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23 October 1986

Dear George

THE SPACE PLAN

1 You will recall that when the British National Space Cerntre (BNSC) was established last November one of its initial remits was to produce "a coherent national space plan". I attach a copy of that plan along with an executive summary.

THE OPTIONS

2 The UK has to decide now whether it should continue to aim for a significant role in space. The establishment of the BNSC has coincided with a significant increase in activity in the European Space Agency (ESA), through which most of our international space effort is conducted. You will recall that at the Rome Ministerial meeting in January 1985 which I attended it was agreed that the ESA budget should increase by 70% in real terms by 1990.

3 A level budget in cash terms and a significant decline in the value of the £ mean that we have difficulty in maintaining any significant presence in ESA. We must decide now whether we are prepared to pay enough to participate in ESA at a level such as to maintain our capability in space (with a reciprocal national programme to support this), or whether we allow our participation to continue to decline, so that we drift out of the business (and no doubt before long leave ESA).

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4 The latter course would be totally inconsistent with our policies of support for high technology and their application, and moves towards greater European collaboration exemplified by programmes such as EUREKA and ESPRIT. I do not see how we can portray ourselves as an advanced technological country and a sound technological partner in Europe if we drop out of the European effort in space. It would also be politically dangerous to be seen to turn our backs on an area which can act as a catalyst for many leading edge technologies, not to mention the strategic problems which the loss of national capability would produce.

5 Space is a young industry. The rapidly changing technology and the large capital outlays involved make it high risk but there could be long term large commercial rewards for a whole range of industries. If the UK is to be in a position to secure its full share of these benefits, it will have to keep up with the game while the technology and the applications are developing.

6 We cannot, as a nation, take a major role in every area of space activity. We cannot afford to. We must, therefore continue to give priority to those areas with the best prospects of long term commercial benefit such as satellite communications and earth observation which feature heavily in both the ESA and national parts of the plan. However, we cannot concentrate exclusively on these areas, as we have done for the most part in recent years. If we are not involved in infrastructure projects such as the space station, our route to continuing involvement in space technology will be cut off and we will not have guaranteed access to the station, which will provide the basis for many space applications of the next century.

Details Of The Plan

7 The 1986/87 government budget on space (excluding certain military programmes) is £108 m. Of this £75 m goes to ESA and the rest (£33 m) is spent on national and a few other international activities. The national programme has been squeezed in recent years by the needs of our ESA membership although the level of our ESA participation itself has reduced. Historically, the UK's average participation in ESA has been about 14% (our GNP share is 16.9%). This year it has been constrained to 12½% with only an 8½% average participation in new programmes (cf France 28%, Germany 27% and Italy 16½%).

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8 Whilst there can be no hard and fast rules over the ratio between the spend on ESA and national programmes, the current position provides an inadequate national backing for the UK's involvement in ESA projects. This will lead to us not being able to take full advantage of our participation in ESA. For example, we do not yet even have the ground facilities in the UK to receive data from the ERS-1 remote sensing satellite in which we have a sizeable interest.

9 The plan is divided into broad areas of technology, the largest of which are satellite communications and earth observation both of which have significant recommended ESA and national programmes. Our ESA participation also includes involvement in the Space Station, the (mandatory) science programme, and new launch systems. The national programme includes money for space science, a satellite platform technology programme and improved national satellite test facilities.

Communications

10 After the Americans we have arguably the best communications satellite industry in the world thanks to taking the lead in all the ESA communications satellite programmes to date. Our industry is now able to reap the benefits of earlier pump priming: the latest INMARSAT competition for instance was fought out between two British-led international consortia.

11 With a reduced share in ESA programmes and continuing military orders, it should be possible for the UK to maintain its edge over its European competitors. The market for dedicated, fixed satellite links is now becoming more established and commercially profitable and so our funding in ESA is moving out of that area into areas with longer term market potential such mobile communications for ships, aircraft and trucks. We also need to ensure an adequate national programme to support the European work. The plan proposes that we take the lead in the more important future ESA projects in this area. I think that it is important that we do so, so that we can then look to industry increasingly to take up initiatives through commercial and defence programmes.

