, which was also well attended by members and others from Britain. At the plenary sessions in addition to the Societies that had been represented in Paris there were delegates from astronautical bodies in the Netherlands, Italy, Switzerland, and the U.S.A. Among those present was Hermann Oberth.

The London Congress was the prototype of the annual meetings that were to follow in having a public meeting, plenary session of delegates, and a technical symposium. The symposium held at London had as its theme "Earth-Satellite Vehicles," a down-to-Earth topic which properly emphasized the first step in spaceflight. At that time there was no need to hold parallel sessions and there was no international program committee, the symposium being co-ordinated by the host society (in the case of the London Congress the BIS Technical Advisory Committee was responsible).

A. C. Clarke, on taking over as Chairman of the BIS Council from A. V. Cleaver, welcomed those attending the Congress and Eugen Sänger presided over the plenary meetings of the delegates. The International Astronautical Federation was duly inaugurated at the end of these sessions on 4 September 1951. The constitution drafted by the BIS on the basis of its correspondence with its contemporary founder-societies was not immediately adopted, however, because of disagreement on a single issue (the question of voting). It was left to the Third International Congress to agree to the principle of having a single voting society in each country represented in the Federation. This is still a controversial issue.

The BIS is naturally proud of the major role that it played in the foundation of the IAF. It is a matter of interest that at the 10th International Astronautical Congress (also organized by the BIS in London) in 1959 the International Academy of Astronautics (IAA) and International Institute of Space Law (IISL) came into being.

PERMANENT HEADQUARTERS

Another important development occurred in 1952. On 12 May 1952 the Society moved into an office (a modest L-shaped room) at 12 Bessborough Gar-

* Technical Director (L. R. Shepherd), Deputy Technical Director (G. V. E. Thompson), and Council Chairman (A. V. Cleaver).

dens, London SW1 as tenants of the Queen and her government--or more precisely, of the Crown Agents. This was a normal commercial transaction--the BIS is an independent Society neither receiving a government subsidy nor subject to any government control or direction (other than the law of the land, which applies to all citizens and corporate bodies). The Society does, however, have excellent relations with government scientists and establishments working in relevant fields. This is often a two-way relationship, with each party doing what it can to assist the work of the other.

About this time, a paper was read on "Interstellar Travel", demonstrating that the Society's interest in space had no limitations. But more pressing problems were not neglected. The design and testing of rocket motors received considerable attention, as did the mathematics of transfer between different orbits, food and atmosphere control in space vehicles, landing on airless planets, a lunar base, and a host of other topics. Demonstrations of the properties of rocket propellants were given and visits to various research establishments were organized for members.

Besides these "internal" activities, leading members of the Society worked hard to disseminate information about astronautics to the general public by means of books, magazine and newspaper articles, occasional radio programs, but above all to scientific or social organizations, schools, factories, trade unions, youth groups, etc. Common fallacies and misconceptions about interplanetary travel were gradually dispelled, interest in the subject was awakened, and as a result the Society's membership rose rapidly in the early 1950s.

Rockets were now being used extensively to explore the upper atmosphere. In August 1953 an important conference on this subject was organized by the Royal Society at Queens College, Oxford. About half the BIS Council attended and participated in the discussion. The most significant of the papers presented was that of Singer, who developed the ideas of Gatland and co-workers (mentioned above) and proposed the MOUSE satellite vehicle (Minimum Orbital Unmanned Satellite Earth) concept and identified many of the applications for which the 100 lb satellite would be suitable for studying solar radiation, cosmic rays, weather, etc.

Although the Society's eyes were directed firmly towards the future, the past was not neglected. As World War II receded into history, secrecy was relaxed and it became possible for the *Journal* to publish valuable accounts by German engineers, such as Riedel and von Braun, describing early rocket experiments and the development of the V2 (or A4) and other rocket weapons. Data sheets were printed on existing rocket vehicles and engines.

