24 (1975) Nr. 10

TRACTATENBLAD

VAN HET

KONINKRIJK DER NEDERLANDEN

JAARGANG 1990 Nr. 43

A. TITEL

Verdrag tot oprichting van een Europees Ruimte Agentschap, met Bijlagen; Parijs, 30 mei 1975

B. TEKST

De Nederlandse, de Engelse en de Franse tekst van het Verdrag, met Bijlagen, zijn geplaatst in *Trb.* 1975, 123. Voor de ondertekening zie ook *Trb.* 1980, 198.

D. PARLEMENT

Zie *Trb.* 1980, 198, rubriek J van *Trb.* 1981, 126, rubriek J van *Trb.* 1982, 42 en 110, rubriek J van *Trb.* 1983, 30 en 160, rubriek J van *Trb.* 1984, 13, *Trb.* 1985, 134 en rubriek J hieronder.

Bij de goedkeuring van de Wet van 26 oktober 1984 (zie *Trb.* 1985, 134) aanvaardde de Staten-Generaal de opvatting dat de Verklaringen betreffende de vrijwillige programma's, bedoeld in artikel V, eerste lid, van het Verdrag, verdragen zijn tot uitvoering van het ESA-verdrag, hetgeen betekent dat voor de aanvaarding daarvan in de toekomst geen parlementaire goedkeuring meer is vereist. Zie ook rubriek J hieronder.

E. BEKRACHTIGING

Zie *Trb.* 1980, 198 en *Trb.* 1985, 134.

G. INWERKINGTREDING

Zie *Trb.* 1980, 198.

J. GEGEVENS

Zie *Trb.* 1975, 123, *Trb.* 1980, 198, *Trb.* 1981, 126, *Trb.* 1982, 42 en 110, *Trb.* 1983, 30 en 160, *Trb.* 1984, 13 en *Trb.* 1985, 134.

De in *Trb.* 1985, 134 opgenomen Verklaringen zijn aan de Eerste en Tweede Kamer van de Staten-Generaal medegedeeld bij brieven van 29 januari 1986.

In overeenstemming met artikel V, eerste lid, letter b, van het Verdrag juncto artikel I, tweede lid, van Bijlage III bij het Verdrag is een aantal verklaringen opgesteld betreffende niet-verplichte programma's. Hieronder volgt daarvan een overzicht, voor zover het programma's betreft waaraan het Koninkrijk der Nederlanden deelneemt.

Anders dan in voorgaande Tractatenbladen over dit Verdrag, waarbij een chronologische volgorde werd aangehouden, zijn de verklaringen hieronder ingedeeld per soort activiteit, te weten:

I. LANCEERSYSTEMEN

a) *Ariane-5 draagraket:*

Declaration terminating the large cryogenic engine (HM 60) preparatory development programme
ESA/PB-ARIANE/LXVII/Dec.1
(drawn up on 31 October 1985)

The States participating in the large cryogenic engine (HM60) preparatory development programme,

Recalling that the HM60 preparatory programme was undertaken to initiate the most critical development tasks concerning this engine which is to equip the future European launcher,

Expressing satisfaction with the proposal for carrying out the Ariane-5 programme, using the HM60 engine, as an optional programme of the Agency,

Noting the Council Resolution at ministerial level (ESA/C-M/LXVII/Res. 1 (Final)) of 31 January 1985,

Having regard to the Council Resolution on the execution of the Ariane-5 launcher preparatory programme, incorporating the HM60 preparatory programme (ESA/C/LXX/Res.),

Having regard to the draft Declaration on the execution of the Ariane-5 preparatory programme,

Having regard to the Declaration on the HM60 preparatory programme (ESA/PB-ARIANE/LX/Dec.2 (Final), rev. 2) drawn up on 22 October 1984 which took effect on 13 December 1984, and the corresponding implementing rules,

I. Agree to terminate the HM60 preparatory programme and to continue it under the Ariane-5 preparatory programme;

II. Decide that the Declaration on the HM60 preparatory programme and the implementing rules will cease to have effect at the time when the Declaration on the Ariane-5 preparatory programme comes into force.

De verklaring is ingevolge paragraaf II gelijktijdig met de hiernavolgende verklaring op 1 augustus 1987 in werking getreden.

Declaration on the Ariane-5 preparatory programme
ESA/PB-ARIANE/LXVII/Dec.2
(drawn up on 5 November 1985)
(amended on 26 July 1987)
(updated on 17 December 1987)

The participating States referred to below (hereinafter referred to as "the participating States"),

Noting the availability thanks to the Ariane programmes of an independent and competitive European launch capability meeting the short- and medium-term user requirements, and desirous of maintaining and strengthening this capability,

Recalling the Resolution adopted by the Council meeting at ministerial level on 31 January 1985 (ESA/C-M/LXVII/Res. 1 (Final)), and in particular paragraph II.3 thereof whereby the Council "welcomes and endorses the proposal to undertake as an optional programme, in the field of space transportation systems, development of the Ariane-5 launcher equipped with the large cryogenic engine HM60, which development is to be completed by 1995",

Recalling that, on account of the critical nature of the development in question, certain participating States agreed to undertake a preparatory programme for the development of the HM60 (Vulcain) large cryogenic engine for equipping the Ariane-5 launcher (ESA/PB-ARIANE/LX/Dec. 2 (Final), rev. 2 drawn up on 22 October 1984),

Noting that the said participating States have agreed to terminate this HM60 preparatory programme as such, on the understanding that it will be incorporated in the Ariane-5 preparatory programme (ESA/PB-ARIANE/LXVII/Dec. 1, drawn up on 31 October 1985),

Having regard to the Ariane-5 preparatory programme proposal submitted by the Director General following the europeanisation proposal submitted by France,

Desirous that the development work on the HM60 (Vulcain) engine and Ariane-5 launcher should be undertaken within a single programme, and that the preparatory work should be started now in order to comply with the availability objective specified in the Resolution of the Council at ministerial level referred to above,

Noting that the Ariane-5 launcher might have to launch a manned spaceplane such as Hermes, as an extension of the provisions of Chapter II.4 of the aforementioned Resolution adopted by the Council meeting at ministerial level,

Having regard to Council Resolution ESA/C/LXX/Res.1 (Final) of 12 June 1985, approving the execution within the framework of the Agency of an Ariane-5 preparatory programme incorporating the HM60 (Vulcain) large cryogenic engine preparatory programme,

Having regard to Resolution ESA/PB-ARIANE/LXXVII/Res.1

(Final) of 18 March 1987 by which the participating States agreed to extend the preparatory programme,

Having regard to article V.1(b) of the Convention, and to Annex III thereof,

I. Agree to undertake an Ariane-5 launcher preparatory development programme as the first phase in carrying out the programme for the Ariane-5 launcher equipped with the HM60 large cryogenic engine, within the framework of Resolution No. 1 adopted by the Council meeting at ministerial level on 31 January 1985 and referred to in the preamble;

II. Agree that this Ariane-5 preparatory programme shall on the one hand cover and complete (as Part 1) the HM60 (Vulcain) engine preparatory development programme referred to in the preamble and, on the other, cover (as Part 2) the preparatory work on the launcher proper;

III. Agree that, within the framework of an extension of the programme until the end of 1987, a distinction no longer be made between expenditure relating to parts 1 and 2 respectively;

IV. Take note of the general objectives of the Ariane-5 launcher programme as described in Annex A (section 1) to this Declaration, and APPROVE the objectives and technical content of the preparatory programme described in Annex A (section 3) to this Declaration;

V. Accept the continuation under this Declaration of the rights and obligations arising under the Declaration on the HM60 (Vulcain) preparatory programme (ESA/PB-ARIANE/LX/Dec. (Final), rev. 2), without this giving rise to commitments outside this Declaration for those participating States which have not subscribed the Declaration on the HM60 preparatory programme;

VI. Agree:

a) to allocate for executing the Ariane-5 preparatory programme a financial envelope of 276.3 million accounting units at mid-1984 prices and 1985 conversion rates, increased successively by an additional envelope of 115 million accounting units and then by a further additional envelope of 177.9 million accounting units, at the same economic conditions, to cover an extension of work under the programme until the end of December 1987, thus bringing the overall financial envelope of the preparatory programme to 569.2 million accounting units;

b) to contribute, within the limit of that envelope and in accordance with the particular arrangements and the scale of contributions

shown in Annex B to this Declaration, to the cost of carrying out the preparatory programme;

VII. Agree on the following arrangements for moving on to the Ariane-5 development programme:

a) the participating States shall, on submission of the dossier referred to in Annex A, review the programme and examine the technical and financial proposal for the development programme of the Ariane-5 launcher equipped with the HM60 (Vulcain) engine; they shall in due course submit a recommendation to the Council concerning adoption of a Resolution on the execution, as an optional programme, of the Ariane-5 development programme;

b) besides this the interested participating States shall draw up a Declaration on this development programme; it is envisaged that the Declaration will combine the Ariane-5 preparatory programme, incorporating the HM60 (Vulcain) preparatory programme, and the development programme, with a view to determining the overall contributions of the States participating in the development;

c) a participating State that is not in a position to subscribe the Declaration on the development programme shall notify the Director General of this in writing;

d) a Member State that has not participated in the Ariane-5 preparatory programme may take part in the Ariane-5 development programme subsequently, provided it contributes, pro rata to its participation, to the expenditure that is not included in the calculation of the industrial return, and that is specified in paragraph VII.3 below; the scale of contributions shall be adjusted accordingly.

VIII. Agree on the following arrangements for the execution by the Agency of the Ariane-5 preparatory programme:

1. The Agency, which shall have overall direction of the preparatory programme, shall rely on the Centre National d'Etudes Spatiales (CNES) on conditions analogous to those applying to the previous Ariane programmes. The Agency and CNES shall conclude an Agreement defining the arrangements for their cooperation and the means enabling the Agency to fulfil its mission, in particular the monitoring of the preparatory programme.

2. This Agreement shall include an undertaking by CNES to set up and maintain throughout the execution of the programme a team of suitable size responsible for the technical direction and financial management of the programme. CNES shall bear the costs of this team, except for its mission costs, and of logistic and administrative support except, as specified in Annex B, for outside management assistance and for the specific data-processing resources needed for implementing the programme management procedures. Each year

these costs shall be examined jointly by ESA and CNES. Mission costs shall be borne on an annual lump-sum basis.

3. The Agreement shall also include an undertaking by CNES to place with the participating States contracts of a value corresponding to their percentage contribution to the total of the industrial work under the preparatory programme and leading to an industrial return coefficient close to one. This coefficient shall be calculated taking into account the HM60 (Vulcain) preparatory programme.

Any imbalances in industrial return that may persist on completion of the Ariane-5 preparatory programme (taking into account, as the case may be, use of the contingency margin) shall be taken into account when drawing up the Declaration referred to in paragraph VI (b), as shall the measures approved by Council for implementing Chapter III of Resolution No. 1 adopted on 31 January 1985 by Council meeting at ministerial level.

Work done outside the Member States, maintenance work during non-use of test-stands, programme management and consumption of liquid hydrogen and oxygen shall not be included when calculating the industrial return coefficient.

4. A participating State that is not in a position to subscribe the Declaration referred to in paragraph VI.(b) above shall, is necessary, take measures to facilitate the transfer of results from the preparatory programme to the industrial firms of the other States taking part in the development programme.

IX. Agree that the preparatory programme work can start as soon as the subscribed contributions amount to 80% of the financial envelope referred to in paragraph V(a) above; it is understood that the work shall be started only on the basis of the level of contributions subscribed.

X. Agree that this Declaration shall be open to subscription until 15 January 1986, the final date by which the participating States may announce that they are not able to accept the provisions of the present Declaration and thus cease to be participating States.

This Declaration is subscribed by the following participating States:

Participant	*Date*
Switzerland	5 November 1985
France	7 November 1985
Belgium	13 November 1985
United Kingdom	16 December 1985
Germany	19 December 1985
Denmark	14 January 1986
Spain	15 January 1986
Netherlands	15 January 1986
Sweden	16 January 1986
Italy	3 February 1986
Ireland	10 December 1986
Norway	10 December 1986

ANNEX A

Objectives and content of the Ariane-5 preparatory programme

1. *Background*

1.1 *Evolution of launch systems*

The foreseeable trend of user requirements for launch systems (an increase in satellite masses in geostationary orbit, the need to be able to intervene in low Earth orbit or to launch into LEO integrated commercial satellites that have been optimised for the Shuttle, an increase in satellite diameter, etc.), the need to offer reliability comparable with that of the Shuttle system and the need to continue reducing launch costs, mean that the future Ariane launcher required in the mid-1990s has to be defined now in order to maintain an independent and competitive European launch capability.

1.2 *Ariane-5 objectives*

The current objectives of the Ariane-5 development programme are recapitulated below, the said objectives being subject to confirmation by the Ariane-5 preparatory programme.

a) Technical objectives

(i) Performance (launch from Kourou)

- Ariane-5 must be able to place in geostationary transfer orbit one or more satellites with a guaranteed total mass of 6800 kg (including the adaptor or the multiple launch systems) with a medium-energy upper stage.
- Ariane-5 must be able to place satellites, station modules or platforms with the guaranteed mass of 18 000 kg in a low circular orbit of 550x550 km/28° 5′ inclination.
- Ariane-5 must be able to place the Hermes spaceplane in a

transfer orbit prior to the final circular orbit of 500 km x 500 km x 28° 5′ in such a way that after circularisation by Hermes the latter has a mass of 21 000 kg. The Ariane-5 launcher must be capable of lifting 12 000 kg into a circular orbit of 800 km altitude and 98.6° inclination, it being understood that these figures are not a specified requirement but the result of the guaranteed reference-orbit performance for launching Hermes.

(ii) Payload launch conditions

– Ariane-5 must be able to launch one or more payloads into the same orbit, a dual launch capability being the basic requirement.

– The volume available for payloads is constituted by a cylinder with a diameter of 4.57 m, defined as follows: 4.9 m per satellite in the case of single or dual launches; 10.5 m in the case of a module or platform.

(iii) Dependability and safety

– The reliability objective is 0.98 for the complete mission of the launcher.

– The availability objective is determined on the one hand by a launch window of a few minutes (for a low orbit rendez-vous) and by a maximum launch hold of 24 hours.

– As well as meeting present safety requirements for persons and property, the Ariane-5 design must enable the H155 stage to fall back safely and must not endanger the safety of the crew in the event of an incident on the ground or in flight.

(iv) Growth potential

– Ariane-5 must be capable of evolving, without calling in question its overall configuration, in order to reduce launch cost, uprate performance, increase the volume available for payloads or improve reliability.

b) Time schedule objectives

– The development of Ariane-5 must be completed no later than 1995 for launching automatic payloads.

c) Economic objectives

– With a launch rate of 8 per year, the overall cost of an Ariane-5 launch into GTO will need to be as low as possible and at all events at least 10% below that of an Ariane 44L; furthermore, the price per kg of a fully-loaded Ariane-5 launch into GTO will have to be some 45% below that of an Ariane 44L.

d) Industrial objectives

the industrial arrangements will enable Europe to keep its independence with regard to launch systems.

1.3 *Summary description of the Ariane-5 launcher*

a) General configuration

Ariane-5 consists of a mission-independent lower composite, and an upper composite comprising for automatic missions a final stage, a

vehicle equipment bay, a fairing and, as the case may be, a Speltra bearing structure; for manned missions, the upper composite will be replaced by the Hermes spaceplane and its adaptor.

b) Lower composite

The lower composite consists of

– a main cryogenic stage (H155) powered by an HM60 (Vulcain) engine and containing 155 tonnes of liquid oxygen and hydrogen, with a burn time of about 615 s;

– two large solid-propellant (P230) boosters, each containing 230 tonnes of grain and delivering a thrust at lift-off of about 750 tonnes, witha burn-time of about 125 s.

c) Upper composite (automatic missions)

The upper composite consists of

– an L5 stage containing 5 tonnes of storable propellant, used for LEO, sun-synchronous and geostationary transfer missions;

– an upper part consisting of a vehicle equipment bay, a fairing and a payload adaptor (single launch) or one or two Speltra bearing structures (dual or triple launch).

1.4 *Main characteristics of the HM60 (Vulcain) engine*

The work does not prejudge the issue of using the engine in the first or second stage.

a) Performance

– Engine thrust: 1060 kN in vacuo, corresponding to about 940 kN on the ground;

– Specific impulse in vacuo: 430 s;

– Burn-time in flight: 615 s.

b) Major design criteria

– the engine will use a diverted-flux cycle;

– the turbopumps will be separate;

– engine reliability will be compatible with the launcher objective, which is set at 0.98;

– from the design stage onwards, technical choices are to be guided by concern to reduce production costs while keeping within the performance objectives listed above;

– maximum ease of maintenance of the engine will be sought;

– the pressure level in the combustion chamber will be about 100 bar.

1.5 *Summary description of the launch facilities*

a) Launch site

– A new launch site, ELA-3, capable of launching Ariane-5 vehicles, will be built at Kourou; it will be used for tests of the H155 stage propulsion system.

– The facilities as a whole will enable 8 Ariane-5 vehicles to be launched per year with a possible minimum interval of one month between two successive launches.

b) Playload Preparation Complex

The present Payload Preparation Complex will be adapted to the new Ariane-5 requirements if the launch rate or payload dimensions so require; new buildings will be constructed for the assembly and encapsulation of payloads and the fairing.