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Earth Observation

12 Although currently in its infancy, earth observation is generally seen as the next major growth area in the utilisation of space. It is perhaps at the stage that communications satellites were 15 years ago and will provide opportunities for a wide range of industry and commerce to benefit from space activities. Indeed the range of potential users appears so wide that many have yet to be identified. No other technique can give the repetitive global coverage needed to predict the weather; manage and observe the Earth's resources; and observe the surface of the earth as a whole.

13 Some of the best commercial opportunities may well lie in the handling, interpretation and dissemination of the vast amount of data produced. There are clear opportunities for hardware and software companies and systems designers. While there are obvious military and scientific uses of this technology there is also the chance for many other classes of user, by no means all yet identified, to benefit from the information, suitably processed and presented. To secure much of this for the UK, however, much more will need to be spent nationally on the "ground segment", and in the technology of sensors. The plan advocates a 20% involvement in ESA's future observation programme, a level at which the UK should also be able to exert greater influence on the choice of information gathered.

Space Station

14 The plan envisages a 15% stake in the Columbus programme (Europe's contribution to the Space Station). This was planned to be split equally between DTI, MOD and industry, at the time of the Rome Ministerial. Promises from industry have not yet been forthcoming but I would propose to press further for them, or for an equivalent involvement in other parts of ~~Columbus~~ such as the technology programme. Our main interest is in the polar platform on which we have established the lead and can identify potential users, defence, commercial and scientific.

6. / the BNSC programme

15 It is important also to have a small interest in the rest of the Columbus programme. Not only will it provide further opportunities for the British software and communications industry but, possibly more significantly will prevent us from being frozen out of direct involvement in the space station by other nations who might claim that the polar platform is not properly part of Columbus, which physically it is not.

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Space Science

16 Participation in the ESA science programme is mandatory at GNP (16.9%). The programme itself is growing at 5% annually and, since most of the equipment sent up into space under the programme is produced by member states, we need an enhanced national programme to support our involvement.

Microgravity

17 The microgravity programme has commercial potential for new materials, semi-conductor processes and the manufacture of pharmaceutical and biological products. An 8% share should ensure enough influence on the programme.

Launchers

18 As you know we have traditionally had only a small stake in the Ariane family of launchers and that is again proposed for Ariane 5. Although small, our present involvement does include some high technology parts such as the navigation system. The plan advocates a 10% share in Hermes if it is adopted as an ESA project. Much will depend on negotiations between now and the next Ministerial in June, but I do not regard participation to this extent in Hermes as a priority. If we persuade ESA to take on the initial feasibility studies for a new generation launcher, of which HOTOL is the leading example, then the HERMES programme may even be dropped.

19 HOTOL is treated separately in the plan. If it is adopted in some form as an ESA project I think we should certainly take a major stake, of perhaps 20% in the feasibility studies, but there is no major expenditure expected until 1989/90, and even then only £20 m.

Other National Programmes

20 The majority of the expenditure recommended to be spent nationally will be devoted to enhanced national programmes to support our ESA involvement in earth observation, communications and space science, without which we will not gain the full benefit of participation. The plan also proposes a programme to provide national satellite test facilities comparable with those of our European competitors. There are major costs and potential

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security risks in transporting satellites overseas for testing. A modern British spacecraft test facility would thus be of great benefit to both our industrial and military programmes and to the UK space industry. The satellite platform technology programme will concentrate on technology common to all space projects such as flight dynamics and control, antennas, propulsion and power supplies. A national technology demonstration programme largely conducted through bilateral international collaboration will provide more flight opportunities than are available through ESA. These are needed to test and demonstrate new items of UK spacecraft technology and new UK payloads in the scientific, commercial and defence fields. There is scope in both these programmes for industrial contributions.

SUMMARY

21 Industrially, space activity is at a stage when major governmental support is both necessary and, I believe, desirable. The costs and risks are too high for industry to bear themselves. Most of the direct commercial benefits to them are still in the long term. Space research is, however, an important technology driver; it sets standards of excellence in industry and brings broadly based returns to many end users and spin off benefits by technology transfer across industry.

22 The scientific programmes in the plan contribute to fundamental research and the development of new technologies and processes. Whilst they cannot be expected to have the same sort of commercial benefits as many other programmes, in many ways they are the basis of much of our present space competence. They also strenghen the links between government, industry and the universities both at home and abroad of which the Giotto mission was such an excellent example.

23 Involvement in space ensures access to international space facilities such as launchers, ground stations, satellites and the space station (when it comes). Without such access and our domestic capability to produce satellites (which could not be sustained without our involvement in ESA) we would face severe security problems.