It is impossible to mention here all the topics covered in the Society's *Journal* at that time--suffice to say that they dealt with all aspects of spaceflight, often in considerable detail. Some have since become matters of fact; others (such as extraterrestrial mining or farming) have still to be put into practice. Two series of mathematical papers--those of Lawden on the correction and perturbation of interplanetary orbits, and those by King-Hele on the descent of Earth satellites through the upper atmosphere--were providing the theory which would be needed in all the forthcoming work with artificial satellites.

In July 1955 the U.S. Government announced an artificial satellite program which would be linked with the International Geophysical Year (IGY), due to commence in July 1957. The BIS began to organize "Moonwatch" and radio tracking teams to observe the satellites (it should not be forgotten that this was before the establishment of the massive governmental and international tracking stations--the giant radio telescope at Jodrell Bank was in construction but had run into engineering and financial difficulties). At the Copenhagen Congress of the IAF (August 1955) the U.S.S.R. also announced interest in artificial satellites, but little information about their plans was given.

This led to an increase in the public awareness of astronautics and so the BIS Council judged the time right for the issue of a popular space magazine. In October 1956, *Spaceflight* commenced publication, initially under the editorship of Patrick Moore, the well-known amateur astronomer, author, and TV personality. A selection of twenty-four of the best papers from the Society's *Journal* also appeared as a book edited by Len Carter¹⁶ and was an immediate success. Len Carter had edited the *Journal* since March 1947 as well as being the Society's Secretary, but in view of the great increase in office he now had to relinquish the editorship, G. V. E. Thompson replacing him.

After the war the membership of the BIS grew steadily to reach just over 900 in the first five years after its incorporation. Then in the space of two years it more than doubled, standing at 2010 on 30 September 1952. To some extent this spectacular increase reflected the considerable attention given by the national press to the Paris and London Congresses.

The BIS now matched the ARS in the size of its membership and shared the honor of being one of the two largest astronomical societies in the world. The progress in membership continued, passing the 3000 mark in 1957 and reaching a peak of 3300 at the end of 1959. There was a slight drop in membership during the mid-sixties but by the mid-seventies it had stabilized again at just over 3000. This level sometimes appears to have been fixed by some natural law!

Other societies and educational establishments were now finding that certain aspects of astronautics were having an impact in their own fields, so it was opportune to hold joint symposia with the BIS on appropriate topics. The first of these was the Symposium on High Altitude and Satellite Rockets,¹⁸ organized jointly by the BIS, the College of Aeronautics, Cranfield, and the Royal Aeronautical Society and held at the College in July 1957. Details of the U.S. satellite program were given and a Russian delegation attended.

DAWN OF THE SPACE AGE

On 4 October 1957 as delegates (including a strong BIS contingent) were travelling to Barcelona for the eighth IAF Congress, there came the news of the launching of the first Russian Sputnik. The Space Age had begun! Astronautics immediately captured the imagination of press and public, for what had previously seemed fantasy had become fact. Activity increased in all aspects of BIS work.

In 1958 the Society was twenty-five years old. This special anniversary was celebrated at a banquet at the Waldorf Hotel, London, held in conjunction with the International Symposium on Space Medicine and Biology organized by the BIS and held in the Great Hall of the British Medical Association.^{19,20} The voyage of the dog Laika in the second Russian satellite, *Sputnik 2*, on 3 November 1957 had indicated that manned spaceflight would not be long in coming and so this symposium was well attended. Three of the papers presented were from the RAF Institute of Aviation Medicine and a strong team from the U.S. Office of Naval Research discussed American work. The early unmanned satellites had given valuable results for this field, one interesting discovery being the van Allen radiation belts around the Earth.