1.6 *Ariane-5/Hermes compatibility*

The Ariane-5 lower composite must be compatible with the Hermes spaceplane in mechanical, electrical, aerodynamic and, more generally, system level terms. The spaceplane will contain the electrical equipment required to guide and control the composite. An L5-derived propulsion module located in the adaptor will place the spaceplane/propulsion module assembly in transfer orbit prior to circularisation into final orbit by the spaceplane.

1.7 *Timetable for main milestones in the Ariane-5 development programme*

Assuming that the Ariane-5 development programme starts no later than 1 January 1988, the indicative timetable for the main development milestones is as follows:

– System concept review	end 1987
– Preliminary design review of launcher stages and elements	1987–1990
– Launcher stage and elements ground qualification	1993–1994
– Completion of system tests in Europe	1993
– ELA-3 availability	1992
– First qualification test flight	start of 1995
– First operational flight	start of 1996
– First test flight (Hermes mission)	end 1997
– End of development	1997

2. *Programme scheduling*

The Ariane-5 programme timetable objective is that the development of the launcher be completed by 1997; this objective entails the carrying out, pending finalisation of the programme proposal and a corresponding decision, of an Ariane-5 preparatory programme over the period December 1984 to December 1987.

The HM60 (Vulcain) engine being an integral part of Ariane-5, the associated activities need to be merged in a single programme from the start of the Ariane-5 preparatory programme, which will thus include the HM60 (Vulcain) preparatory programme.

Once the decision has been made to go ahead with the Ariane-5 development, the Ariane-5 preparatory and development programmes will be consolidated in a single programme under the name of "overall Ariane-5 programme".

3. *Content of the Ariane-5 preparatory programme*

3.1 *The preparatory programme covers:*

– the work to be carried out or started on the HM60 (Vulcain) engine, i.e. that covered by the previous HM60 (Vulcain) preparatory programme complemented by additional HM60 (Vulcain) engine work to be carried out or started between late 1986 and late December 1987 (Part 1);

– Ariane-5 work – excluding HM60 (Vulcain) – to be carried out or started during the period 1 January 1986 to late December 1987 (Part 2);

– the study of space transportation requirements, of the competitiveness of the Ariane-5 launcher, in particular as regards small payloads and, where necessary, of proposals for measures of a technical nature;

– a study of the implications for the launcher of manned flights;

and the necessary studies relating to compatibility with the various elements of the in-orbit infrastructure (including the timetable and cost aspects) making it possible to meet the objective of European autonomy as stated in the Resolution adopted by the Council meeting at ministerial level on 31 January 1985.

3.2 *HM60 (Vulcain) cryogenic engine*

The HM60 (Vulcain) work under the Ariane-5 preparatory programme is in two parts:

– a part corresponding to the previous HM60 (Vulcain) preparatory programme,

– an additional part required by the extension of the preparatory work planned until December 1987.

a) Initially planned preparatory work

(i) Technological work

This will be carried out on the following critical engine elements:

– turbopumps: bearings, moving joints, turbines, pumps

– thrust chamber: materials used, fabrication method for injector and divergent

– gas generator,

the objective being to be able to start the first tests on the turbopumps, gas generators and combustion chambers at the end of 1987.

(ii) Definition of hardware and fabrication

– Engine: choice of configuration, system concept review (late 1984), preliminary design review (second half of 1986) and partial drawing up of the fabrication working drawings; definition of the mechanical and functional interfaces between subsystems.

– Turbopumps: working drawings and fabrication (excluding

assembly and acceptance testing) of the first two turbopumps (LH_2 and LOX) and installation on teststand.
- Thrust chamber: working drawings and fabrication of first thrust chamber and installation on test-stand (without the divergent).
- Sundry equipment: fabrication and acceptance of first items.

(iii) Teststands
- Turbopump stand: full development at Vernon, including its acceptance.
- Chamber stand: development of infrastructure and procurement of the Hardthausen stand subsystems. Final acceptance of the stand allowing the chamber to be put into use on the stand.
- Engine stands: studies and choice of firms in respect of the stands (one at Vernon and one at Hardthausen). Procurement of long-lead items and commencement of civil engineering work.

b) Additional work

(i) Technological work
- Water simulation tests on the inducers and impellers.
- Tests on bearings and propellant seals.

(ii) Definition of hardware and fabrication
- Installation of first generator on stand.
- Integration of the 1st development turbopump and installation on stand.
- Start of equipment development tests. Preliminary design review covering most items of equipment.

(iii) Test stands
- Complete acceptance of the turbopump test stand (PF52).
- Completion of the chamber test stand (P32) and initial tests.
- Civil engineering work on the engine test stands.

3.3 *Ariane-5 launcher (excluding HM60)*

a) System studies and tests

- General studies (trajectories, performance, aerodynamics, flight control, general loads, environment) and associated tests (aerodynamic and acoustic).
- Study of functional chains.
- Studies relating to dependability.
- Analysis of the vehicle/ground interfaces and writing of the associated interface specification.

b) Subassembly studies

Continuation of subassembly definition studies with a view to arriving at the preliminary design in 1987 of:
- the P230 booster
- the HM60 (Vulcain) engine
- the H155 propulsion system
- the other elements of the lower composite: connecting structures

(P230 and H155 forward and aft skirts, P230/H155 interface) and P230 and H155 nozzle actuation systems
- the L5 upper stage (including its 20 kN engine)
- the vehicle equipment bay
- the fairings
- the payload support systems (adapter and Speltra).

c) Technological work

Technological work will be carried out on the critical elements of the launcher in order to develop the technological or industrial processes; this work will bear on the following:
- development of the cylindrical cases of the P230 boosters in shear-spun steel
- precise definition of the P230 propellant and its fabrication process
- development of the P230 large-dimensioned nozzles and flexible bearing

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ANNEX B

Financial provisions

I. *Financial envelope of the Ariane-5 preparatory programme*

The financial envelope covering work under the preparatory programme up to 31 December 1987, 569.2 MAU at mid-1984 prices and 1985 conversion rates, breaks down as follows, using the current budget structure:

	MAU
Staff expenditure	1.4
Running expenditure	4.0[1])
Facilities	8.1[2])
Investments	262.9[3])
Development	289.2[4])
Direct expenditure	565.6
Administrative and site service costs	1.8
Variable support costs	0.9
Fixed support costs and investments	0.9
Indirect expenditure	3.6
GRAND TOTAL	569.2

[1]) including 2.9 MAU to cover CNES mission costs

[2]) including 1.2 MAU to cover external management assistance and 6.2 MAU for management-specific data-processing resources.

[3]) including 2.2 MAU to cover investments in management-specific data-processing resources.

[4]) including reimbursement of 246 KAU of prefinancing by General Studies undertaken by MBB in 1984 and 8.5 MAU for liquid hydrogen and oxygen consumption.

II. *Scale of contributions*

The participating States shall contribute to the financial envelope of the Ariane-5 preparatory programme in accordance with the following scale:

Participant	*%*
Germany	22.00
Belgium	4.45
Denmark	0.15
Spain	0.69
France	47.93
Ireland	0.04
Italy	15.00
Norway	0.37
Netherlands	1.00
United Kingdom	0.41
Sweden	4.05
Switzerland	0.32
Not covered	3.59

Work under the Ariane-5 preparatory programme is to be carried out with aim of coming as close as possible to the above scale of contributions.

III. *Overall scale for the entire Ariane-5 programme*

It is planned to draw up, in the Declaration on the development programme referred to in paragraph VI(b) of the present Declaration, an overall scale of contributions covering the preparatory and development programmes.

The Declaration on the development programme will define the mechanism for adjustment of contributions in terms of the evolution of the geographical distribution of work, and in particular a first adjustment of the scale no later than 18 months after the date on which the Declaration enters into force.

If the allocation of work to a participating State led to an increase of more than 5% of the rate shown in the initial scale, this work would be allocated to that State only subject to its prior agreement to bear the cost of this work; within this limit such agreement would not be necessary, and the scale of contributions would be adjusted accordingly.

In subscribing this Declaration, the participating States may inform the Agency of the target of contributions sought for the overall Ariane-5 programme (preparatory programme plus development proper).

The table below gives, indicatively and without involving any commitment, a first estimate of these target rates as at the date of drawing up the Declaration on the preparatory programme.

Participant	*%*
Germany	22
Belgium	5 – 6.5
Denmark	1
Spain	3
France	45 – 51
Ireland	–
Italy	15
Norway	1 – 2
Netherlands	3
United Kingdom	4
Sweden	3 – 4
Switzerland	2

The work of the Ariane-5 preparatory programme shall be carried out with the objective of keeping as closely as possible to the indicated contributions to the overall programme.

IV. *Schedule of payment appropriations for the preparatory programme*

The indicative schedule of payment appropriations in MAU (mid-1984 prices and 1985 conversion rates) is as follows:

	1984	1985	1986	1987	1988	1989	Total
Initial prog.	4.0	38.8	80.9	152.6	–	–	276.3
Extension 1	–	–	–	65.4	49.6	–	115.0
Extension 3	–	–	–	–	165.3	12.6	177.9
Total	4.0	38.8	80.9	218.0	214.9	12.6	569.2

V. *Revision clause*

The provisions of this Annex may be revised by a unanimous decision of the participating States.

De verklaring is ingevolge paragraaf IX op 1 augustus 1987 in werking getreden.

Declaration on the Ariane-5 launcher development programme
ESA/PB-ARIANE/LXXXV/Dec.1
(drawn up on 4 December 1987)
(updated on 31 May 1989)

The participating States referred to below (hereinafter referred to as "the participating States"),

Noting the availability thanks to the previous Ariane programmes of an independent and competitive European launch capability meeting the short and medium-term user requirements, and desirous of strengthening this capability by developing a much more powerful version of the Ariane launcher, capable of being more competitive in meeting the new requirements of users inside and outside Europe, and with regard to the other space transportation systems, while making it possible to satisfy the mission requirements of the Hermes spaceplane and of elements of the Columbus in-orbit infrastructure,

Recalling the Resolution adopted by the Council meeting at ministerial level on 31 January 1985 (ESA/C-M/LXVII/Res.1 (Final)), and in particular paragraph II.3 thereof whereby the Council "welcomes and endorses the proposal to undertake as an optional programme, in the field of space transportation systems, development of the Ariane 5 launcher equipped with the large cryogenic engine HM60, with a view to completing it by 1995",

Considering the necessary programmatic coherence, within the framework of the long-term European space plan, between the Ariane 5 launcher, Hermes and Columbus and all its commercial, scientific and other users,

Having regard to the Declaration on the Ariane 5 preparatory programme (ESA/PB-ARIANE/LXVII/Dec. 2 (Final) rev. 2) drawn up on 5 November 1985, and in particular the provisions of section VII thereof, concerning the arrangements for moving on to the development programme,

Considering the results obtained and the progress made in work under the Ariane 5 preparatory programme, and that this work has, under an extension of the said preparatory programme, been extended beyond its duration as initially planned,

Having regard to the Ariane 5 launcher development programme proposal submitted by the Director General following the work and studies done under the preparatory programme, and the recommandation on it by the Ariane Launcher Programme Board (ESA/C(87)61),

Noting that the Ariane 5 launcher is conceived to serve as a launcher for spacecraft in automatic flight configuration, as a launcher for the Hermes manned spaceplane and as a launcher for space station infrastructure elements such as those planned under the Columbus programme,

Noting the undertaking given by the Arianespace company to

commercialise the Ariane 5 launcher in due course in accordance with arrangements that will be defined later with the Agency,

Having regard to the management principles adopted for execution of the Ariane 5 development programme (ESA/PB-ARIANE(87)64, rev.1, Annex),

Having regard to Resolution ESA/C-M/LXXX/Res. 1 (Final) on the European longterm space plan, adopted on 10 November 1987 by the Council meeting at ministerial level, and in particular to Chapter III, section A.2, thereof agreeing to execution of the Ariane 5 development programme within the framework of the Agency,

Having regard to Articles V.1(b) and XI.5(c)(i) of the Convention and to Annex III thereto,

I. Agree to undertake the Ariane 5 launcher development programme, structured in slices, as a European programme within the Agency framework, on the basis of the work and studies done under Ariane 5 preparatory programme, as reflected in the development programme proposal referred to in the preamble, and in accordance with the arrangements set out below,

II. Approve the general objectives and technical content of the Ariane 5 launcher development programme (slice 1), as set out in Annex A to this Declaration;

III. Agree:

(a) to allocate for carrying out the development programme a financial envelope of 3496 million accounting units at mid-1986 prices and 1987 conversion rates; NOTE that a sum of 618 million accounting units at the same economic conditions, corresponding to the Ariane 5 preparatory programme including its extension, is to be added to this envelope so as to arrive at an amount of 4114 million accounting units, which corresponds to the overall financial envelope for the Ariane 5 programme.

Any tendency that is identified towards an overrun of this initial financial envelope of 3496 million accounting units shall, with a view to the application of Article III.4 (a) of Annex III to the Convention, be notified in advance to all the participating States and to the Administrative and Finance Committee. The Agency will submit a special report if it deems that this financial envelope may be overrun. On the basis of this report, and in due time before the vote on the annual budget corresponding to such an overrun, discussions and decisions will take place on the technical and programmatic aspects.

b) to contribute the development programme envelope and in accordance with the funding mechanism set out in Annex B to this Declaration, to the cost of executing this programme.

The contributions of the participating States to the financial envelope referred to above and the geographical distribution of work

stemming therefrom take account of measures compensating for past imbalances, as well as anticipatory compensation measures, applicable as from 1991 onwards, decided by Council at its 80th meeting, held at ministerial level in The Hague on 10 November 1987(ESA/C-M/LXXX/Res.1 (Final), Chapter IV.3 and 5); these measures are described under section II of Annex B hereafter.

The geographical distribution of work shall be reviewed once the industrial structure for the programme is clearly defined or, at the latest, after 24 months from the entry into force of this Declaration; the conclusion of this review will lead to a correction of the situation through a redistribution of work, otherwise through revision of the contribution scale, using the mechanism described in Annex B hereto, as a help in maintaining the overall return objective while guaranteeing each participating State a geographical return of at least 0.90 by the end of the present programme.

IV. Note the undertaking of the States participating in the preparatory programme which are also participants in the present development programme to allow the use, for the purpose of any implementation of the provisions of Article III.4 (a) of Annex III to the Convention, of the funds corresponding to 20% of the amount of the financial envelope of 618 million accounting units of the preparatory programme, on the understanding that the corresponding contributions can be called up, in accordance with the corresponding contribution scale and in compliance with the rules and procedures in force in the Agency, for the sole purpose of funding cost overruns relating to work initiated under the said preparatory programme.

V. Agree to the following provisions for carrying out additional slices of the programme:

a) on a proposal from the Agency, the participating States shall vote on whether to carry out an additional slice of the programme. However, no State shall be obliged to take part in any slice in which it has not agreed to participate, and its contribution may not be increased to take account of the execution of such slice;

b) any Member State of the Agency may take part in any such additional slice of the programme provided that it has acceded to this Declaration. The Member State in question shall notify its acceptance to the Director General;

c) those participating States that have declared themselves interested in participating in one of the programme's additonal slices shall unanimously determine the financial envelope and contributions scale to be applied to the execution of industrial work under such slice of the programme.

VI. Agree on the following arrangements for carrying out this programme:

1. The Agency shall have overall responsibility for and overall technical and financial control of the development programme. It will delegate the technical and financial management of the programme to CNES, in accordance with the management principles set out in the Annex to ESA/PB-ARIANE(87)64, rev. 1, on the understanding that the general clauses and conditions governing Agency contracts remain applicable and that the Agency will retain an involvement in decisions on the choice of contractors. For the Ariane-5 programme, a quarterly report based on the quarterly reports to Council shall be submitted to the participating States, including enough details on the technical, financial and timetable aspects in particular to enable cost trends and the technical reasons for them to be identified in good time.

2. The Agency shall be responsible for ensuring that programme aspects common to its main programmes using the Ariane 5 launcher (particularly Hermes, Columbus and the EDRS) are consistent and compatible.

3. The Agency and CNES shall, on the basis of the principles set out in the Annex to ESA/PB-ARIANE(87)64, rev. 1, this Annex having been approved by the participating States, conclude an Agreement defining the arrangements for their cooperation and the means enabling the Agency to fulfil its mission, having particular regard to the aspects of coherence with other Agency programmes and of safety in connection with the crewed flight configuration.

3.1. This Agreement shall include an undertaking by CNES to set up and maintain a team of appropriate size, responsible for the technical direction and financial management of the programme. CNES shall bear the costs of this team, except for its mission costs, and those of logistic and administrative support, except for external management assistance and for the specific data-processing resources needed for implementing the programme management procedures. Each year these costs shall be examined jointly by the Agency and CNES. Mission costs shall be borne on an annual lump-sum basis.

3.2. The Agreement shall also include an undertaking by CNES to place with the participating States contracts of a value corresponding to their percentage contribution to the total of the industrial work under the development programme and leading to an industrial return coefficient close to one.

4. The Agency shall ensure that the geographical distribution of work under this programme is in accordance with the objectives defined by the ESA Convention and by Council; it shall periodically supply the participating States with the relevant information.

5. The Agency shall draw up with the Arianespace company a special rider to the convention to fulfil the company's undertaking to commercialise the Ariane 5 launcher in due course, in accordance with arrangements to be set out in due course in subsequent riders.