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24 Paul Channon and I propose - subject to your views - to recommend to colleagues the space plan broadly as it stands. The decisions on finance will be difficult. New money will be needed for the whole of the increase over existing PES provision for space. Paul and I feel we could not recommend to colleagues that we should proceed on any other basis. I do hope to have your support on this. I am looking forward to discussing all this informally with you, as I shall with Kenneth Baker, in order to get a clear view of the wishes of those Departments with a major interest in the BNSC, before we go more formally to a wider group of colleagues.

25 Meanwhile I am writing in similar terms to Geoffrey Howe, because of the FCO's interest in this subject.

GEOFFREY PATTIE

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BRIEF SUMMARY OF THE SPACE PLAN

1 This note summarises the main points of the space plan prepared by the British National Space Centre, as part of its remit when it was established in November 1985.

2 The plan recommends that the UK takes an average 14% share of the growing European Space Agency (ESA) programme and implements an expanded national programme in order fully to benefit from participation in ESA. The total recommended expenditure profile over the next few years will be (in £m cash)

	86/87	87/88	88/89	89/90
ESA Programme exc HOTOL	93	135	157	176
National Programme	39	66	94	126
TOTAL	132	201	251	302
(HOTOL	0	2	3	21)
Current Allocation	108	112	113	119

UK PARTICIPATION IN ESA PROGRAMME

3 The breakdown of the UK's recommended participation in the ESA programme is at Annex A. It includes two mandatory lines (general budget and the science programme) to which the UK must contribute its GNP share (currently 16.9%) and six optional lines. At the Rome Ministerial Conference of ESA in January 1985 it was agreed that the total ESA programme would increase by 70% in real terms by 1990.

Mandatory Expenditure

4 The Rome Ministerial agreed to an annual 5% increase in the science budget until 1990. Our GDP share requires annual expenditure rising to £22 m by 1989/90.

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Optional Programmes

5 The UK has traditionally concentrated on those ESA programmes which appear to have the best commercial prospects - most recently satellite communications. The plan proposes continued UK leadership in future communications projects; a major involvement in the earth observation programme; the lead in the polar platform part of the Space Station and a small, but significant stake in microgravity and launch systems (notably Ariane 5).

Satellite Communications

6 The plan proposes that the UK should continue to lead the future ESA telecommunications programme by taking a 33% stake in the more important parts, thus continuing our leadership in communications within ESA. This stake would reduce to a GNP share (16.9%) over time as industry can be expected to take up commercial opportunities. This is an area where the UK has the most credible industry outside the USA, through taking the lead in earlier ESA progrmmes and with the military Skynet series. Funding will be aimed at areas with long term market potential and military applications, such as mobile communications for ships, aircraft and trucks, and data relay satellites.

Earth Observation

7 Earth observation is the next major growth area in the exploitation of space, with a wide range of scientific, commercial and military applications, many not yet identified. The plan recommends a 20% participation in future programmes, along with the continuance of present projects and a significantly enhanced national programme (see para 14).

Space Station (Columbus)

8 The Rome Ministerial meeting agreed to respond positively to President Reagan's offer for Europe to participate in the space station. The UK has secured the lead on the polar orbiting platform, the most attractive element of Columbus in terms of hardware and applications, including defence. The plan proposes an overall participation of 15% in Columbus, which would also provide opportunities for the UK software and communications industry both in the station itself and the ground segment.

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Microgravity

9 There is a growing industrial interest in using the microgravity facilities of the space station for a wide range of manufacturing processes. The plan recommends an 8% share in the ESA programme which is considered enough to influence its content and provide sufficient flight opportunities.

Launch Systems

10 The UK currently has a 5% stake in the Ariane 4 launcher. This allows British industry to provide the vital guidance system and gives us access to the launcher. Participation at a similar level in the Ariane 5 development should be sufficient to maintain our present technological stake in the programme, and is recommended in the plan.

11 The plan also suggests a 10% stake in the French Hermes project, a "mini-shuttle" designed to be launched by Ariane 5. Decisions as to whether Hermes should be taken beyond the study phase into development will not be taken before the next ESA Ministerial meeting next summer. It will be competing for funds with the initial development of a "next generation" launcher, of which the British HOTOL, currently the subject of a "proof of concept" study by British Aerospace and Rolls-Royce is the leading example. If, as seems likely, ESA cannot finance both the Hermes and next generation launcher projects, then we will wish to support the feasibility study into the next generation launcher to run for four years, with a spend profile during this period of 1987/88: £2 m; 1988/89: £3 m; 1989/90: £21 m. If this results in Hermes not being taken forward then there will naturally be no need for any provision for Hermes.