The following year (1959) was an exceptionally heavy one for the BIS. In addition to its ordinary activities of publishing and local meetings, the BIS was again host-Society to the IAF and organized the Tenth International Astronautical Congress at Church House, Westminster. The Society at last received a good measure of Government support, with the Congress being opened by the Minister of Supply and the delegates being invited to a reception at Lancaster House. Eighty-one papers were read at the Congress. In addition, there was a Space Law Colloquium held in parallel at Lincoln's Inn. The whole series of meetings was preceded by a Commonwealth Space Flight Symposium, which surveyed work then going on in the British Commonwealth.²¹ Proposals were made at the Symposium for the establishment of a joint Commonwealth Space Agency, but these came to naught.

BIS MEMORANDA TO UK GOVERNMENTS

After the launching of the first artificial satellite the BIS increased its activity in the political arena, being concerned to see a strong industry devoted to space technology established in the U.K. Leaving aside any question of national pride, this seemed to be clearly in the interest of the Society in securing its future professional standing. At this time, although lagging behind the U.S.A. and U.S.S.R., Britain was seriously in the business of rocket propulsion, having at an advanced stage of development a large liquid-propellant rocket (Blue Streak) and a smaller one (Black Knight). These had been intended for a military application, which was abandoned, and the opportunity existed of adapting them as spacecraft launching vehicles. The BIS was anxious to support this.

In January and February 1960 two special meetings were convened by the Society with the object of drawing up a memorandum concerned with the need for a U.K. space program and intended for submission to the Government. The participants in these meetings comprised BIS Council members, senior members of the aeronautical and space-related industry, and political figures. Most of those present were members of the BIS. The document produced made a number of recommendations under the heading "A Space Programme for the UK", the main features of which were:

1. A specific project to develop Blue Streak and Black Knight as a satellite launching vehicle.

2. A later project to develop a more powerful launch vehicle combining Blue Streak with higher-performance second and third stages.
3. A detailed feasibility study of communications satellites and an examination of their significance.
4. A program of research on winged reentry vehicles.
5. A modest program on space medicine.
6. A long-term program on advanced propulsion systems (nuclear, electrical, etc).

The above Memorandum was submitted to the Prime Minister (Harold Macmillan) on 2 March 1960, and was referred to the Science Minister (Lord Hailsham), who received a deputation from the BIS (A. V. Cleaver, P. Masefield, L. R. Shepherd) on 10 May. The outcome of the meeting was that the BIS was invited to submit a more detailed document to the Prime Minister and the Minister for Science stressing the benefits to the country of a space program and its impact upon technology in general. This the Society duly did.

Subsequently, BIS representatives met an all-party group of MPs at the House of Commons to assist them in setting up a Parliamentary Committee on Space.

The BIS proposal to develop a launch vehicle based upon a combination of Blue Streak and Black Knight was never implemented, though it was the subject of a feasibility study carried out in the Royal Aircraft Establishment at Farnborough. However, the U.K. Government submitted a proposal to other European countries which led to the setting-up of ELDO, with the principal object of developing a three-stage launching vehicle (Europa) using Blue Streak as the first stage. This project, unfortunately, was abandoned some years later after the U.K. reneged on the agreement with its ELDO partners during the term of the Wilson Government. It may be realized, however, that a smaller launching vehicle, Black Arrow (based on Black Knight) was developed, at a very low cost, and used to launch a small satellite. This too was abandoned after one successful mission and subsequently the British aerospace industry concentrated on spacecraft and played no part in developing launchers.

In 1965 the BIS submitted another detailed memorandum to the Wilson Government on the theme of European cooperation in space, the main points being:

1. The need to set up a single Western European space authority.
2. The need for Western Europe to develop more powerful launching vehicles, including a reusable type.
3. The undertaking of a broad program of space research covering both the Earth's environment and deep space studies.
4. The pursuit of a manned spaceflight program.

This memorandum met with little response, the U.K. Government of the day being unfavorably disposed towards space technology and to some extent hostile to European collaboration in the field. The Government was responsible for the withdrawal of British support from ELDO (which had been set up on Britain's initiative) and for moving the country down from the fairly forward position that it had hitherto occupied in space technology to a much lower status.