This rider should spell out the Arianespace company's undertaking to provide the Agency with an annual, up-to-date assessment of the satellite launch market. The Agency shall communicate this study, accompanied by its comments, to the Programme Board.

6. In addition to the systems and facilities developed within the framework of the Agency and during the Ariane 5 preparatory programme, the Agency shall strive to use the facilities available in the participating States and the results obtained following Ariane 5 activities financed by them out of their national funds, as well as the results of its own relevant programmes; to this end and for the purpose of use under the development programme, the participating States are invited to forward to the Agency all the technical results to which they have unrestricted access and which are relevant to the programme, subject to intellectual property rights over these results.

7. The Agency shall propose the payloads to fill the capacity of the demonstration flights with the aim of obtaining participation in launch costs by the appropiate payload authorities, it being understood that the expenditure directly linked to a payload will be borne by the bodies responsible for it. Decisions shall be taken by the participating States in accordance with rules, which will have to be adopted at an early stage, governing accommodation of payloads on demonstration flights.

8. The Agency shall have overall responsibility for the programme's product assurance. From this viewpoint and that of aspects affecting the safety of Hermes crews, the Ariane 5 and Hermes systems shall be treated as a whole.

VII. Invite any States participating in the Ariane 5 preparatory programme that would not be interested in taking part in the development programme to notify the Director General of this as soon as possible so that the contribution scale can be adjusted in accordance with the provisions of section II of Annex B to the Declaration on the preparatory programme. Where the case arises, these States shall be requested to take any measures necessary to facilitate the transfer of the results of the preparatory programme to firms in the other States participating in the development programme;

VIII. Agree that the work can start as soon as the described contributions amount to 80% of the financial envelope referred to in section III above; it is understood that the work shall be started only on the basis of the level of contributions subscribed.

IX. Invite the Member States that are not interested in participating in this programme to give notification as soon as possible and before 31 December 1987, in order to take account of Resolution

ESA/C-M/LXXX/Res. 1 (Final), Chapter III, sections 4 and 5, that they are not able to accept the provisions of the present Declaration.

This Declaration has been subscribed by the following participating States:

Participant	*Date*
Switzerland	15.12.87
Sweden	15.12.87
France	15.12.87
Norway	23.12.87
Ireland	23.12.87
Austria	30.12.87
Spain	10.12.87
Germany	10.02.88
Netherlands	10.02.88
Belgium	11.02.88
Denmark	17.02.88
Italy	23.04.88

ANNEX A

Objectives and content of the Ariane-5 development programme

1. *Context*

1.1 *Trend of launch systems development*

The foreseeable trend of user requirements on launch systems (an increase in the mass to be put into geostationary orbit, the need to be able either to intervene in, or launch integrated commercial satellites into, low Earth orbit (LEO), and an increase in satellite diameter), coupled with the need to offer a high level of reliability and to work towards a reduction in launch costs, mean that the future Ariane launcher required for the mid-1990s has to be developed now, so that Europe can keep an independent and competitive launch capability.

1.2 *Ariane-5 objectives*

1.2.1 Performance (launching from Kourou)

Ariane-5 must be able to put into geostationary transfer orbit one or more satellites with a guaranteed total mass of 6800 kg (including the adapter or multiple-launch devices), using a medium-power upper stage. This equates, in the dual-launch configuration, to a net lift performance of 5900 kg.

Ariane-5 must be able to put into a circular low Earth orbit (of 550 x

550 km x 28.5°) station modules or platforms with a guaranteed mass of 18 000 kg.

Ariane-5 must be able to launch a composite consisting of the Hermes spaceplane and its adapter containing a propulsion unit, with a mass of between 27 000 and 28 000 kg *, into a trajectory such that Ariane-5 falls back into the Atlantic Ocean. After the propulsion unit and the Hermes propulsion system have provided a total velocity increase of approximately 700 m/s, Hermes enters a circular orbit of 500 km altitude and 28.5° inclination with a final mass of 21 000 kg.

Ariane-5 must be capable of lifting 12 000 kg into a circular orbit of 800 km altitude and 98.6° inclination, it being understood that these figures are not a specified requirement but the result of the guaranteed reference-orbit performance for launching Hermes.

1.2.2 Payload launch requirements

Ariane-5 must be able to put one or more payloads into the same orbit, with a dual launch as a baseline requirement.

The volume provided for payloads is to be represented by a cylinder of 4.57 m diameter, defined as below:

- in a single launch, a length of between 5 and 12m. The latter length, intended for launching elements of Columbus, will call for the use of a long fairing;
- in a dual launch, a length of 5 m for each satellite; and
- in a triple launch, a length of 5 m for two of the satellites and of 3.8 m for the third.

1.2.3 Dependability and safety

The reliability target is put at 0.98 for the launcher's total mission in its automatic version; this results in a predicted reliability of 0.99 for the lower composite (in crewed flight configuration).

The availability target is set by a launch window of a few minutes (for low-orbit rendezvous) and a launch postponement of 24 hours at most.

The design of Ariane-5 has to allow, over and above respect for the safety of persons and property, for a safe fallback of the stages, and must not compromise the safety of the crew in the event of a mishap on the ground or in flight. The intrinsic safety target, in respect of the Ariane-5/Hermes configuration is set at 10 –3.

1.2.4 Timetable objectives

Ariane-5 must be operational by 1995 at the latest, for commercial launches of automatic payloads. It should furthermore be capable of undertaking Hermes launches after two automatic qualification launches, a number of operational automatic flights and additional qualification specific to crewed flights.

1.2.5 Economic objectives

The aim is that the cost of using Ariane-5, fur dual launch into GTO,

* The final value depends on the optimisation work being done on the Hermes propulsion unit.

will be at least 10% lower than that of using an Ariane 44L, assuming eight launches a year including four into GTO. On the basis of this target being met, and taking into account the mass put into GTO by the versions of the launcher, Ariane-5 will allow a reduction of some 45% in the cost-per-kilogram compared with Ariane 44L.

1.2.6 Industrial aspects

1.2.6.1 European independence

Ariane-5 will be, for Europe, the means of remaining independent in launch matters, in particular as regards:

- the procurement of raw materials and individual components (such as special alloys and electronic components),
- the purchasing of finished components and even complete items of equipment, and
- the provision of services (e.g. the tracking network).

1.2.6.2 Industrial organisation

The industrial organisation will be set up in such a way as to ensure each participating State a similar geographical return in the development and production phases.

1.2.7 Growth potential

The design of the Ariane-5 launcher will have to provide a growth potential, with a view to cutting launch costs, or improving performance, or providing a larger volume for payloads, or increasing reliability and/or safety;

Starting from the basic HM60 and P230 propulsion units. it is possible to derive versions with a higher lift capacity:

- substituting an H10 for the L5 will give a gain of at least 2000 kg into geostationary transfer orbit;
- for a Hermes launch, replacing the H155 with a two-engine H205 with separate bulkheads will provide a performance gain of at least 4000 kg, and lessen the risk of fallback into the sea in the event of an HM60 malfunction.
- it is furthermore possible to increase the fairing diameter, for instance for launching the modules of in-orbit stations;
- and finally it is possible to envisage creating, on the basis of an L5 stage, a transfer stage for moving heavy loads in low Earth orbit towards either elements of Columbus or the international Space Station.

Conservative measures are taken, whenever this is possible at low cost, to meet this requirement for growth potential, either in the launcher design or in ground infrastructures and test facilities.

1.3 *Manufacturing and launch objectives in the operational phase*

The production facilities, the design and development of which are an integral part of Ariane-5 development, will allow production of 10 launchers a year. The ELA-3 launch complex will also cope with this rate.

1.4 *Description of the Ariane-5 launcher*

1.4.1 General configuration

The Ariane-5 launcher is made up of a lower composite which is mission-independent, and an upper composite comprising, for automatic missions, a final stage, a vehicle equipment bay, a fairing and – if required – a Speltra payload support structure *. For crewed missions this upper composite is replaced with the Hermes spaceplane and its adapter.

1.4.1.1 Lower composite

The lower composite comprises:

– a main cryogenic stage (H155) ignited on the ground, powered by an HM60 engine and holding 155 tonnes of liquid hydrogen and oxygen; its burn-time is about 615 seconds;

– two large solid-propellant boosters (P230s) each containing 230 tonnes of grain and delivering a thrust of about 750 t at lift-off for a burn-time of about 120 s.

1.4.1.2 Upper composite

For automatic missions this comprises:

– a storable-propellants stage (L5) used for low Earth or sunsynchronous orbit missions and for putting a payload into geostationary transfer orbit;

– a vehicle equipment bay; and

– an upper section that depends on the missions, viz.

  · in the case of a single launch, a short or a long fairing (the Columbus-specific configuration) plus an adapter.

  · for dual or triple launches, one or two Speltra support structures, the short fairing and the adapter for the payload occupying the lower position.

For crewed missions the upper composite is made up of the spaceplane mounted on its adapter (fitted with an additional propulsion unit).

1.5 *HM60 Vulcain engine*

The engine operates on the "diverted flux" principle, using liquid hydrogen and oxygen as propellants.

Under baseline conditions the performance figures are:

– chamber pressure between 90 and 110 bar;

– specific impulse in vacuum: 430 s with a standard deviation of 1.5%;

– mixture ratio between 5.1 and 5.3 with a standard deviation of 1.2%;

– thrust between 940 and 1060 kN with a standard deviation of 1.5%

– equipped engine mass 1300 kg.

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* Speltra: Structure Porteuse Externe de Lancements Triples Ariane (= external support structure for Ariane triple launches).

For dimensioning purposes a safety factor of 10 will be applied to the burn-time - i.e. giving a total of around 6000 seconds.

Likewise, a safety factor of 4 will be applied to the number of startups – i.e. a total of 20.

1.6 *Brief description of launch facilities*

a) Launch complex

– A new launch complex, ELA 3, will be built at Kourou for the Ariane-5 launchers; it will be used for testing the H155 stage propulsion system. Units for producing the cryogenic items needed for launches will be set up on the launch site.

– The whole of these facilities, including in particular two mobile launch tables, will permit ten Ariane-5 launches a year, the shortest interval possible between launches being one month.

b) Payload preparation complex

The present payload preparation complex will be adapted to cope with the new Ariane-5 requirements if the launch rate or payload dimensions make this necessary; new buildings will be built for assembling and encapsulating the payloads and fairing.

c) Complementary facilities

Complementary logistic facilities will be set up for transporting the launcher elements in Europe and Guiana. Tracking and telemetry receiver facilities will be adapted to the Ariane-5 launchers.

d. Facilities for reducing launch-complex vulnerability

The facilities needed for lessening the vulnerability of ELA 2, and for keeping certain equipment up-to-date, will be set up.

1.7 *Ariane-5/Hermes compatibility*

The design of the Ariane-5 launcher must make it capable of carrying out crewed missions using the Hermes spaceplane, and of doing so at minimum cost. It is however understood that the performance requirements for launching satellites (see 1.2 above) will have priority as far as Ariane-5 development and production is concerned.

1.8 *Main stages of development*

Assuming the Ariane-5 development programme starts up in January 1988 at the latest, the main stages of development will be as follows (the dates are indicative):

– System concept review	late 1987
– Start of development	1.1.1988
– Preliminary design review, stages and launcher elements	1987–1990
– Ground qualification, stages and launcher elements	1993–1994
– End of system testing in Europe	1993
– ELA 3 available	1992
– 1st test flight	early 1995

- End of development for automatic-payload launches 1995
- 1st operational flight (automatic mission) early 1996
- 1st test flight (Hermes mission) 1998
- End of development 1998

2. *Content of the Ariane-5 programme*

2.1 *Main development tasks*

Development of the Ariane-5 laucnh system covers:

- developing and ground-qualifying the elements constituting the launcher,
- development and qualification of the launch and logistic facilities, and
- flight qualification of the system,

Note – The Ariane-5 programme includes development of elements peculiar to the Columbus mission (long fairing, adapters and so on), excluding changes to or new construction of the ground facilities for launch preparations (EPCU). No work stemming from a change in the initial definition of Columbus requirements will be financed under the Ariane-5 programme.

- the measures needed to take account of the Hermes mission (dimensioning of structures, safety aspects and reliability of the lower composite, etc.), in particular the costs of specific measures intended to protect the crew from residual risks run, tests to demonstrate the level of reliability achieved, additional development intended to ensure Ariane-5/Hermes compatibility, together with the launcher hardware needed for testing, are an integral part of Ariane-5 deveiopment.

2.2 *Development and ground qualification of the launcher*

2.2.1 System work

Activities include:

- overall studies allowing definition of the general system characteristics and performance, and of the general specifications vis-à-vis the launcher's subassemblies;
- studies connected with dependability (reliability, availability and safety);
- system tests:
  - at reduced scale - aerodynamic, acoustic and thermal,
  - at 1:1 scale - static/dynamic structural tests, flight control and guidance simulation, validation of electrical systems.

2.2.2 P230 boosters

The logic of the overall plan for the development of the constituent elements of the booster and launcher is as follows:

- individual tests on each of the subassemblies or items for equipment,

- tests on subassemblies by integrating equipment (2 bomb tests, circuit tests, vibration tests on subassemblies and recovery tests),
- booster tests with step-by-step integration of adjacent elements (4 development hot tests and 2 qualification hot tests),
- two complete stage qualification hot tests in flight configuration.

This logic makes it possible, by progressively integrating elements qualified at a lower level, to arrive at stage qualification on the ground.

2.2.3 HM60 Vulcain engine

The development programme is structured in two phases:

- the present preparatory phase leading to validation of the technologies and critical components, to prototype fabrication of the main subassemblies and a start on building the necessary teststands, and
- a development phase that covers finalising of the definition and production master files, completion of all the test facilities and carrying out of the development and qualification tests.

The diverted-flux engine configuration allows separate development work on the two turbopumps, the combustion chamber and the gas generator.

The test logic involves progressively integrating subassemblies that have already been qualified, one with another, until a complete engine is arrived at; the endurance testing is done at engine level.

350 tests at engine level will be run during the development programme, up to qualification flights in the automatic version, to which will be added 200 extra tests to demonstrate readiness for flight with a crew.

De verklaring is ingevolge paragraaf VIII op 11 februari 1988 in werking getreden.

Het *Koninkrijk der Nederlanden* legde bij aanvaarding op 10 februari 1988 de volgende verklaring af: "... subject to the measures to compensate for past imbalances and the anticipatory compensation measures being fully implemented, as agreed in resolution ESA/ C-M/LXXX/ Res.1 adopted by the Ministers in The Hague on 10 November 1987" (tekst resolutie niet afgedrukt).

b) *Hermes (bemande ruimte pendel):*

Declaration on the Hermes preparatory programme
ESA/C/LXXV/Dec.2
(drawn up on 23 October 1986)
(updated on 3 August 1987)

The participating States referred to below (hereinafter referred to as "the participating States"),

Recalling Resolution ESA/C-M/LXVII/Res. 1 (Final) on the European long-term space plan adopted by the Council meeting at ministerial level on 31 January 1985,

Recalling in particular Chapter II.4 of that Resolution whereby the Council "takes note with interest of the French decision to undertake the Hermes manned spaceplane programme", and in which it "invites France and associated partners to keep the Agency informed of progress of the studies with a view to including this programme, as soon as feasible, in the optional programmes of the Agency",

Considering the proposal by France to internationalise this Hermes programme and the dossier submitted at the Council meeting of 5-6 March 1986,

Having regard to the Hermes preparatory programme proposal (ESA/C(86)59),

Recalling that studies on the various elements of the future European space infrastructure, including the compatibility and coherence of the Hermes spaceplane with the other elements of this infrastructure and in particular with Columbus, are being undertaken within the Agency in the framework of an extension of the long-term space transportation systems preparatory programme,

Considering that the Hermes spaceplane programme will constitute one of the major elements for the construction of a European space infrastructure and will contribute to Europe's autonomy in the exploitation and utilisation of outer space, and to its participation in the international space station,

Considering that the setting up of a Hermes preparatory programme will contribute usefully to the adoption of subsequent decisions on the continuation of a coherent implementation of the European long-term space plan,

Considering the progress of studies and work carried out to date under the long-term space transportation systems preparatory programme, and by France and its partners under bilateral agreements,

Noting the Declaration on the Columbus preparatory programme drawn up on 28 November 1984 (ESA/PB-SL/XLIX/Dec. (Final), rev. 3),

Noting the Declaration on the Ariane 5 preparatory programme drawn up on 5 November 1985 (ESA/PB-ARIANE/LXVII/Dec. 2 (Final)), and in particular Annex A thereto,

Having regard to the basic principles proposed for the management scheme of the Hermes programme (ESA/C(86)106, rev. 2)
Having regard to Council Resolution (ESA/C/LXXIV/Res. 1 (Final)) of 27 June 1986 approving the execution in the framework of the Agency of a Hermes preparatory programme,
Having regard to Resolution ESA/PB-ARIANE/LXXIX/Res. 1 (Final) of 10 June 1987 by which the participating States agreed to increase the preparatory programme financial envelope by 53.96 million accounting units in order to ensure the continuity of certain items of work until 31 December 1987,
Having regard to Article V.1(b) of and Annex III to the Convention,

I. Agree to undertake, on the basis of the proposal referred to in the preamble, a preparatory programme comprising continuation of the definition studies on the Hermes European spaceplane system and the associated ground segment with a view to preparing a proposal on development around mid-1987, in coordination with the other programmes relating to European space infrastructure;

II. Take note of the general objectives of the Hermes programme set out in Annex A (section 1) to the present Declaration and APPROVE the objectives and technical content of the preparatory programme, described in Annex A (sections 2 and 3) to the present Declaration;

III. Agree:
a) to allocate for executing the Hermes preparatory programme a financial envelope of 48.04 million accounting units at mid-1985 prices and 1986 conversion rates, increased by an additional envelope of 53.96 million accounting units at the same economic conditions, to cover an extension of work under the programme until the end of December 1987, thus bringing the overall financial envelope of the preparatory programme to 102 million accounting units;
b) to contribute, within the limit of this envelope and in accordance with the particular modalities and scale of contributions shown in Annex B to this Declaration, to the cost of carrying out the preparatory programme;

IV. Agree on the following arrangements for continuing the programme:
a) before the end of the preparatory programme the participating States shall carry out a review to prepare the decision to move on to a development programme, on the basis of a detailed technical and financial evaluation of the Hermes programme including the ground segment, operations and the size of the fleet, and of a development programme proposal prepared by the Agency; they shall in due course submit a recommendation to the Council concerning adoption of a

Resolution on the execution, as an optional programme, of the Hermes development programme,

b) in addition, the interested participating States shall draw up a Declaration on this development programme; it is envisaged that this Declaration associate the present preparatory programme and the development programme with a view to defining the overall contributions of the States participating in the development programme,

c) a participating State that is not in a position to subscribe the Declaration on the development programme shall notify the Director General of this in writing;

d) a Member State which has not participated in the Hermes preparatory programme may take part subsequently in the Hermes development programme, after notifying the Director General and subject to:

(i) meeting the conditions laid down in the programme Implementing Rules, and

(ii) contributing, pro rata to its participation, to the expenditure not included in the calculation of industrial return,

the scale of contributions shall be adjusted accordingly;

V. Agree on the following arrangements for the execution by the Agency of the Hermes preparatory programme, it being understood that it shall not prejuge the arrangements which will be made for the development programme:

1. The Agency shall have responsibility for and overall technical and financial control of the Hermes project ("level A" responsibility) in accordance with its rules. In particular all contracts relating to execution of the Hermes preparatory programme shall be awarded and placed in accordance with the rules and procedures in force in the Agency and shall be managed under the Agency's responsibility.