Technology Demonstration

12 The recommended GNP participation in the small technology demonstration programme will provide the UK with important opportunities to fly small technology developments by UK industry which need to be space tested.

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NATIONAL PROGRAMME

13 Details of the national programme proposed in the plan are given at Annex B. It is designed to maximise the benefit which the UK derives from its involvement in ESA and concentrates on earth observation technology, space science (to support the expanding mandatory ESA programme), satellite platform technology and improved national test facilities.

Earth Observation

14 To derive substantial benefit from being a major participant in ESA's earth observation programme and leader of the polar platform, the UK must have its own adequately equipped ground facilities to receive, process, analyse and apply the data and a programme of sensor and applications development. The plan envisages £10 m a year for technology developments including demonstration in orbit; £5 m a year each for the ERS-1 data centre and sensor development; and £2 m a year each for the West Freugh reception facilities and user utilisation studies. The latter is of particular significance because of the very wide range of uses (commercial, defence and scientific) of this technology.

Space Science

15 Instruments for flying on ESA satellite platforms are usually supplied by the member states. An increase in UK national funding so that we can make full use of the expanding (mandatory) ESA programme is thus recommended.

Satellite Platform Technology

16 The plan recommends a technology programme co-ordinated between the various scientific, commercial and defence interests. The programme would concentrate on spacecraft technology common to all space projects. The work would be undertaken mainly by industry, but in collaboration with universities and government establishments.

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Satellite Test Facilities

17 The quality of spacecraft test facilities in the UK is much lower than those of our main European competitors and the need to test satellites overseas can add millions of pounds to the cost of a programme, such as Skynet, and present security problems. The plan recommends significant capital investment jointly with industry to the benefit of all sectors which use space.

Communications

18 The recommended programme covers modest enhancements to the existing communications programme at RSRE Defford and some in-orbit technology demonstration.

Launch Systems

19 This covers the national cost of proof of concept studies for HOTOL, and further developments into launcher technology such as guidance systems.

Other Programmes

20 The plan also recommends smaller sums for a UK-based polar platform operations centre; for navigational aids and a small national microgravity programme.

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ANNEX

THE ESA SUBSCRIPTION, 1986-87 TO 1989-90: CASH £ million (at June 1986 (and percentage share of the ESA Programme over the four-year period)

	Current Programme 1986-87	1986-87	87-88	88-89	89-90
MANDATORY					
A. General Budget (16%)	10	11	13	14	15
B. Science Programme (16%)	14	15	18	19	22
OPTIONAL					
C. Satellite Communications (31%)	26	33	37	33	34
- ECS (16%)		3	5	4	1
- Olympus (39%)		21	8	1	1
- Future telecoms. prog.(33%)		6	18	24	22
- Data relay satellites (19%)		1	1	1	7
- Telecoms trials (30%)		1	2	-	-
- Advanced systems and technology (16%)		1	3	3	3
D. Earth Observation (17%)	18	21	26	29	29
- ERS 1 (14%)		12	13	9	8
- Operational Meteosat (17%)		8	7	5	4
- Preparatory Prog. (16%)		1	1	1	1
- ERS 2 (20%)		-	4	8	6
- Advanced polar mission (20%)		-	-	4	6
- Solid Earth mission (20%)		-	1	2	4
E. Space Station (Columbus) (15%)	5	5	23	34	41
F. Microgravity (8%)	0	-	1	5	5
G. Launch Systems (8%)	7	8	16	20	27
- Ariane 4 (5%)		5	-	-	-
- Preparatory Progs. (10%)		1	-	-	-
- Launch Site (10%)		2	4	4	4
- Ariane 5 (4%)		-	5	9	11
- Hermes (10%)		-	7	7	12
H. Technology Demonstration (16%)	0	-	1	3	3
TOTAL	80	93	135	157	176
(HOTOL	-	-	2	3	22