Seven years later, in February 1972, the BIS sent a further recommendation to the Heath Government, again urging the establishment of a European Space Authority. This time the Society was in powerful company, for the U.K.'s Science Research Council and Aeronautical Research Council were of the same opinion on this issue and were also pressing for a European counterpart of NASA. The British Minister for Aerospace and Shipping (Heseltine) put this proposition to a European Space Conference in November 1972 and on 1 January 1974 the European Space Agency was founded.

SYMPOSIA

After the Tenth International Astronautical Congress it was decided that the holding of technical symposia should be a regular feature of BIS work, and that practice has continued to this day. On occasion they are held in conjunction with other organizations. The time seemed opportune for a closer grouping of the European astronautical societies and it was decided to hold periodic European Symposia on Space Technology. The BIS hosted the first of such meetings, held at Federation of British Industries House in June 1961. Similar symposia have been held ever since then, with the venue rotating from country to country.

The titles of the subjects chosen for the Society's own one- or two-day symposia during the early 'sixties showed how widely these ranged over most aspects of astronautics--the topics ranged over Communication Satellites, Liquid Hydrogen as a Rocket Propellant, Rocket and Satellite Instrumentation, Space Navigation, Materials in Space Technology, Navigation and the Early Exploration of the Moon, Astronautics in the School Curriculum, Generation of Power in Space, Meteorology from Space, Advanced Propulsion, Aerospace Vehicles, Ground Support Equipment, the ELDO Launching Vehicle, and the Engineering of Scientific Satellites. The papers presented and the ensuing discussion appeared in the Society's *Journal*--sometimes they even reached a wider readership by being also published in books.²⁰⁻²⁷

As part of its work in the field of education, the BIS organized a course on Rocket Motor Technology, intended for teachers. A *Teacher's Handbook of Astronautics* plus two supporting books and materials were published and proved popular.²⁸

One of the Society's duties has been, and still is, to signal its recognition of the achievements of distinguished workers in astronautics by making appropriate awards. A grade of Honorary Fellowship was used to honor the work of the early pioneers. When spaceflight really came about, it was deemed appropriate to extend

the range of awards to gold and bronze medals for individuals and silver plaques for group achievements. The first gold medals were awarded in 1961 to Yuri Gagarin (for the first manned flight in space) and to Wernher von Braun (for the development of the Pershing, Redstone, Jupiter, and Saturn rockets at NASA's George C. Marshall Space Flight Center). The third was awarded in 1964 to Valentina Nikolaeva (*née* Tereshkova), the first woman to make an orbital flight. Both the Russian cosmonauts were able to come to London at the invitation of the BIS to receive their medals and many members attended the ceremonies. Subsequently, Edwin Aldrin, Neil Armstrong, and Michael Collins each were to receive a gold medal for the Society in recognition of the triumph of *Apollo 11*, while NASA was presented with a silver replica of the lunar landing vehicle in recognition of the group effort. Other silver awards have recognized both American and Russian successes in space, but are too numerous to mention.

After much discussion in Council and with the Society's solicitors, a new Constitution (or rather Memorandum and Articles of Association) was approved in 1965. This included abandoning powers to carry out mining and other operations on the Moon, etc. About that time the decision was taken to suspend publication of the *Journal* temporarily in order to place *Spaceflight* on a monthly basis from January 1966. K. W. Gatland had replaced Patrick Moore as Editor of *Spaceflight* in 1959 and was to continue in that office until May 1981. *Spaceflight* has continued to appear monthly ever since 1966, except for occasional double numbers made necessary by staffing problems at holiday times.

In 1966 the BIS received a Spacemobile on loan from NASA for several months. This was a very large van, fully equipped with a wide variety of models, films, and other visual aid equipment. Lecturers from the Society toured Britain with the vehicle to carry out experiments and demonstrations at hundreds of schools, colleges, teachers' training centers, factories, and service establishments.