2. The Agency may delegate certain management tasks ("level B" responsibility), to appropriate national entities.

3. In particular, the Agency in conformity with document ESA/C(86)106, rev. 2, shall delegate to CNES tasks related to the development of the spaceplane and to parts of the ground segment needed for this development. On that basis, the Agency and CNES shall define in an Agreement the arrangements for the execution of delegated tasks and the means enabling the Agency to fulfil its mission. The delegation of tasks to CNES or to other national entities for the ground segment related to the operation of the spaceplane shall be the subject of later proposals and decisions.

4. This Agreement shall include the commitment on the part of CNES to set up and maintain a team of appropriate size to carry out the tasks delegated by the Agency. CNES shall bear the costs of this

team and those of the technical, administrative and logistic support, in accordance with the provisions laid down in the implementing rules.

5. The Agency will be responsible for ensuring that the contracts placed directly by it and/or on its behalf by CNES and other national entities comply with the requirements of geographical distribution for the programme.

6. The Agency shall aim to use the means available in the participating States and the results obtained from activities relating to Hermes financed by them out of their national funds or from the Agency's own relevant programmes; the participating States shall be accordingly invited to convey to the Agency for use by the present preparatory programme all the technical results at their free disposal that are of interest for that programme, subject to the intellectual property rights over the said results.

VI. Agree that the preparatory programme work can start as soon as the subscribed contributions amount to 70% of the financial envelope referred to in paragraph III above; it is understood that the work will be started only in line with the level of contributions subscribed. Agree also to carry out without delay an evaluation of the contracts concerning the work covered by the preparatory programme which have been concluded previously by CNES or participating States, with a view to any continuation of these contracts under the Hermes preparatory programme;

VII. Agree that the present Declaration shall be open for subscription until 30 November 1986, the final date by which the participating States may announce that they are not able to accept the provisions of the present Declaration, and thus cease to be participating States.

This Declaration is subscribed by the following participating States:

Participant	*Date*
Switzerland	23.10.1986
Belgium	29.10.1986
France	5.11.1986
Sweden	6.11.1986
Denmark	21.11.1986
Germany	25.11.1986
Italy	27.11.1986
Ireland	27.11.1986
Austria	27.11.1986
Spain	30.11.1986
United Kingdom	30.11.1986
Netherlands	30.11.1986
Canada	15.01.1987

ANNEX A

Objectives and content of the HERMES preparatory programme

1. *Context-general objectives of the HERMES programme*

The purpose of the present Hermes programme is to:

- supply a major element of a European space infrastructure and contribute to Europe's autonomy in the exploitation and use of outer space;
- supply a manned transportation system capable of making the return trip between Earth and low orbits;
- develop a European industrial capability in advanced technology areas.

The Hermes European spaceplane is designed to be used with the other elements of the European space infrastructure (e.g. Ariane-5, Columbus, subsequent elements of the European Space Station, Data Relay Satellite, and the associated ground segment).

It is envisaged that the Hermes development programme will cover the construction of two spaceplanes and the associated ground segment. It will include two qualification flights.

Hermes is designed to support

- intervention missions (maintenance/reconfiguration/assembly) and
- supply missions (transportation of crew/freight),

on both Columbus and the international Space Station.

These missions are priority goals and are the reference missions for Hermes. Autonomous flight missions (i.e. without rendezvous with an in-orbit infrastructure) can also be accommodated if compatible.

Hermes will also be used, as far as possible, with other non-European in-orbit infrastructures.

The programme file, submitted to delegations at the ESA Council meeting of 5-6 March 1986, explains the desirability of this programme and describes the missions, design and initial definition of the project along with development and costs. This programme file will be completed by CNES and will be formally submitted by the end of May 1987. The Agency has produced a first outline of a programme proposal, which will be extended and modified so as to allow a decision to be made by Council meeting at ministerial level on developing Hermes in coordination with the proposals for other elements of the European space infrastructure.

2. *Objectives of the HERMES preparatory programme*

The preparatory programme is to follow on from the studies previously undertaken under bilateral agreements and as specific studies under the long-term space transportation systems preparatory programme (STS-LTPP).

The first objective of the Hermes preparatory programme is to make available the elements necessary for supplementing the programme file already submitted, from the technical viewpoint, in terms of coherence with the other elements of the European space infrastructure, with regard to the programme's cost, timetable and industrial structure as well as to the operations costs, the ground segment, the size of the fleet and the cost of adapting Ariane-5 to manned flights. This task also includes all the Agency's activities associated with the discussions with CNES of the evaluation results and the necessary technical negotiations of the final programme objectives and specifications.

The second objective deals with industrial activities aimed at:

- the detailed definition of the spaceplane and the associated ground segment, including basic technology studies, together with the initial investment in ground facilities needed urgently;
- the initial definition of the operational ground segment and of the crew-related infrastructure;
- the continuation of the Hermes mission and utilisation studies as well as initial definition of the EVA (extravehicular activity) technology, which is an important basic tool in the Hermes operations.

3. *Content of the preparatory programme*

The preparatory programme covers the Hermes phase B2 activities due to end on 1 July 1987, as well as the following tasks:

a) *Advanced definition work on the overall HERMES system*

This continuation of the industrial system activities is mainly aimed at the following specific tasks:

- updating the general technical and economic performance level and the resources available to the users,

– detailed work on crew security and safety including in particular an assessment of the need for a rescue system such as an ejectable cabin, and of the safety implications for the design of Ariane-5 and the ground segment,
– work on certain system aspects relating to, respectively:
  · telecommunications between the spaceplan and the ground segment, and the general architecture of the links,
  · tracking and navigation,
  · ground/onboard data exchange and evaluation of the associated data-processing requirements,
  · Hermes and its in-orbit operations interfaces.
– the drawing up of documents and procedures intended for monitoring and controlling the programme, including:
  · system and interface requirements,
  · product assurance and reliability requirements,
  · supporting documents such as standards and procedures, and
  · management specifications.
– the drawing up of environmental standards and of anthropometric standards needed for manned flights,
– preliminary definition of the Hermes operational concept coherent with the other elements of the in-orbit infrastructure.

b) *Work on coherence with the other elements of the infrastructure*
This work will aim to assess and implement on Hermes the recommendations on coherence resulting from the work carried out under ESA programmes dealing with the other elements of the in-orbit infrastructure, in particular Columbus. It will include the analysis, and if required the implementation, of the recommendations made by the coherence task force.

c) *Work leading to the preliminary definition of Hermes utilisation*
This work will include a detailed review of the utilisation scenario and analysis of a possible improvement in system performance, and will end with:
– the drafting of the preliminary specifications for user interfaces concerning the various ESA programmes relating to the in-orbit infrastructure and to Columbus in particular,
– a detailed review of the overall servicing cycle,
– preparation of a draft mission operations manual, and finally
– the initial definition of a demonstration mission.

d) *Preliminary definition of the extravehicular activities (EVA) support system*
It is important, above all for safety reasons, that Hermes be fitted, as from the experimental flights, with simplified extravehicular equipment. Moreover, longer-term definition of this equipment must take account of all manned missions (Columbus). Given the length and

cost of this development, the Agency wishes to have a costed and reasoned EVA development programme proposal available early in 1987, and to update this towards the end of the year.

The activities currently planned under the STS-LTPP extension and general studies (totalling 650 kAU) relate only to a general analysis conducted by two contractors in parallel and the study of two specific critical aspects (life support and human aspects).

The actions foreseen under the HPP include:

- the extension of the system studies, in particular in the area of:
  - the inventory and utilisation of existing European industrial resources for development and test,
  - a deeper definition of the user requirements and the identification of minimum performances needed in a first generation of EVA equipment,
  - the support to accommodation studies considering Hermes and Columbus interfaces and constraints,
  - the preparation of a ground and in-orbit validation programme,
  - the definition and costing of EVA specific ground facilities,
  - the assessment of the commonality in requirements and technology of the EVA and IVA (intravehicular activities) equipments;
  - the start of detailed definition of the design selected in March 1987, and of the associated development plan.
- a preliminary definition of the specific technology needed for the EVA suits;
- a preliminary definition of the technology needed for the integrated information system in the EVA helmet (display, communication, etc.).

All these tasks correspond roughly to an initial definition phase (Phase B.1) and involve no technological development activities. It is also understood that inclusion of the work put in on defining an EVA development strategy in the Hermes preparatory programme will not prejudge approval of the Executive's proposal for the funding of the programme proper.

e) *Definition work on the spaceplane*

This concerns the detailed technical definition of the spaceplane and the drawing up of a development plan for the various hardware and software elements and for the corresponding development and test facilities.

The work bears on:

(i) the overall engineering of the spaceplane:
  - study of aerodynamic shape and centre-of-pressure location of the revised Hermes specification, using calculations and tests,
  - study of dimensioning trajectories, mechanical and thermal

loads, and the architecture of the structure and the thermal protection system,
- study and reassessment of the electrical architecture, the man-machine interfaces, and the spaceplane's internal layout,
- study of methods of navigation, rendezvous, flight control and of flight qualities in the atmospheric phase,
- study of safety and reliability, including detailed assessment of the feasibility of an ejectable cabin and its impact on development,
- drawing up construction design rules and test rules,
- budget computation and update (mass, power consumption, propellants, etc.);
- detailed study of the automatic reentry and landing system.

(ii) assembly of the spaceplane and tests on it:
- method and necessary facilities for the plane's assembly and its qualification and acceptance tests, including the definition of flight models and, pending the Agency's decision on the subject, of a hypersonic demonstrator and some of the associated equipment;

(iii) definition and update of the various spaceplane subsystems:
- airframe, thermal protection, guidance and flight control in the atmospheric phase, cockpit layout, functional electronics and communications, propulsion, onboard power supply, thermal control, life support and manipulator arm;
- the study of these subsystems goes hand in hand with the study of the simulation systems and the associated implementation and control systems.

f) *R&D work*

This work completes the activities undertaken in the following areas:

(i) aerodynamics and aerothermics:
theoretical studies in hypersonics
wind tunnel validation;

(ii) structure and thermal protection:
detailed definition and evaluation of warm composite-structure technology, characterisation of external surface materials and of insulation (mechanical and thermal properties, resistance to oxidation);

(iii) flat-screen display technology;

(iv) evaporator and fluid loop technology;

(v) power generation;
fuel cells, lithium cells, auxiliary power unit and possibly thermal engines;

(vi) onboard software;

(vii) airlock and docking adapter, with associated mechanisms.

g) *Definition work on the HERMES ground segment*

The purpose of this work is to make progress with the definition of the ground segment specific to the Hermes spaceplane, comprising:

- the central mission control and the flight control centre (including their functional requirements and interfaces),
- the Hermes communication centre,
- crew facilities (including training facilities),
- launch preparation infrastructures,
- landing and rescue infrastructures,
- the transport plane and training plane.

This work also includes an analysis of the operational requirements for putting the spaceplane into operation during its utilisation cycle. It will need to confirm the compatibility of the Hermes ground segment with that of the other space infrastructure elements, and check that Hermes requirements have been taken into account under other programmes.

h) *Work on the development and uprating of manufacturing and test facilities*

This concerns the investments that need to be made in the short term for wind tunnels and the manufacturing and test facilities for the thermal protection system.

i) *Continued build-up of the ESA team and continued assessment of the CNES HERMES proposal*

This task is the continuation of the effort covered by the extension of the long-term space transportation systems preparatory programme for the period June to December 1986.

The activities deal with:

- the last part (after October 1986) of the Agency's evaluation of the CNES proposal based on detailed meetings with CNES and industry and on the first results of LTPP contracts; some additional consultancy contracts will also be placed during this period,
- the presentation to the programme board of the Agency's recommendations and the negotiation of possible improvements to CNES's updated programme file, the preparation of the programme proposal for phase C/D and its updating up to the time of its submission to Council meeting at ministerial level;
- the preparation, approval and implementation of the Hermes specifications system;
- finally, the continued build-up of the Agency management team until the decision on the development programme.

4. *Indicative timetable for the HERMES preparatory programme*

The preparatory programme initially covers the period from October 1986 through June 1987. It will be extended through the end of 1987.

5. *Revision clause*

The provisions of this Annex may be revised by a unanimous decision of the participating States.

ANNEX B

Financial provisions

1. *Financial envelope for the HERMES preparatory programme*

The financial envelope for the preparatory programme referred to in para. III(a) of the Declaration amounts to 102 MAU at mid-1985 prices and 1986 conversion rates.

	MAU
Staff expenditure	1.48
Running expenditure	2.52[1])
Facilities	3.33
Capital expenditure	13.62[2])
Development	76.90
Direct expenditure (Total)	97.85
Administrative and site costs	2.08
Variable support costs	1.16
Fixed support costs	0.91
Indirect expenditure (Total)	4.15
GRAND TOTAL	102.00

[1]) including 1.6 MAU to cover CNES mission expenses

[2]) including 0.5 MAU for investment in management-specific EDP equipment

2. *Scale of contributions*

The participating States shall contribute to this financial envelope on the following scale:

Participants	*% Initial scale*
Austria	0.07
Germany	30.00
Belgium	6.40
Denmark	0.40
Spain	5.60
France	42.00
Ireland	0.20
Italy	15.00
Netherlands	4.00
United Kingdom	3.37
Sweden	2.50
Switzerland	2.00
Canada	1.10
TOTAL	112.64

It is recalled that some participating States (Austria, Belgium, Italy, *Netherlands,* Sweden and Canada) have carried out industrial activities under bilateral Agreements with France with a view to preparing the Hermes preparatory programme. The funds allocated by these States for these activities are not included in the financial envelope mentioned in paragraph 1 above.

An adjustment will be made when the decision is taken to set in train the Hermes spaceplane development programme proper, taking account, as the case may be, of the decisions made by the competent bodies of the Agency on measures aimed at compensating for the deficit of certain States.

If it transpires that the decision to go ahead with the development programme cannot be taken, the scale of contributions will be adjusted at the end of the present Hermes preparatory programme.

The same applies to a participating State which does not participate in the development programme.

3. *Indicative overall scale and arrangements for the development programme*

It is envisaged to establish, in the Declaration on the development programme, an overall scale combining the preparatory and development programmes (excluding contributions under bilateral agreements). When subscribing the present Declaration, participating States may notify the Agency of their target rates of contribution for the overall programme. The following table gives, as an indication and

without commitment, a preliminary estimate of those target rates at the date of drawing up the Declaration on the preparatory programme.

Participant	*%*
Austria	(1.5)-(2)
Germany	(20)-(30)
Belgium	(7)
Denmark	(0)-(1)
Spain	(5)-(7)
France	(45)-(50)
Ireland	(0.6)
Italy	(13)-(15)
Norway	(0)-(1)
Netherlands	(5)
United Kingdom	(5)-(10)
Sweden	(3)-(4)
Switzerland	(2)
Canada	(2)-(2.5)

It is envisaged that the Declaration on the development programme will define the mechanism for adjusting contributions to match the evolution of the geographical distribution of work, taking account, as the case may be of the decisions made by the competent bodies of the Agency on measures aimed at compensating for the deficit of certain Member States. In particular, a first adjustment of the scale shall be made no later than 18 months after the date on which the Declaration enters into force.