ANNEX B

NATIONAL PROGRAMME

15 OCT 86	CURRENT PROGRAMME 1986-7	RECOMMENDED PROGRAMME CASH £ MILLION			
		1986-7	1987-8	1988-9	1989-90
Satellite Communications	2	3	5	7	10
Earth Observation	16	17	30	43	55
Astronomy and Solar System Science	7	7	13	18	18
Microgravity	0	0	0	1	2
Space Station	0	0	0	2	2
Launch Systems	1	3	4	3	2
Satellite Test Facilities	0	1	1	6	19
Satellite Platform Technology	7	8	13	15	18
TOTAL	33	39	66	95	126

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ANNEX C

ECONOMIC AND COMMERCIAL BENEFITS OF UK INVOLVEMENT IN SPACE

1 The economic justification for a major government involvement in space is based on the following:

(a) risk. The rapidly changing technology, the large capital outlays involved, and the commercial risks make it impracticable to attract private sector capital until commercial opportunities become clearer;

(b) wider benefits. Space activities are a source of innovation for a whole range of industries but the space industry itself may not necessarily benefit financially from them, examples of this already are benefits to the PTTs and the users of television and telecommunications services;

(c) access. There is no guarantee of access to US space facilities and the European space industry which is still relatively at an infant stage should be helped to compete effectively with the US industry which itself has benefited enormously from US Government assistance.

ECONOMIC AND COMMERCIAL BENEFITS

2 The main direct commercial benefits to the UK from space to date have come in the area of communications where we have led all the ESA programmes so far. This and the growing stream of military projects has led the UK to have the most credible satellite communications industry outside the US. British Aerospace and Marconi Space Systems are the leaders in this field. They are now beginning to benefit from orders in this area but even here it took many years before the technology had been proved and sufficiently demonstrated to persuade the PTTs to invest in communications satellites. The demand for telecommunications satellites is now doubling every four years.

3 Mobile communications (for planes, ships, vehicles etc) are now seen as the next area for which there are good commercial prospects and the space plan reflects this in proposing a movement of funds towards supporting projects in this area, and away from dedicated, fixed communications satellites.

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4 Important contracts won by British space companies include:

INMARSAT 2 for	: Order for 3 satellites, with an option 4 more. Contract worth $165 million awarded to an international consortium, led by British Aerospace as prime contractor.
EUTELSAT 2	: Marconi providing payload for three satellites (with an option for a fourth). Total value £260 m of which Marconi has £40 m.
SKYNET 4	: MOD order for three £45 m satellites from a British Aerospace/Marconi consortium. 75% UK content. Major associated work has gone to ground segment industry.
INTELSAT 6	: British Aerospace largest subcontractor (15% or $80 m) in this project.
Ground station civil communications terminals	: Business worth about £25 m annually won by Marconi and up to 20 (mainly new) other British companies.

A British Aerospace/Marconi consortium is also bidding for the £100 m NATO order for 2 Skynet satellites.

5 These contracts inevitably tend to emphasise the role of British Aerospace and Marconi as prime contractors. Concealed within these orders is, however, a considerable level of subcontract work which has gone to many smaller companies in a wide range of industries both in manufacturing and services such as computer software and systems design and management.

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6 There are no current official figures available for turnover of the UK space industry. The latest figures are for 1983 when the turnover of the British Space industry (hardware only) was estimated as $180 m*, compared with a space budget of about $98 m. Apart from Canada, the UK was the only country whose space industry turnover exceeded its total national space budget (ie in our case the sum of our national and ESA programmes). Since then, turnover has increased by virtue of programmes such as those listed above and their associated ground infrastructure.

EMPLOYMENT

7 Figures relating to employment in the UK space industry are very difficult to assess. British Aeropsace and Marconi's space divisions employ 3,000 between them. But this figure ignores those elsewhere in the companies involved in space work as well as those employed in the supplier industry and the wide range of downstream activity.

8 Long term, high risk and high technology ventures such as space projects tend to give rise to externalities, or benefits accruing elsewhere than to the companies undertaking the projects. Space is an important source of innovation, the benefits of which extend through inter-sector transfers of technology and systems to other sectors of industry. In the case of telecommunications, the major benefits have gone to the PTTs and the users of television and telecommunications services. In the case of earth observation, benfits will accrue to industries involved in data analysis and processing and through technology transfer to much of industry. There will also be a wide range of users of the data, many of which have yet to be identified, who will benefit.

* OECD

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