By 1968 the finances of the Society had improved and it became possible to recommence publishing the *Journal*, at first quarterly and later bi-monthly. Professor G. V. Groves was appointed Editor. The new Constitution now enabled the Society to be registered as a Charity, which gave it a number of tax advantages. An equipment fund was launched, which allowed composing and ancillary equipment to be bought, with the result that great savings were made in typesetting *Spaceflight* (from 1972) and the *Journal* (from 1974). They were typed out and paged in the Society's Headquarters, although still printed externally. The *Journal*, meanwhile, became a monthly again in 1970. Its page size had been reduced when it reappeared, but in 1978 it was restored to its old format (A4). These changes provided a greatly improved service to members but meant that the work at the office was multiplied by an even greater factor. More working space was urgently required especially since the threat of demolition of the Society's offices was looming to make way for redevelopment of the surrounding area, mostly Crown property.



Figure 1 Old BIS Headquarters at 12 Bessborough Gardens, London (since demolished under a redevelopment scheme).

NEW HEADQUARTERS AND THE FUTURE

A search was made for alternative premises and an appeal for funds to make such a move possible was launched. Members and friends responded handsomely and eventually a suitable site was found. The building was derelict, but had potential. Eventually it was purchased, plans for its rebuilding were drawn up, and planning permission obtained, the plans modified to meet conditions imposed by various authorities (part of the site was occupied by a listed historic building and required special treatment), and builders chosen. The rebuilding was an anxious time for the Executive Secretary (who had to keep an eye on progress and watch out for any snags or misinterpretations of instructions by the builders, as well as carrying on with the routine business of the Society) and other staff, but eventually the construction was complete and by May 1979 the BIS had crossed the Thames to the South Bank and was installed in its new headquarters.²⁹

The Society was no longer in rented accommodation, but in property it owned completely and it has been the Council's policy to continue to improve its Headquarters. We now had satisfactory offices, library, a Conference Hall, Council Room, a reception area for members, kitchens, storage space, etc. Equipment was updated (the BIS has now acquired word processors, a modern plain paper copier, and other advanced machines to expedite its work) and we are today considering further expansion.



Figure 2 Present BIS Headquarters (1979) at 27/29 South Lambeth Road, Vauxhall, London, SW8 1SZ.

Back in April 1974, the first of a series of "red-cover" issues of the *Journal* had been published; these dealt with Interstellar Studies--a subject in which the BIS had a long-standing interest. "Red-cover" issues have continued to appear at frequent intervals. A group of BIS members has also been working on a starship study since 1972 and this culminated in a very successful book on Project Daedalus, as it became known.³⁰

Other "special-color" issues of the *Journal* followed, each dealing with a particular topic in astronautics (orbital dynamics, space science, astronautics history, etc.) and each with its own "Series Editor". This enabled Professor Groves to relinquish the editorship of the *Journal*, and when Ken Gatland's professional commitments forced him to step down as Editor of *Spaceflight* in May 1981 (after a long and exhausting tenure of that office), Professor Groves was able to take his place. A third journal, *Space Education*, began in 1981, under the wing of *Spaceflight* initially, but now independent and edited by A. D. Farmer.

Recent books issued by the BIS include *High Road to the Moon* (which records many of the Society's original ideas and discussions on lunar exploration in the visionary drawings of the late R. A. Smith³¹ and *The Eagle Has Wings* (which tells the story of major U.S. space projects from 1945 to 1975).³²

The BIS is about to start its second half-century, and we have every confidence that even greater achievements lie ahead for our society and astronautics in general. We look forward to the establishment of large permanent spacestations, to a return

to the Moon in greater strength to establish a lunar base, and (though perhaps not in the lifetimes of the authors of this paper) the first manned mission to Mars. The BIS hopes to continue to contribute ideas towards these projects. Indeed, with its interest in star travel, the Society sometimes gazes even further ahead. If the reader thinks that too distant to merit present discussion, let us remind him or her that two man-made vehicles have already left the Solar System. Who knows where they may go eventually?