Should the allocation of work to a participating States lead to an increase of more than 5% of the rate shown in the initial scale, this work will be allocated to that State only subject to its prior agreement to bear the cost of this work; within this limit such agreement would not be necessary, and the scale of contributions would be adjusted accordingly.

4. *Schedule of payment appropriations*

The indicative schedule of payment appropriations is as follows (in MAU at mid-1985 prices and 1986 conversion rates):

	1986	1987	1988	Totaal
HPP	0.24	47.80	–	48.04
HPP Ex tn	–	14.00	39.96	53.96
				102.00

5. *Revision clause*

The provisions of this Annex may be revised by a unanimous decision of the participating States, taking into account the informative nature of its paragraph 3.

De verklaring is ingevolge paragraaf VI op 25 november 1986 in werking getreden.

Declaration on the Hermes development programme
ESA/PB-ARIANE/LXXXV/Dec.2
(drawn up on 15 December 1987)
(updated on 29 June 1989)

The participating States referred to below (hereinafter referred to as "the participating States"),

Recalling the objective, among others, assigned to the European space programme of strengthening a European space transportation capability meeting the foreseeable requirements of users within and outside Europe and remaining competitive with space transportation systems existing or planned elsewhere,

Recalling Resolution ESA/C-M/LXVII/Res. 1 (Final) on the European long-term space plan adopted by the Council meeting at ministerial level on 31 January 1985,

Considering that the Hermes development programme will constitute one of the major elements for the construction of a European space infrastructure, will contribute to Europe's autonomy in the exploitation and utilisation of outer Space and to its participation in the international space station, and will pave the way to future space transportation systems,

Considering the necessary programmatic coherence, within the framework of the European long-term space plan, between Hermes, Ariane-5 and Columbus and all its commercial, scientific and other users,

Having regard to Resolution ESA/C/LXXIV/Res.1 (Final) of 27 June 1986 and to Declaration ESA/C/LXXV/Dec.2 (Final), rev. 1 on the Hermes preparatory programme, and in particular to the provisions of section IV of the Declaration,

Considering the results obtained and the progress of work done under the Hermes preparatory programme and that the work in question is being extended beyond its initially planned duration by way of an extension of the said preparatory programme.

Having regard to the Hermes European spaceplane development programme proposal submitted by the Director General following the work and studies done under the said preparatory programme (ESA/PB-ARIANE(87)HDP/WP/6, rev. 2), as well as to the recommendation by the Ariane Launcher Programme Board on this subject (ESA/C/(87)(63),

Having regard to the management scheme adopted for execution of the said preparatory programme (ESA/C(86)106, rev. 2) and the Agreement concluded between the Agency and CNES to this effect,

Having regard to Resolution ESA/C/LXXIX/Res. 1 on the ground segment associated with the European in-orbit infrastructure operations, adopted by Council on 5 November 1987,

Having regard to Resolution ESA/C-M/LXXX/Res. 1 (Final) on the European long-term space plan, adopted on 10 November 1987 by

the Council meeting at ministerial level, and in particular to Chapter III, section A.2, thereof agreeing to execution of the Hermes development programme in two phases, within the framework of the Agency,

Having regard to Articles V.1b) and XI.5c)(i) of the Convention and to Annex III thereto,

I. Agree to undertake the Hermes spaceplane and associated ground segment development programme, in two phases, as a European programme within the Agency framework, on the basis of the work and studies done under the Hermes preparatory programme, as reflected in the development programme proposal referred to in the preamble, and in accordance with the arrangements set out below;

II. Approve the general objectives of the Hermes development programme and the technical content of phases 1 and 2, as set out in Annex A to this Declaration; NOTE that the technical content of phase 2 will be open to review when the time to decide to move on to the said phase;

III. Agree:

a) to allocate for carrying out the development programme a financial envelope of 4429.4 million accounting units at mid-1986 prices and 1987 conversion rates, including a firm financial envelope of 530 million accounting units for carrying out phase 1 of the development programme; NOTE that a sum of 104.6 million accounting units at the same economic conditions, corresponding to the Hermes preparatory programme including its extension, is to be added to this envelope so as to arrive at an amount of 4534 million accounting units, which corresponds to the overall financial envelope for the Hermes programme.

Any tendency that is identified towards an overrun of this initial financial envelope of 4429.4 million accounting units shall, with a view to the application of Article III.4 (a) of Annex III to the Convention, be notified in advance to all the participating States and to the Administrative and Finance Committee. The Agency will submit a special report if it deems that this financial envelope may be overrun. On the basis of this report, and in due time before the vote on the annual budget corresponding to such an overrun, discussions and decisions will take place on the technical and programmatic aspects.

b) to contribute, within the development programme envelope and in accordance with the funding mechanism set out in Annex B to this Declaration, to the cost of executing this programme.

The contributions of participating States to the financial envelope referred to above and the geographical distribution of work stemming therefrom take account of measures compensating for past imbalances, as well as anticipatory compensation measures, applicable as from 1991 onwards, decided by Council at its 80th meeting, held at

ministerial level in The Hague on 10 November 1987 (ESA/C-M/LXXX/Res. 1 (Final), Chapter IV.3 and 5); these measures are described under section II of Annex B hereafter.

The geographical distribution of work shall be reviewed once the industrial structure for the programme is clearly defined or, at the latest, after 24 months from the entry into force of this Declaration; the conclusion of this review will lead to a correction of the situation through a redistribution of work, otherwise through revision of the contribution scale, using the mechanism described in Annex B hereto, as a help in maintaining the overall return objective while guaranteeing each participating State a geographical return of at least 0.90 by the end of the present programme.

c) In good time for the decision to move on to phase 2 of the development programme, the Agency shall present an analysis of the phase 1 results and their impact on the technical content and financial and timeable aspects of phase 2. On this basis, the participating States shall examine the results of phase 1 to determine whether the programme objectives can be attained within the overall financial envelope mentioned above. This examination shall also ensure the maintenance of coherence between the programmes making up the in-orbit infrastructure and in particular the orientation given to the Columbus development programme by virtue of Chapter II of Resolution ESA/C-M/LXXX/Res. 1 (Final) of 10 November 1987. The decision to embark on phase 2 related to full development work shall be taken before the end of 1990 by a two-thirds majority of the participating States, provided that such majority represents at least two-thirds of the contributions to the programme, in accordance with Article II, section 2 of Annex III to the Convention, it being understood that the stipulations of Article III.1 of the said Annex shall apply in the event of a cost overrun.

IV. Agree on the following arrangements for the execution by the Agency of the Hermes development programme:

1. The Agency shall have overall responsibility for and overall technical and financial control of the development programme ("level A" responsibility) in accordance with its rules. In particular, all contracts relating to execution of the Hermes development programme shall be awarded and placed in accordance with the rules and procedures in force in the Agency and shall be managed under the Agency's responsibility. For the Hermes programme, a quarterly report based on the quarterly reports to Council shall be submitted to the participating States, including enough details on the technical, financial and timetable aspects in particular to enable cost trends and the technical reasons for them to be identified in good time.

2. The Agency shall be responsible for ensuring that programming aspects common to the in-orbit infrastructure programmes (particu-

larly Ariane-5, Hermes, Columbus and the EDRS) are consistent and compatible.

3. The Agency may delegate certain management tasks ("level B" responsibility) to national entities of participating States.

3.1 In particular, the Agency shall delegate to CNES, in conformity with the principles laid down in ESA/C(86)106. rev. 2, tasks related to the development of the spaceplane and to certain parts of the ground segment needed for this development. On that basis, the Agency and CNES shall define in an Agreement the arrangements for the execution of delegated tasks and the means enabling the Agency to fulfil its mission. The delegation of tasks to CNES or to other national entities for the ground segment facilities for in-flight monitoring of the spaceplane shall be the subject of later proposals and decisions.

3.2 This Agreement shall include an undertaking by CNES to set up and maintain a team of appropiate size to carry out the tasks delegated by the Agency. CNES shall bear the costs of this team, apart from mission costs, and those of the technical, logistic and administrative support, apart from external management assistance and special computer facilities needed for implementing the programme management procedures, in accordance with the provisions laid down in the implementing rules. These costs shall be examined jointly each year by the Agency and CNES. Mission costs shall be borne on an annual lump-sum basis.

4. The Agency shall be responsible for ensuring that the contracts placed directly by it and/or on its behalf by CNES and other national entities comply with the requirements of geographical distribution for the programme; the Agency shall periodically supply the participating States with the relevant information.

5. In addition to the systems and installations developed in the framework of the Agency and during the Hermes preparatory programme, the Agency shall strive to use the facilities available in the participating States and of the results obtained following Hermes activities financed by them out of their national funds, as well as of the results of its own relevant programmes; to this end and for the purpose of use under the development programme, the participating States are invited to forward to the Agency all the technical results to which they have unrestricted access and which are relevant to the programme, subject to intellectual property rights over these results.

6. The Agency shall be responsible for tasks relating to the crew (selection, general training and development of equipment) and shall delegate tasks relating to pilot training to CNES, in accordance with ESA/C(86)106, rev. 2, and on the basis of Resolution ESA/C/LXXIX/Res. 1 adopted on 5 November 1987.

7. The Agency shall be responsible for the Hermes programme

infrastructure, delegating to CNES the technical and financial management of the activities related to the following elements:

a) infrastructure for preparing the spaceplane at Kourou,

b) use of wind tunnels for validating the spaceplane's aerothermal design,

c) integration and maintenance facilities for the spaceplane,

d) ground-based flight simulators.

The tasks relating to other ground facilities, and in particular to the flight control centre, will be delegated in due course on the basis of Resolution ESA/C/LXXIX/Res. 1, adopted on 5 November 1987.

8. The Agency shall propose the payloads to fill the capacity of the operational validation flight or flights with the aim of obtaining participation in launch costs by the appropiate payload authorities, it being understood that the expenditure directly linked to a payload will be borne by the bodies responsible for it. Decisions shall be taken by the participating States in accordance with rules, which will have to be adopted at an early stage, governing accommodation of payloads on operational validation flights.

9. The Agency have overall responsibility for the programme's product assurance. From this viewpoint and that of aspects affecting the safety of the crews and persons on board Hermes, the Ariane-5 and Hermes systems shall be treated as a whole.

10. The Agency shall propose to the participating States the legal provisions governing the status of the Hermes spaceplane and its crew.

V. Invite any States participating in the Hermes preparatory programme that would not be interested in participating in the development programme to notify the Director General of this as soon as possible so that the contribution scale can be adjusted in accordance with the provisions of section II of Annex B to the Declaration on the preparatory programme. Where the case arises, these States shall be requested to take the measures necessary to facilitate the transfer of the results of the preparatory programme to firms in the other States participating in the development programme;

VI. Agree that the work can start as soon as the subscribed contributions amount to 80% of the financial envelope referred to in section III above; it is understood that the work shall be started only on the basis of the level of the contributions subscribed;

VII. Invite the Member States that are not interested in participating in this programme to give notification as soon as possible and before 31 December 1987, in order to take account of Resolution

ESA/C-M/LXXX/Res. 1 (Final), Chapter III, sections 4 and 5, that they are not able to accept the provisions of the present Declaration.

This Declaration has been subscribed by the following participating States:

Participant	*Date*
Switzerland	15.12.1987
Austria	30.12.1987
Sweden	11.01.1988
Norway	10.02.1988
Spain	10.02.1988
Germany	10.02.1988
Netherlands	10.02.1988
Belgium	11.02.1988
France	12.02.1988
Italy	15.02.1988
Denmark	17.02.1988
Canada	29.06.1989

ANNEX A

Objectives and content of the Hermes development programme

1. *Objectives of the Hermes programme*

1.1 Origins of the programme

Europe has achieved autonomy in the development of launchers and of satellites for a variety of missions. Spacelab has been its first major step in developing its expertise for manned applications of space.

As decided at the Rome ministerial conference in 1985 and confirmed in the following Council meetings. Europe must gradually acquire a complete autonomy in manned spaceflight.

Together with Ariane-5, its launcher, and Columbus, Hermes forms an essential element of this plan, as it must provide the capability to transport crew and equipment into low-earth orbit, perform a variety of servicing and other missions, and return to earth.

1.2 Overall objectives

The objectives of the Hermes programme are to develop an autonomous manned transportation system for low earth orbit with its associated pay-load, crew and ground infrastructure elements.

These objectives are thus:

- to design, develop, qualify and test in flight an Hermes system

capable of meeting the mission requirements described in section 1.3 below

– to acquire the detailed technology and design expertise required for this development as a fully autonomous European capability and know-how, to be put at the disposal of the Agency for further programmes

– to place the Hermes system, after the development phase and a further validation phase, at the disposal of the Agency and under its full control, for at least 15 years of operational life

– to ensure sufficient growth potential in the Hermes system to allow an extension of its capabilities and to adapt it to additional elements of the orbital infrastructure if required.

These objectives will be achieved in two consecutive phases for which the tasks, content and timetable are set out in 2.2, 2.3 and 2.4 below.

1.3 Mission of Hermes

The primary mission of Hermes will be the periodical supply and servicing of the Columbus Man-Tended Free-Flyer (MTFF) and, when required, the visit to the International Space Station (ISS) and of its Agency-supplied Attached Pressurised Module (APM).

The resulting mission requirements are thus:

– the capability of three flights per year with a nominal rendezvous schedule to the MTFF of two visits per year; a lifetime of 15 years for a total of 30 missions for each spaceplane

– the transport into orbit of at least three crew members (two of whom would be available for MTFF servicing activities) under safety conditions to be defined in detail by the Agency and their return to earth

– the capability to autonomously rendezvous and dock with the MTFF/ISS in their nominal orbits, with at least six days in a docked configuration

– the transport of at least 3000 kg from Earth to orbit ("upload"), this figure including airborne support equipment. The volume, size, and geometry constraints of transported equipment must be defined, as well as the safety conditions of certain hazardous cargo; the "download" (cargo to be returned to Earth) will be derived from the "upload" after deduction of consumables and of jettisonable hardware

– the provision for nominal servicing by IVA (intravehicular activities) for internally mounted payloads and subsystems

– a capability for external servicing, contingency and rescue operations with the help of an externally manipulator arm and of EVA (extravehicular activities) equipment

– an autonomy in flight for at least 11 days

– the provision of certain services and supplies to the MTFF in the

area of power, atmosphere control, ECLS, telecommunications and propellant refuelling.

Missions for the performance of in-orbit experiments or technology demonstration as well as other missions like the extension duration up to 3 to 4 weeks and visits to other space stations (Mir) or platforms may be considered to the extent that the corresponding requirements on Hermes performances are within the envelope defined for the primary mission.

1.4 Requirements and compatibility with other programmes

The requirements to be met by the Hermes system will be covered by the Hermes system requirement document and its annexes (see (ESA/C(87)63, para. 8.1.1). Among these requirements are the interfaces with the other programmes (Columbus, EDRS, Ariane-5) and the ground infrastructure. These interfaces wil be managed and controlled by the Agency as from the start of the Development Programme.

The requirements placed by Hermes on the Ariane-5 launcher will respect the priority given in the development and production of the latter to its commercial competitiveness.

2. *Content of the Hermes Development Programme*

2.1 Content of the Hermes system

The Hermes system to be developed in the programme contains the following elements:

- the spaceplane
- the ground segment
- the crew and crew equipment (including EVA equipment)
- the payload accommodation and supporting equipment

2.1.1 The spaceplane

This element comprises the spaceplane itself and all facilities and tools required to develop and qualify the spaceplane functionally and operationally up to and including the first manned flight.

The spaceplane is a winged vehicle of approximately 15.5 m length and 10.5 m wingspan with an in-orbit mass of 21 tonnes maximum: it accommodates a crew of three and a payload of 3 tonnes. It will be launched by the Ariane-5 launch vehicle equipped with a – Hermes specific – second stage (L5-B), which will be developed and procured, with the Ariane launcher adaptor, as part of the Hermes programme. The internal layout consists of an ejectable front cabin, a pressurized cargo bay and a living area: the total available internal volume is approximately 30 m^3.

Two flight models of the spaceplane are included in the programme.

2.1.2 Ground segment

– Industrial facilities

The industrial facilities are those needed for the spaceplane

development such as windtunnels and equipment and subsystem related test facilities.

– Facilities required during the development phase

In addition to the use of facilities needed for the development of several elements of the IOI, the following facilities will be required:

· Rendezvous and docking facilities
· In-orbit servicing facilities
· Crew training facilities

– Launch and landing facilities

The following facilities are part of the Hermes programme:

· Nominal and emergency landing sites
· Logistics facilities at the CSG and in Europe for maintenance and refurbishment of Hermes (spare parts are foreseen for the first two missions)
· Hermes carrier aircraft facilities
· Communication, data link and automatic landing aids for the launch (ending with separation of Hermes from Ariane-5) and landing
· Extension of ELA-3 installation and additional MGSE needed for Hermes at the CSG.

– Operations facilities

The following facilities will be developed or made available for the Hermes programme:

· Mission Operation Facility: Central Mission Control Centre (CMCC)
· Element Control facility: Hermes Flight Control Centre (HFCC)
· Ground Communications and Network Facilities

– Payload exploitation facilities

For the first two Hermes missions (first automatic flight and first manned flight) the payload wil consist of the instrumentation and equipment required to validate Hermes for the operational phase. No specific payload exploitation facilities are required for this purpose.

2.1.3 The crew and crew equipment

This element covers the tasks associated with the selection and training of the crew as well as the suits and personal equipment needed. It also covers the EVA (extravehicular acitivity) equipment that is needed not only to perform external servicing operations but also for ensuring the crew's safety in an emergency.

2.1.4 The payload accommodation and supporting equipment

This element of the Hermes system is needed for the preparation of the operational validation flights and the operational phase itself. Only its initial definition is covered by the Hermes development programme.

2.2 Tasks covered by the Hermes development programme

2.2.1 General programme tasks

The main tasks to be carried out under the Hermes development programme as a whole are:

- the overall management of the programme by ESA and CNES throughout the programme
- the Hermes system definition including the specifications of the requirements of its main elements and the necessary studies associated among others with crew safety, utilisation and operation
- the Hermes system qualification ending with the two spaceplane qualification flights and the analysis of flight results
- the spaceplane development, assembly, integration and testing including all the tasks necessary to the development of its subsystems equipments, software, materials and components
- the development and qualification of the ground segment as described in section 2.1.2
- the selection, recruitment, training of crew and the development of associated equipment.

2.2.2 Specific tasks under phase 1 of the programme

Phase 1 of the Hermes development programme comprises the following tasks:

- checking and consolidating the system definition so as to confirm the approach chosen to achieve the mission safety and performance objectives;
- the work necessary to reduce the project's technical risks to an acceptable level, in particular that relating to aerodynamics;
- supplying the Ariane-5 and Columbus projects with the data necessary for their definition and for the main interfaces;
- confirmation of the programme's timetable and financial aspects, in particular by obtaining and negotiating firm, detailed industrial tenders.

2.3 Hermes development plan

2.3.1 Phase 1 of the development plan

The plan of action for phase 1 comprises the following activities:

a) management

- ESA and CNES management, general studies and specialised consultancy;

b) system level

- detailed definition of the configuration
- analysis and confirmation of the performance budgets
- study on safety and in particular on the ejectable cabin
- construction of two system models with the following objectives:
  - First mock-up (MA 1) · validate habitability and equipment accommodation, etc.
  - Cockpit Simulator (SDC) · define man/machine interfaces and simulate cockpit conditions

– study of the Ariane and Columbus interfaces, supplying the necessary models and mock-ups

c) technological predevelopment

– the critical technologies necessary for the Hermes will first be studied so as to make the necessary choices between alternative solutions, and undertake the development adopted and test the necessary pre-qualification models.

The areas that will receive priority during this phase are in principle:

- aerodynamics (build-up of facilities, preparation of computer models, R&D)
- thermal protection
- warm structures
- fuel cells
- software
- equipment necessary for the crew (for EVA, among other things).

d) definition of subsystems and equipment

The subsystems for the Hermes spaceplane and the ground segment, as well as the corresponding equipment, will be defined during phase 1 only if necessary for the system activities described above.

2.3.2 Phase 2 of the development plan

After the phase 1 results have been reviewed in detail and the industrial contracts for phase 2 negotiated, the latter will be embarked on and will cover the following development and qualification activities:

– development of the spaceplane and its subsystems as well as of the ground segment

– assembly and testing of subsystem test models and of the spaceplane fullscale models. These models and their functions are listed below:

· Second Mock-up (MA2)	· validate assembly concepts, define fixtures and fabrication tools
· System Integration Test Bed (BIS)	· simulate normal and emergency procedures · global endurance tests
· Identifaction Model (MI)	· validate overall integration, acceptance and utilisation procedures and software · fault and contingency analysis
· Structural and Thermal Model (MSHT)	· environmental tests, qualification of carrier aircraft
· Static Test Model (MS)	· structural qualification

– the qualification of the spaceplane on the ground and during subsonic flights from the carrier aircraft

– the qualification of the ejectable cain, of the ground segment and of the crew equipment
– the final qualification of the Hermes system in two orbital flights; the second qualification flight will be manned.

2.4 Development timetable:
On the basis of start-up of the Hermes development programme in January 1988 at the latest, the main development stages are as follows (indicative timetable):

2.4.1 Phase 1 schedule

– Start of phase 1	January 1988
– Preliminary requirements review	mid-1988
– Preliminary selection of critical technologies	late 1988
– Calculation model for aerodynamics and critical wind tunnels available	late 1989
– Spaceplane system and subsystem reviews	March 1989–March 1990
– Call for tenders for phase 2 and negotiation	autumn 1990

2.4.2 Phase 2 schedule

– Start of phase 2	January 1991
– Critical design review	1993
– Start of subsonic flight tests	1996
– First (automatic) in-orbit test flight	1998, or earlier
– Second (crewed) in-orbit test flight	1999, or earlier
– First MTFF service mission	1999

These target dates will be reviewed at the end of phase 1, and could be adjusted in the frame of the provisions described under section III(c) of the present Declaration.

3. *Revision clause*
3.1 In the case it is necessary to adjust the content of the Columbus development programme, if Article II of Resolution ESA/C-M/LXXX/Res. 2 (Final) of 10 November 1987 for participation in the international space station takes effect and where it would be necessary to adjust the content of the Hermes development programme in order to maintain the necessary coherence between the in-orbit infrastructure programmes, the corresponding provisions of this Annex will be revised by a two-thirds majority of all the participating States, provided such a majority represents at least two-thirds of the contribution to the Hermes development programme. The programme content will be adapted to the new situation within a time limit compatible with the execution of the programme, so as to allow, in particular, the main industrial contracts to be placed.
3.2 Any revision which may take place at the time of transition from phase 1 to phase 2 in accordance with the provisions of Article III(c)

of this Declaration, will be made by the same majority as the one described under section 3.1 above.

3.3 In all other circumstances, the provisions of this Annex may be revised by unanimous decision of the participating States.

ANNEX B

Financial provisions

I. *Financial envelope of the Hermes development programme*

1. The financial envelope of the Hermes development programme amounts to 4429.4 MAU at mid-1986 prices and 1987 conversion rates. The indicative breakdown, based on the current budget structure, is as follows:

	MAU
Staff expenditure	36.4
Running expenditure	32.0
Facilities	33.0
Capital expenditure	574.0
Development	3654.0
Direct expenditure total	4329.4
Administrative and site costs	55.0
Variable support costs	25.0
Fixed support costs and investments	20.0
Indirect expenditure total	100.0
GRAND TOTAL	4429.4

2. *Financial sub-envelope for phase 1*

The firm sub-envelope allocated to phase 1 of the development programme amounts to 530 million accounting units, at the same economic conditions. The indicative breakdown, based on the current budget structure, is as follows:

	MAU
Staff expenditure	8
Running expenditure	6
Facilities	10
Capital expenditure	51
Development	429
Direct expenditure total	504
Administrative and site costs	12
Variable support costs	8
Fixed support costs and investments	6
Indirect expenditure total	26
GRAND TOTAL	530

At the time of the decision to move on to phase 2, the participating States shall determine the firm sub-envelope for this phase, within the development programme financial envelope, and how it should be broken down on the basis of the budget structure in force at the Agency. Without prejudice to possible subsequent application of the provisions of Article III.4 of Annex III to the Convention, the participating States may, on that occasion and by a unanimous decision, revise the development programme financial envelope.

In the event of a cost overrun, Article III.1 of Annex III to the Convention shall apply.

II. *Scale of contributions*

The participating States shall contribute to the Hermes development programme's financial envelope in accordance with the following initial scale:

Participant	Scale[1]) %
Austria	0.50
Germany	27.00
Belgium	5.80
Canada	0.45
Denmark	0.45
Spain	4.50
France	43.50
Italy	12.10
Norway	0.20
Netherlands	2.20
Sweden	1.30
Switzerland	2.00
TOTAL	100.00

[1]) In the contributions of the participating States to the above financial envelope, on the basis of this scale and the geographical distribution of work stemming therefrom, account shall be taken of measures that are in line with Chapter IV section 5 of Resolution ESA/C-M/LXXX/Res. 1 (Final), adopted on 10 November 1987, which are intended to compensate for the imbalances recorded at the end of 1987 and are defined by the amounts required at that time to bring each return coefficient to 1. These measures will be applicable to the period 1988–1990. In addition, a register containing the respective compensation measures for the period 1988–1990 will be maintained by the Executive ("special account of compensation measures"), and will be continuously adjusted so that the value of the compensation measures can be available to the Member States. The Executive will report regularly on these compensation measures to the IPC.

This column also takes account of the effects of the anticipatory compensation measures decided by Council meeting at ministerial level in Chapter IV, section 3, of Resolution ESA/C-M/LXXX/Res. 1 (Final), which are intended to prevent future imbalances arising by applying compensation of 2% of the development programme's financial envelope between States with prime-contractor responsibilities or major responsibility for a significant part of the programme, and those not having this type of responsibility. These measures will be applicable from 1991 until the end of the work. A special report on these anticipatory measures will be made before their implementation.

III. *Arrangements for examining the geographical distribution of work and for revising the scale of contributions*

1. During the first two years of execution of the development programme, the Agency shall seek to allocate the work between the participating States in accordance with the geographical distribution of work resulting from the compensation measures referred to in

section II above, and shall present a report demonstrating that all options for reallocating work to the said participating States have been exhausted.

2.1 The geographical distribution of work shall be reviewed once the industrial structure for the programme is clearly defined or, at the latest, after 24 months from the entry into force of this Declaration; the conclusion of this review will lead to a correction of the situation through a resdistribution of work, otherwise through revision of the contribution scale, on the basis of the industrial structure that is known and planned for the continuation of the programme. Allowance will be made for the need to guarantee a geographical return of at least 0.90 for all participating States at the end of the programme, while determining how a better distribution of work over all the programmes could, as far as possible, prevent a revision of the contribution scales.

2.2 This review will be conducted subject to negotiations with the participating States concerned, it being understood that neither a surplus of financial cover nor a structural deficit for the programme shall result. Should a State be unable to agree to its revised contribution rate, the share of work allocated to its industry would be reviewed.

2.3 This new scale shall serve as a point of reference for the geographical return target.

IV. *Schedule of payment appropriations*

The schedule of payment appropriations shall reflect firm annual ceilings for the first three years of the programme (1988–1990), corresponding to its phase 1. At the time when phase 2 is started up, the schedule will become firm for the first four years of phase 2. Subsequently, before the end of each current budget year "n", the participating States shall fix the amount of the ceiling for year "n + 4", in order at all times to have firm annual ceilings for the three years following the current year, and shall examine the payment estimates entered for the subsequent years, it being understood that the call-ups of contributions may exceed the indicated figures should the provisions of Article III.4(a) of Annex III to the Convention be put into effect.

In the event that the amount of the ceiling for year "n + 4" is different from that appearing in the previous schedule, the new ceiling shall be fixed by a two-thirds majority.

In the event of a cost overrun at the time of the decision to undertake phase 2, Article III.1 of Annex III to the Convention shall apply.

In the case it is necessary to adjust the content of the Columbus development programme, if Article II of Resolution ESA/

C-M/LXXX/Res. 2 (Final) of 10 November 1987 for participation in the International Space Station takes effect, and where it would be necessary to adjust the content of the Hermes development programme in order to maintain the necessary coherence between the in-orbit infrastructure programmes, the schedule hereafter will be revised by a two-thirds majority of all the participating States, provided such a majority represents at least two-thirds of the contribution to the Hermes development programme.

Taking account of the above, and it being understood that the schedule will be subject to re-examination before the start of phase 2 of the programme which could lead to its revision at a double two-thirds majority, the schedule of payment appropriations needed for the Hermes development programme (in MAU at mid-1986 prices and 1987 conversion rates) is as follows:

PHASE 1			PHASE 2									
1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
82	*175*	*273*	*342*	*394.4*	*464*	*535*	*565*	*560*	*525*	*475*	*39*	*4429.4*

V. *Revision clause*

The provisions of this Annex may be modified by a unanimous decision of the participating States, with the exception on the one hand of the scale shown in section II above, for changes in which the procedures set out in section III shall apply and on the other hand, of the schedule described in section IV above, which contains the modalities of its own revision.

De verklaring is ingevolge paragraaf VI op 11 februari 1988 in werking getreden.

Het *Koninkrijk der Nederlanden* legde bij aanvaarding op 10 februari 1988 dezelfde verklaring af als voor het programma inzake de ontwikkeling van de Ariane-5 raket (zie hierboven onder a).

II. RUIMTESTATIONS EN -PLATFORMS

a) Ruimtetransport systemen voor de lange termijn:

Declaration concerning a preparatory programme for long-term space transportation systems
ESA/C/LV/Dec.
(drawn up on 6 October 1982)
(amended on 22 April 1986)

The participating States listed below (hereinafter called "the participating States"),

Considering that the two European space transportation system programmes (Ariane and Spacelab) and their follow-on development programmes will be completed towards the middle of the present decade,

Convinced of the need to maintain in Europe an independent launch capability that meets the foreseeable requirements of European users and is competitive with space transportation systems existing or planned elsewhere,

Considering the prospects of making use of Space by means of space platforms and in-orbit infrastructures, whether as a purely European programme or in cooperation,

Considering that with a view to subsequent decisions on an overall European Space transportation capability – which it is desirable be taken towards the middle of the decade – it is essential that a reflection and study effort be initiated as soon as possible, taking into account work and skills developed within related ESA programmes and at national level,

Considering also, in view of the successful cooperation with the United States in the area of manned orbital systems, that it is necessary to identify and analyse the ways in which Europe can participate in the space station programme currently being examined by NASA,

Having regard to the Resolution adopted by the Council at its 54th meeting (ESA/C/LIV/Res. 1 (Final)) agreeing to the execution within the framework of the Agency of a preparatory programme for long-term space transportation systems,

Having regard to Article V. 1 (b) of the Convention, as well as to Annex III thereto,

I. Agree to undertake the execution of a preparatory programme for long-term space transportation systems and approve its general objectives and technical content described in Annex A to the present Declaration;

II. Agree to allocate to the execution of this preparatory programme a financial envelope of 11.1 million accounting units, at

mid-1981 price levels and 1982 conversion rates and in conformity with the budget structure in force on 1 January 1982; agree to allocate for the continuation of the work over the period 1986–1987, a financial envelope of 7.6 MAU (at mid-1985 orices and 1986 conversion rates);

III. Agree to contribute to this financial envelope in accordance with the provisions of Annex B to the present Declaration;

IV. Invite the Director General to:
- ensure coordination between the work undertaken under this programme and the work carried out under related ESA programmes, so as to benefit from the latter and avoid any duplication of work;
- draw on the expertise demonstrated in connection with earlier programmes;
- ensure coordination between the work undertaken under this programme and the work carried out by the participating States under their national programmes, and make maximum use of the results that have been achieved under the national programmes in question and which are of interest to the present programme;
- seek to take an active part in the preliminary space station definition studies conducted by NASA.

V. Take measures with a view to facilitating the Agency's access to the available results of the work carried out under their related national programmes, to the extent necessary for optimum execution of the present programme, as well as the Agency's use thereof, subject to compliance with any intellectual property rights;

VI. Agree that work may start as soon as the subscribed contributions amount to 73% of the financial envelope referred to in paragraph II; it is understood that work will be initiated only on the basis of the level of subscribed contributions;

VII. Fix at 15 January 1983 the deadline by which a participating State may notify the Director General, in conformity with Article I.4 of Annex III to the Convention, that it is not in a position to subscribe to the provisions of the present Declaration and the Implementing Rules for the programme; agree however, in view of the timetable constraints of the programme, to do their utmost to notify their acceptance of this Declaration as soon as possible, and to consider, if need be, interim measures for the commitment of urgent work.

The present Declaration is subscribed by the following States:

State	*Date*
Germany	6 October 1982
Sweden	6 October 1982
Belgium	27 October 1982
Denmark	9 December 1982
France	22 December 1982
Netherlands	24 December 1982
Italy	6 January 1983
Spain	14 January 1983
United Kingdom	14 Januari 1983

ANNEX A

1. *Broad lines of the preparatory programme*

The preparatory programme is intended to analyse the various options open to Europe for space transportation systems (STS – launchers and in-orbit infrastructures) beyond Ariane 4 and Spacelab FOD * and shall provide participating States with the elements necessary for making decisions on the selection of a long-term policy and on the start of new programmes.

For this the preparatory programme will:

a) investigate the foreseeable world user requirements and in particular the European demands,

b) analyse options open to Europe beyond the programmes now approved to fulfil these demands. This includes:

– investigation and preparation of the necessary decision elements on:

- maintaining in Europe an independent launch capability,
- developing a European in-orbit infrastructure,
- pursuing transatlantic cooperation through participation in the future Unites States space station programme,

– analysis and preparation of decision elements for a long-term European space policy concerning space transportation and orbital systems.

c) study and identify the technological work necessary to validate critical technical elements,

d) make estimates of costs to Europe of the various options.

The preparatory programme will deal with three main themes, which cover all possible options. These are:

(i) maintain in Europe an independent launch capability that meets the foreseeable requirements of European and other

* FOD = Follow-on Development

users and is competitive with space transportation systems existing or planned elsewhere,

(ii) provide Europe with a capability of carrying out orbital operations (including return to Earth) by means of in-orbit infrastructures developed independently or by cooperation with NASA in the future US space station activities.

(iii) maintain Europe's access to manned systems opened by Spacelab by participating in US space station activities and considering the evolution of European in-orbit infrastructures.

The whole of the preparatory programme activities will be based on and make use of the results from all programmes within the Agency context or in the Member States, related work now engaged, and the expertise available (e.g. the predevelopment studies on cryogenic engines, the operation of free-flyers, and other predevelopment studies).