REFERENCES

1. F. H. Winter, *Prelude to the Space Age: The Rocket Societies 1924-1940*, Smithsonian Institution, Washington, 1983.
2. L. E. Winick, *Spaceflight*, 1978, **20**, p.162.
3. F. H. Winter, *Spaceflight*, 1977, **19**, p.243.
4. *Spaceflight*, 1967, **9**, pp.150, 201, 234, 264, 299.
5. G. V. E. Thompson, *Spaceflight*, 1979, **21**, p.402.
6. A. V. Cleaver, *Spaceflight*, 1961, **3**, p.169.
7. P. E. Cleator, *Rockets through Space or the Dawn of Interplanetary Travel*, Allen & Unwin, London, 1936.
8. P. E. Cleator, *J. Br Interplan Soc*, 1950, **9**, p.49.
9. H. E. Ross, *J Br Interplan Soc*, 1950, **9**, p.93.
10. H. E. Ross, *Spaceflight*, 1961, **3**, p.164.
11. E. Burgess, Paper to 17th IAA Symposium on the History of Astronautics, 1983, IAA-83-287.
12. K. W. Gatland, A. E. Dixon, and A. M. Kunesch, *J Br Interplan Soc*, 1950, **9**, p.155; 1951, **10**, pp.97, 107, 115; 1953, **12**, p.274.
13. *Spaceflight*, 1979, **21**, p.227.
14. A. V. Cleaver, *J Br Interplan Soc*, 1950, **9**, p.315.
15. L. R. Shepherd, *Spaceflight*, 1956, **1**, p.159.
16. *Realities of Space Travel: Selected Papers of the British Interplanetary Society*, (Edited by L. J. Carter), Putnam, London, 1957.
17. W. S. Bainbridge, *The Spaceflight Revolution*, Krieger, New York, 1983.
18. *High Altitude and Satellite Rockets: A Symposium Held at Cranfield, England, 18th-20th July 1957*, Royal Aeronautical Society & British Interplanetary Society, London, 1958.
19. *J Br Interplan Soc*, 1960, **17**, pp.278-327.
20. *Space Research and Technology: Proceedings of Symposia Sponsored by the British Interplanetary Society: Space Medicine Symposium: Rocket and Satellite Symposium: Space Navigation Symposium: Liquid Hydrogen Symposium*, (Edited by G. V. E. Thompson), Gordon & Breach, New York-London, 1962.
21. *Spaceflight Technology: Proceedings of the First Commonwealth Spaceflight Symposium Organized by the British Interplanetary Society, 1959*, (Edited by K. W. Gatland), Academic, London, 1960.

22. *Communications Satellites: Proceedings of a Symposium Organized by the British Interplanetary Society*, (Edited by L. J. Carter), Academic London, 1962.
23. *Materials in Space Technology*, (Edited by G. V. E. Thompson and K. W. Gatland), Iliffe, London, 1963.
24. *Rocket Propulsion Technology, Vol. 1. Proceedings of the First Rocket Propulsion Symposium. 1961*, (Edited by D. S. Carton), Plenum, London, 1961.
25. *Spaceflight Today*, (Edited by K. W. Gatland), Iliffe, London, 1963.
26. *Space Research and Technology. Vol. 1. The Space Environment*, (Edited by N. H. Langton), University of London Press, London, 1969.
27. *Space Research and Technology. Vol. 2. Rocket Propulsion*, (Edited by N. H. Langton), University of London Press, London, 1970.
28. *Teachers Handbook of Astronautics*, (Edited by S. W. Smith), British Interplanetary Society, London, 1963.
29. E. Waine. *Spaceflight*, 1979, 21, p.409.
30. *Project Daedalus: The Final Report of the BIS Starship Study* (Edited by A. R. Martin), British Interplanetary Society), London, 1978.
31. R. C. Parkinson and R. A. Smith, *High Road to the Moon*, British Interplanetary Society, London, 1979.
32. A. Wilson, *The Eagle Has Wings*, British Interplanetary Society, London, 1982.