2. *Content of the Preparatory Programme*

The preparatory programme will cover technical studies, entrusted in the main to industry, and analyses of the future needs of European and other missions carried out in close liaison with the potential users. Economic studies will permit a comparison of the various solutions envisaged.

The study topics so far identified that will allow an analysis of the different possibilities that will be open to Europe before the middle of the decade are:

A. European Launching Capability.

Studies on possible improvements to the overall cost-effectiveness of the present European launch capability for the predominant markets.

B. Space station utilisation aspects and mission requirements.

Identification and refinement of mission models, market analyses, reference missions for European in-orbit infrastructures and for cooperation with the US space station programme.

C. In-orbit infrastructures.

C.1 European in-orbit infrastructures (IOI):

Definition and evaluation of different IOI approaches, definition of the possible contents of these, of the implementation scenarios, economic assessments, derivation of programme implementation data, synthesis at the systems level and elaboration of recommendations.

C.2 The US space station programme:

Assessment of the European interest in taking part in and making use of the American space station programme, definition of the areas for a discrete and coherent European participation and of implementation scenarios, economic assessments, elaboration of the terms of

such a participation, synthesis of the data obtained and recommendations for decision.

C.3 Combined orbital systems:

Definition and evaluation of a coherent European proposal including, if appropriate, a combination of the alternatives resulting from C.1 and C.2 above. This proposal should describe the entire system (ground segment, European or other means of transportation, and orbital system), together with the possibilities of utilisation.

D. Definition studies on the different IOI approaches and on cooperation with the US.

D.1 Definition studies on IOI subjects (e.g. rendezvous and docking, automated operations in orbit, return to Earth, in-orbit manoeuvrability, etc.)

D.2 Definition studies on selected aspects of the US space station programme.

D.3 Studies on the uses of Spacelab derived elements for future space stations.

E. Studies on the launch requirements resulting from the needs of missions mentioned in B. and C.

Definition of the requirements beyond those covered by the activities defined in A, studies on the launching systems required, determination of their feasibility, definition of critical technologies, development plans and costs, estimation of recurrent flight costs.

These activities must make it possible to make an evaluation of the technical content (including operational aspects), cost, cost-effectiveness, timetable, industrial aspects, management formula, and institutional framework of the various possible options for a European effort concerning space transportation systems.

3. *Timetable*

The preparatory programme is intended to cover a period extending in principle up to mid-1987. The study list for each coming year will be presented to participating States in the weeks before the yearly budget approval, and a programme review is foreseen to take place by the end of 1983.

4. *Revision*

The provisions of the present Annex may be revised by a unanimous decision of the participating States.

ANNEX B

1. *Financial envelope*

a) The amount of the financial envelope of the programme, 11.1 MAU at mid-1981 price levels and 1982 conversion rates and in conformity with the budget structure in force at 1 January 1982, breaks down indicatively as follows:

	MAU	
Staff expenditure	0.890	
Running expenditure	0.275	
Facilities	–	
Investment	–	
Development	8.405	
Direct expenditure	9.570	
Administrative support	0.210	
Support special to projects	–	
Support according to usage	1.320	
Indirect expenditure	1.530	
GRAND TOTAL		11.1 MAU

b) The amount of the financial envelope of 7.6 MAU at mid-1985 prices and 1986 conversion rates, breaks down indicatively as follows:

	MAU *	
Staff expenditure	0.36	
Running expenditure	0.10	
Facilities	–	
Capital expenditure	0.03	
Development	5.95	
Direct expenditure	6.44	6.44
Administrative support and site services	0.52	
Variable support costs	0.36	
Fixed support costs	0.28	
Indirect expenditure	1.16	1.16
GRAND TOTAL		7.60

c) An amount of 3.8 MAU of the envelope referred to in para. a) above, corresponding to external studies to be started in 1984 and 1985 is blocked and may be unblocked by a decision taken by a two-thirds majority of the participating States on the occasion of the programme review due to take place by the end of 1983 (cf. Annex A, para. 3).

d) The participating States will reimburse in their totality advance funding up to 0.6 MAU which might be provided for participation, in 1982, in US space station studies, before the coming into effect of the programme budget (interim measure, ref. Article VII of the Declaration).

2. *Scales of contributions*

a) The participating States shall contribute to the aforementioned financial envelope of 11.1 MAU in accordance with the following scale:

* Application of the budget structure in force on 1 January 1983 would lead, according to a preliminary estimate, to this amount going up by about 0.200 MAU and the financial envelope becoming 11.3 MAU.

Participant	*%*
Germany	25.57
Belgium	2.00
Denmark	2.51
Spain	3.00
France	21.40
Italy	10.20
Netherlands	5.00
United Kingdom	7.00
Sweden	1.42
Not covered	21.90

b) The participating States shall contribute to the financial envelope of 7.6 MAU in accordance with the following scale:

Participant	*%*
Germany	25.57
Belgium	7.00
Denmark	1.00
Spain	4.00
France	21.40
Italy	16.00
Norway	1.00
Netherlands	5.00
United Kingdom	16.91
Sweden	3.00
Switzerland	2.00

c) The participating States shall consult together concerning the measures to be taken in the event of a persisting funding shortfall under the programme.

3. *Indicative payments schedule*

in MAU

1982	1983	1984	1985
0.45	3.6	3.6	3.45

The indicative payments schedule for the programme extension is as follows:

(in MAU – mid–1985 prices and 1986 conversion rates)

1986	1987
4.2	3.4

Participant	*Date*
Switzerland	28 February 1986
Belgium	5 March 1986
Spain	5 March 1986
Denmark	17 March 1986
Italy	26 March 1986
Germany	3 April 1986
France	7 April 1986
Sweden	8 April 1986
Netherlands	5 May 1986
United Kingdom	5 May 1986
Norway	6 May 1986

4. *Revision clause*

The provisions os this Annex may be revised by a unanimous decision of the participating States.

De verklaring is ingevolge paragraaf VI op 14 januari 1983 in werking getreden.

b) *Columbus programma (Europees aandeel in een Amerikaans ruimtestation):*

Declaration on the Columbus preparatory programme
ESA/PB-SL/XLIX/Dec.
(drawn up on 28 November 1984)
(amended on 23 June 1987)

The participating States specified below (hereinafter referred to as "the participating States"),

Having regard to the undertaking of a space station programme announced in January 1984 by the President of the United States and the invitation to Europe to participate in this programme,

Having regard to the intention of preparing Europes for a significant cooperative participation in the US Space Station programme and to the need to acquire advanced technologies opening the way, as a long term objective, to autonomous capability in manned spaceflight and advanced in-orbit infrastructures,

Considering that, on the basis of previous programmes, Europe has gained valuable experience in the technology and use of manned space laboratories and has acquired the technical capability and know-how to embark on a space-station-related programme,

Having regard to the Phase A studies carried out jointly by Germany and Italy (entitled "the Columbus project") for the purpose of European space activities with regard to manned systems, platforms and operations in orbit,

Having regard to the joint proposal by the German and Italian Delegations for europeanisation of the Columbus project (ref. ESA/C(84)64),

Having regard to the Council Resolution (ESA/C/LXIV/Res. 4 (Final) of 28 June 1984) agreeing to execute within the framework of the Agency a space-station-related "Columbus" preparatory programme,

Considering that this programme constitutes one of the elements of the Agency's long-term programme that will be submitted to the Council meeting at ministerial level in early 1985,

Having regard to Resolution ESA/PB-COLUMBUS/XI/Res. 1 (Final) of 25 March 1987 according to which the Participating States agreed to raise the financial envelope of the preparatory programme by an amount of 62 million accounting units in order to ensure the continuity of certain work up until 31 December 1987, and to take into account the guidelines of the Programme Board after the evaluation of the results of phase B2.

Having regard to Resolution ESA/PB-COLUMBUS/IV/Res. 1 (Final) of 21 November 1985,

Having regard to Article V.1 (b) and Annexes III and IV of the Convention,

I. Express their interest in the pursuit of activities relating to manned spaceflight and advanced in-orbit infrastructures;

II. Take note of the general objectives of the programme as set out in Annex A (para. 1) of the present Declaration;

III. Agree to undertake the "Columbus" preparatory programme, hereinafter also referred to as "phase B".

IV. Approve the technical content of the preparatory programme as set out in Annex A (para. 2) of the present Declaration;

V. Agree:
a) to allocate for the execution of this preparatory programme a financial envelope of 91.65 million accounting units at the mid-1983 price level and 1984 conversion rates, this envelope being increased by an additional envelope of 62 million accounting units expressed at the same economic conditions to meet an extension of the duration of the work up until 31 December 1987. This brings the overall financial envelope at the preparatory programme to 153.65 million accounting units;
b) to contribute, within the limit of this envelope and in accordance with the scale of contributions and particular modalities shown in Annex B to the present Declaration, to the cost of its execution;
c) that, out of the amount of this financial envelope, the Agency is authorised to commit expenditure up to 10 MAU upon the entry into force of the present Declaration. The availability of the balance of the financial envelope shall be confirmed by each participating State as far as its share is concerned no later than 1 March 1985.

VI. Agree on the following arrangements for carrying out the programme:
a) before the end of the preparatory programme, the participating States shall carry out a programme review to examine the desirability of moving on to a development and utilisation programme; this review shall be based on a detailed technical and financial evaluation of the results of the Columbus preparatory programme, on a development and utilisation programme proposal prepared by the Agency, and on the results of the negotiation on the terms and conditions for cooperation in the space station programme proposed by the United States (development, utilisation and exploitation). The participating States shall address a recommendation to the Council as regards the adoption of a Resolution on subsequent phases of the Columbus programme;
b) In accordance with the provisions of Annex III of the Convention, the interested participating States shall then draw up a distinct Declaration for the subsequent phases of the Columbus programme.

c) participating States that are not in a position to continue the programme shall so notify the Director General in writing and shall cease to be participating States.

d) any industrial return imbalances that may remain at the end of the preparatory programme (allowing, as necessary, for the use of the contingency margin) shall be taken into account when the Declaration on the development and utilisation programme itself is drawn up.

VII. Agree on the following arrangements for carrying out this preparatory programme:

1. On the basis of the joint proposal by the German and Italian Delegations for europeanisation of the Columbus project, the Agency shall use all the means available in Europe and the results obtained from activities financed by the Member States with their national funding, or from its own relevant programmes; the participating States shall accordingly agree to communicate to the Agency, for the purpose of being used by the present preparatory programme, all the technical results at their disposal which are of interest for this programme.

2. Taking into account the work already carried out by the German and Italian agencies and their intended high level of participation in the Columbus development, it is decided to keep DFVLR en MRST/PSN involved in the management and execution of phase B under the Agency's responsibility.

In conformity with the provisions in force, a detailed Agreement in this respect will be established between ESA and DFVLR, MRST/PSN in order to decide on the modalities of this association.

This arrangement will be reviewed at the end of the first part of the preparatory programme at the end of 1985 in order to decide whether its revision for the second and final part of the preparatory programme is desirable.

VIII. Invite the Director General to cooperate with NASA with a view to conducting in parallel the definition studies carried out by the two Agencies, to negotiate the appropriate legal texts for the execution of the respective phase B activities, to identify the conditions and modalities for continuing the cooperation during the subsequent phases, and to report back to them on the evolution and outcome of these negotiations and discussions.

IX. Agree that the work on the preparatory programme may start as soon as the amount of the subscribed contributions attains 70% of the financial envelope referred to in section IV above; it is understood that work will be started only on the basis of the level of subscribed contributions.

X. Agree that the present Declaration shall be open for subscription from 1 December 1984 to 10 February 1985.

The present Declaration has been subscribed by the following participating States:

Participant	*Date*
Germany	28 Jan 1985
Belgium	30 Jan 1985
Denmark	4 Feb 1985
Spain	8 Feb 1985
France	8 Feb 1985
Italy	13 Dec 1984
Netherlands	8 Feb 1985
United Kingdom	30 Jan 1985
Switzerland	23 Sep 1985
Austria	2 Jul 1985
Norway	23 Sep 1985
Sweden	17 Apr 1986

ANNEX A

Objectives and content of the preparatory programme

1. *General objectives and technical content of the Columbus programme*

a) The objective of the space-station-related Columbus programme is to develop user-attractive elements which constitute an integral and substantial part of a cooperative space station system taking into account the option of European autonomy at a later stage.

This programme will comprise the development in Europe of the relevant space technologies and take account of the requirements states by the community of European users with low operating and support costs as main drivers. It will take account of the know-how already acquired in Europe under programmes that exist or are in the course of development such as Spacelab, Eureca, SPAS, the Spacelab pallet, the preparatory programme for long-term space transportation systems and the Agency's technology programme.

This programme will also be carried out with a view to ensuring compatibility with the future European launch systems.

b) The Columbus programme will be based on the preliminary work done by Germany and Italy and made available to the Agency, and will make use of the work done by the Agency (long-term space transportation systems preparatory programme) and of the work done

by other Member States. It will in principle comprise the following elements:

(i) One or more pressurised modules (PM), envisaged as derivatives of Spacelab, manned and/or man-tended and capable of becoming in the long term the core of a European orbital system that can be used, for example, as manned laboratory and habitation modules. The pressurised module(s) serviced by the US Space Station can also be (a) major element(s) of the initial operational capability of the station.

(ii) One or more payload carriers (PCs), envisaged as derivatives of hardware already existing or being developed or studied in Europe. These elements will carry experiments and/or materials production facilities as well as observation or communications facilities and will have servicing and supplies support from the Space Station and/or Shuttle and/or future European launch systems.

(iii) One or more resource modules (RMs) providing the PMs and, if appropriate, PCs with logistics such as power supply, communications, data management, heat rejection, attitude control, etc. This element could be envisaged as a further development of Eureca-type hardware.

(iv) A service vehicle (SV) with limited in-orbit transfer capability, to be operated with the elements already referred to above.

(v) The corresponding ground segment (in particular crew training and integration facilities and the Operations Control Centre for the European elements).

(vi) A users' support programme directed towards the payloads provided by the users and to be included in the space segment as defined above.

(vii) Initial demonstration missions for the various elements of the space system.

(viii) An advanced technology programme.

2. *The COLUMBUS preparatory programme (phase B)*

The preparatory programme shall cover the definition studies of the specific elements for preparing a European in-orbit infrastructure, having regard to the US invitation to participate in its Space Station programme. It also covers technological research work in the area of manned and unmanned systems.

Technical content

a) The studies will comprise definition of the content and cost of the elements and missions relating to the development programme. The items considered in this preparatory programme are as follows:

– the pressurised module, manned and/or man-tended, that can be used as a manned laboratory module or a habitation module and whose adaptability to the common module concept of the space

station and application to the other modules constituting the station will be studied,

- the payload carriers or PCs (in low orbit and polar orbit),
- the resource modules or RMs,
- the service vehicle or SV,
- the ground facilities for mission preparation and support,
- the data transmission system.

These studies will include a comprehensive system analysis with specific reference to questions of compatibility and commonality within the whole of the Space Station and with relation to existing and planned space transportation systems.

b) Supporting technology

A supporting technology programme directly related to the items under study will be carried out.

c) An outline of a space station utilisation programme including the support to be given to the payloads financed outside the development programme and the missions for first period.

The preparatory programme shall be divided into three phases. The first one (1 April to 31 July 1986) called phase B1, will be for the study of the various technical solutions and options with the aim of identifying among them the space station element or elements that the Agency will propose to NASA for development.

The second phase (1 August 1986 to 31 May 1987), called phase B2, will be for the continuation of the definition studies of the space station element or elements retained in common with NASA for development, subject to the satisfactory negotiation of the terms and conditions for the subsequent programme. Before the end of this phase, the Agency will present the relevant technical and programmatic (management, cost and schedule) results to the participating States.

The third phase (1 June 1987 to 31 December 1987) will be for the completion of the definition studies of the space station elements and the finalisation of the industrial management structure and the relevant programmatic data base so as to allow entering contractual commitments for the development phase. Further, coordination activities with the other ESA related preparatory programmes and with the NASA space station programme as well as operations and utilisation activities will be pursued as emphasised hereunder. The third phase work will especially implement the guidelines which the Programme Board may deem appropriate after evaluation of the results of phase B2.

The following objectives will be set:

- to further detail or modify the industrial structure for phase C/D based on the experience gained during phase B2 and on the results obtained at the end of phase B2,
- to complete the ongoing harmonisation between the Columbus, Ariane 5 and Hermes systems,

– to finalise the preliminary design of the Columbus elements after the elimination of configuration options and in conjunction with:
  · finalisation of the necessary interface requirements between the Columbus and Space Station systems,
  · finalisation of the necessary interface requirements between the Columbus system and Ariane 5, Hermes and DRS,
  · finalisation of system provisions for supporting any advanced automation and/or robotics needed to meet the MTFF mission requirements,
– to establish detailed technical specifications for all subsystems and all major equipment,
– to develop detailed programme plans including costing data necessary for a proper start of phase C/D,
– to establish detailed implementation responsibility allocation for all space segment hardware and software items between the industrial contractors,
– to finalise the respective programme management responsibilities and interfaces between ESA and NASA, including the establishment of appropriate joint Programme Requirements Documents,
– to finalise the development of the gournd segment system requirements and to initiate the detailed definition of the relevant facilities,
– to establish implementation responsibility allocation for common space segment/ground segment items (simulators, trainers, mission support software, etc.) based on generated detailed programmatic data,
– to establish, evaluate and validate utilisation cost models and operations cost scenarios,
– to further detail and update model payloads and reference missions,
– to establish and update user interfaces and documentation,
– to conduct specific user-related studies (e.g. microgravity environments, servicing, contamination, interfaces users-payload-element optimisation, i.e. crew activities, telescience and related aspects like robotics),
– to define preparatory missions and their objectives, i.e. to learn how to improve relevant procedures, operational scenarios, implementation schemes, etc., in order to be ready to use the space station,
– to develop a user-oriented information system as well as promotion activities,
– to define astronaut policies,
– to generate, based on an Agency released ITT, a detailed committing implementation proposal for phase C/D.

The objectives and contents of the third phase will be subject to final approval by the participating States on the basis of the technical and programmatic presentation, including overall cost estimate, on

the outcome of phase B2 to be provided by the Agency before the end of this phase.

Management relationships will be set up to ensure technical liaison with NASA and coordination of studies, in accordance with the instructions of the participating States.

3. *Indicative timetable*

The preparatory programme activities should be started as soon as possible with a view to completion by end 1987.

By end May 1987 the Agency will present the elements of the initial programme definition file to the participating States.

At least three months before the end of this programme, the Agency will submit the final version of the programme definition file (management, cost and schedule) in order that the participating States may take the appropriate decisions, in the course of 1987, for starting the development programme.

4. *Revision clause*

The provisions of this Annex may be amended by unanimous decision of the participating States.

ANNEX B

Financial provisions

1. *Financial envelope of the COLUMBUS preparatory programme*

The financial envelope of the preparatory programme referred to in section V of the Declaration amounts to 153.65 MAU at mid-1983 prices and 1984 conversion rates. The indicative breakdown, on the basis of the present budget structure, is as follows:

General Headings	*(MAU)*
1. Staff expenditure	9.91
2. Running expenditure	3.15
3. Facilities	0.28
4. Capital expenditure	0.62
5. Development	118.71
Direct expenditure	132.67
6. Administrative support and site services	13.05
7. Variable support costs	4.32
8. Fixed support costs and investment	3.61
Indirect expenditure	20.98
TOTAL	153.65

2. *Scale of contributions*

The participating States will contribute to the aforementioned financial envelope in proportion to the following provisional scale:

Participant	*Provisional scale %*	*Final scale %*
Belgium	5.00	
Denmark	1.00	
France	15.00	
Germany	38.00	
Italy	25.00	
Netherlands	4.00	
Spain	8.00	
United Kingdom	8.5130	
Switzerland	2.00	
Austria	0.50	
Norway	0.50	
Sweden	0.5625	

The provisional scale of contributions will be used to set industrial guidelines for the geographical distribution of the work to be executed during the whole of the preparatory programme.

Adjustments to the provisional scale will be made when the decision is taken to proceed with the Columbus development programme proper on the basis of the contracts concluded for the whole of the preparatory programme.

If it transpires that this decision cannot be taken, the scale of contributions will be adjusted at the end of the present Columbus preparatory programme on the same basis. The same applies to a participating State which will not participate in the development programme.

Any imbalances which may subsist shall be taken into account in the establishment of the scale of contributions for the development programme proper.

3. *Indicative schedule of payment appropriations*

The indicative schedule of payment appropriations is as follows:

	1985	1986	1987	1988	TOTAL
MAU	7.74	30.49	100.00	15.42	153.65

4. *Revision clause*

The provisions of this Annex may be revised by unanimous decision of the participating States.

De verklaring is ingevolge paragraaf IX op 31 januari 1985 in werking getreden.

Declaration on the Columbus development programme
ESA/PB-COLUMBUS/XVIII/Dec.1
(drawn up on 15 December 1987)
(updated on 29 June 1989)

The participating States referred to below (hereinafter referred to as "the participating States"),

Recalling the objective, among others, assigned to the long-term European space plan, of having available an autonomous European capability in the field of manned spacefligth, through participation in the international programme for a space station and the development of a European infrastructure;

Recalling the Resolution adopted by the Council meeting at ministerial level on 31 January 1985 (ESA/C-M/LXVII (Res. 1 (Final)) and in particular paragraph II.2 thereof whereby the Council "welcomes and endorses the proposal to undertake, as an optional programme, the Columbus programme as an important element of an international space station programme as proposed by the President of the United States,"

Recalling Resolution ESA/C-M/LXVII/Res. 2 (Final) adopted on 31 January 1985 in response to the offer made by the President of the United States, by which Council "accepts that offer – with a view to continuing and strengthening a genuine partnership in the space field with the United States of America and within the framework of the European Long-Term Space Programme and the objectives defined in it – subject to the achievement of fundamental European objectives,"

Considering the necessary programmatic coherence, within the framework of the long-term European space plan, between the Ariane 5 launcher, Hermes and Columbus and all its commercial, scientific and other users,

Having regard to Resolution ESA/C/LXIV/Res. 4 (Final) of 28 June 1984 and Declaration ESA/PB-SL/XLIX/Dec. (Final), rev. 4 on the Columbus preparatory programme and in particular to the provisions of section VI of the Declaration,

Considering the report on the negotiations on the draft Intergovernmental Agreement among the Government of the United States of America, the Governments Members of the European Space Agency, the Government of Japan and the Government of Canada on cooperation in the detailed design, development, operation and utilisation of the permanently manned Space Station and on the draft Memorandum of Understanding between NASA and ESA for the implementation of the said Intergovernmental Agreement,

Considering the results already obtained and the progress made in work under a Columbus preparatory programme, and that this work has, under an extension of the said preparatory programme, been extended beyond its duration as initially planned,

Having regard to the Columbus development programme proposal

submitted by the Director General following the work and studies done under the Columbus preparatory programme, and to the recommendation by the Columbus Programme Board,

Having regard to Resolution ESA/C/LXXIX/Res. 1 on the ground segment associated with the European in-orbit infrastructure operations, adopted by Council on 5 November 1987,

Having regard to Resolution ESA/C-M/LXXX/Res. 1 (Final) on the European long-term space plan, adopted on 10 November 1987 by the Council meeting at ministerial level, and in particular to Chapter III, section A.2, thereof agreeing to execution of the Columbus development programme, in two phases, within the framework of the Agency,

Having regard to Resolution ESA/C-M/LXXX/Res. 2 (Final), adopted on 10 November 1987 by Council meeting at ministerial level,

Having regard to Articles V.1(b) and X1.5 (c) (i) of the Convention and to Annex III thereto,

I. Agree to undertake the Columbus development programme, in two phases, as a European programme within the Agency framework, on the basis of the work and studies done under the Columbus preparatory programme, as reflected in the development programme proposal referred to in the preamble, and in accordance with the arrangements set out below;

II. Approve the general objectives of the Columbus development programme and the technical content of phases 1 and 2, as set out in Annex A to this Declaration; note that the technical content of phase 2 will be open to review when the time comes to decide to move on to the said phase; agree to adjust the content of the Columbus development programme, as necessary, in the light of the outcome of the negotiations on participation in the international space station, in accordance with the provisions of Resolution ESA/C-M/LXXX/Res. 2 (Final) of 10 November 1987, it being understood that the resulting decisions shall be taken by a two-thirds majority of all the participating States, provided such majority represents at least two thirds of the contributions to the programme; studies on the Polar Mission will be undertaken at the beginning of phase 1 with the aim to secure user or private sector co-funding for the flight hardware and its operations and to evaluate modified design approaches for ensuring the mission objectives in a cost-effective manner;

III. Agree:

a) to allocate for carrying out the development programme a financial envelope of 3713 million accounting units, at mid-1986 prices and 1987 conversion rates, including a firm financial sub-envelope of 669 million accounting units for carrying out phase 1 of the development programme; note that a sum of 184.29 million account-

ing units at the same economic conditions, corresponding to the Columbus preparatory programme including its extension, is to be added to this envelope so as to arrive at an amount of 3897.29 million accounting units, which corresponds to the overall financial envelope for the Columbus programme.

Any tendency that is identified toward an overrun of this initial financial envelope of 3713 million accounting units shall, with a view to the application of Article III.4 (a) of Annex III to the Convention, be notified in advance to all the participating States and to the Administrative and Finance Committee. The Agency will submit a special report if it deems that this financial envelope may be overrun. On the basis of this report, and in due time before the vote on the annual budget corresponding to such an overrun, discussions and decisions will take place on the technical and programmatic aspects.

b) to contribute, within the development programme envelope and in accordance with the funding mechanism set out in Annex B to this Declaration, to the cost of executing this programme, without prejudice to the result of the studies referred to in section II above.

The contributions of participating States to the financial envelope referred to above and the geographical distribution of work stemming therefrom take account of measures compensating for past imbalances, as well as anticipatory compensation measures, applicable as from 1991 onwards, decided by Council at its 80th meeting, held at ministerial level in The Hague on 10 November 1987 (ESA/C-M/LXXX/Res. 1 (Final), Chapter IV.3 and 5; these measures are described under section II of Annex B hereafter.

The geographical distribution of work shall be reviewed once the industrial structure for the programme is clearly defined, and at the latest after 24 months from the entry into force of this Declaration; the conclusion of this review will lead to a correction of the situation through a redistribution of work, otherwise through revision of the contribution scale, using the mechanism described in Annex B hereto, as a help in maintaining the overall return objective while guaranteeing each participating State a geographical return of at least 0.90 by the end of the present programme.

c) it is envisaged that the cost of the Columbus exploitation phase will match the envelope shown, for Columbus programme operations, in the Agency's long-term space plan; a decision on the financing of these costs will be taken by the end of 1992;

d) In good time for the decision to move on the phase 2 of the development programme, the Agency shall present an analysis of the phase 1 results and their impact on the technical content and financial and timetable aspects of phase 2. On this basis, the participating States shall examine the results of phase 1 in order to determine whether the programme objectives can be attained within the overall financial envelope mentioned above. This examination shall take account of the outcome of the negotiations on participation in the international

space station, in accordance with the provisions of Resolution ESA/C-M/LXXX/Res. 2 (Final) of 10 November 1987. The decision to embark on phase 2 related to full development work shall be taken before the end of 1990 by a two-thirds majority of all participating States, provided that such majority represents at least two thirds of the contributions to the programme, in accordance with Article II, section 2 of Annex III to the Convention, it being understood that the stipulations of Article III.1 of the said Annex shall apply in the event of a cost overrun.

IV. Request te Agency to ensure that an equal level of priority between all Columbus elements is maintained throughout the programme;

V. Agree on the following arrangements for carrying out this programme:

1. The Agency shall assume overall responsibility for and overall technical and financial control of the development programme. For the Columbus programme, a quarterly report based on the quarterly reports to Council shall be submitted to the participating States, including enough details on the technical, financial and timetable aspects in particular to enable cost trends and the technical reasons for them to be identified in good time; such reports shall also cover the aspects relating to coherence with the Agency's other programmes, and to the interfaces with the international space station.

2. The Agency shall be responsible for ensuring that programming aspects common to the in-orbit infrastructure programmes are consistent and compatible (particularly Ariane-5, Hermes, Columbus and the EDRS).

3. The Agency shall ensure that the geographical distribution of work under this programme is in accordance with the objectives defined by the ESA Convention and by Council; it shall periodically supply the participating States with the relevant information.

4. In addition to the systems and facilities developed within the framework of the Agency, the latter shall strive to use the facilities available in the participating States, as described in ESA/C(87)84 and corr. 1, and in accordance with the principles laid down in Resolution ESA/C/LXXIX/Res. 1, adopted on 5 November 1987.

5. The Agency shall retain responsibility for the conduct of the activities preparatory to utilisation of the Columbus elements and shall have appropriate recourse to the capabilities available in the participating States, in the light of the utilisation requirements of other Agency programmes.

6. The Agency shall be responsible for tasks relating to the astronauts (selection, training and the development of equipment) and shall delegate implementation tasks to DFVLR on the basis of Resolution ESA/C/LXXIX/Res. 1 adopted on 5 November 1987.

7. The Agency shall conclude a Memorandum of Understanding with NASA on the basis of the principles laid down in the Agreement among the Governments of the United States of America, the Governments Members of the European Space Agency, the Government of Japan and the Government of Canada on Cooperation in the Detailed Design, Development, Operation and Utilisation of the Permanently Manned Civil Station.

VI. Agree, on the basis of a plan of use to be submitted by the Director General, on the principle of setting up and funding an exploitation programme from 1993 onwards, and RECOMMEND that payload development and use be covered by other programmes in the fields of microgravity, science and observation of the earth's resources.

VII. Agree to review and finalise in due course the wording of Annex C and to work out, at all events before the start-up of such an exploitation programme, the guiding principles for use of the Columbus elements of the international space station, which will form the subject of an Annex D to this Declaration;

VIII. Invite any States participating in the Columbus preparatory programme that would not be interested in taking part in the development programme to notify the Director General of this as soon as possible so that the contribution scale can be adjusted in accordance with the provisions of section II of Annex B to the Declaration on the preparatory programme. Where the case arises, these States shall be requested to take any measures necessary to facilitate the transfer of the results of the preparatory programme to firms in other States participating in the development programme;

IX. Agree that the work can start as soon as the subscribed contributions amount to 80% of the financial envelope referred to section III above; it is understood that the work shall be started only on the basis of the level of contributions subscribed;

X. Invite the Member States that are not interested in participating in this programme to give notification as soon as possible and before 31 December 1987, in order to take account of Resolution ESA/C-M/LXXX/Res. 1 (Final), chapter III, sections 4 and 5, that they are not able to accept the provisions of the present Declaration.

This Declaration has been subscribed by the following participating States:

Participant	*Date*
Germany	10.02.1988
Spain	10.02.1988
Italy	10.02.1988
Norway	10.02.1988
Netherlands	10.02.1988
Belgium	11.02.1988
France	12.02.1988
Denmark	17.02.1988
United Kingdom	29.06.1988
Sweden	29.06.1989

ANNEX A

Objectives and content of the Columbus development programme

1. *Introduction/background*

Following two major decisions of the ESA Council meeting at ministerial level in January 1985, i.e.

– to accept the offer of the US to Europe for participating in the Space Station programme, subject to the achievement of fundamental objectives,

– to establish, as a long-term objective for Europe, an autonomous capability in the field of manned space flights,

the Columbus preparatory programme was approved and implemented in line with those decisions, the main task of it being the definition (phase B) of the retained elements of the space segment, the development of the critical technologies, and preliminary investigation of the users' requirements and of the operation's infrastructure.

The Declaration (as amended after extension of the preparatory programme) divided the Columbus preparatory programme into two study phases. The first one, called phase B1 was conducted in the period July 1985 to March 1986, followed by a three months extension period. Its objective was to study the various technical solutions and options with the aim of identifying among them the Space Station elements that the Agency would propose to NASA for development under a cooperative arrangement.

The second phase, called phase B2 was conducted over the period November 1986 – May 1987 and it was also followed by a seven months' extension period. Its purpose is the completion of the definition studies of the Space Station elements retained for the Columbus development programme.

In parallel with the space segment definition studies.

– a supporting technology programme, directly related to the definition studies has been carried out,
– an outline of a space station utilisation programme was initiated, including the support to be given to the payloads financed outside the development programme, as well as the initial demonstration missions for a first experimental period, and,
– negotiations at government and Agency (ESA/NASA) level have taken place to define the political and technical terms of the envisaged cooperation with the US.

The Columbus development programme, as proposed, provides for the manufacture and the delivery to orbit of the space segment elements, the build-up of the associated ground infrastructure, and the preparation of initial operations and utilisation.

The development and the operation of the complex automated, man-tended and manned elements of Columbus will represent a fundamental step towards a European infrastructure in low-Earth orbit in the year 2000 and beyond.

2. *Programme objectives*

2.1 *Primary objectives*

The primary objectives of the Columbus programme are:

– To provide in-orbit and ground infrastructure, compatible with European and international user needs from the mid-1990s onwards.
– To continue, and further develop, Europe's capabilities in manned spaceflight already initiated with the Spacelab programme.
– To cooperate with the United States and other partners in an international space station effort in which Columbus will constitute Europe's major contribution, subject to satisfactory conditions being established, in accordance with Resolution ESA/C-M/LXXX/Res. 2 (Final).
– To ensure the development of Europe's capability to achieve autonomy in the longer term, in particular through cooperation in the International Space Station programme.
– To ensure the establishment within Europe of key technologies required for the manned space flight and for the wide spectrum of in-orbit operations, both manned and automatic.

2.2 *Mission objectives*

The primary mission objectives of the programme are:

– To provide infrastructure elements in low Earth and polar orbits to support selected payload missions in the materials and life science disciplines, Earth observations, space science and technology demonstrations.
– To provide manned and unmanned infrastructure elements to ensure the capability for conducting payload missions which require

manned interventions or missions of which the characteristics preclude such intervention and require automated operation.

2.3 *Coherence*

The primary coherence objectives of the programme are:

a) To ensure overall technical, operational and programmatic coherence and cooperation between the Columbus and the Ariane-5, Hermes and European Data Relay Satellite (EDRS) space and ground segments.

In this perspective, the programme management will ensure that:

- compatibility is maintained between the Columbus elements to be launched by Ariane 5 (the MTFF and PPF), and the foreseen Ariane 5 launch capabilities,
- harmonisation is maintained between the in-orbit service requirements of the Columbus elements that need logistic and operational support from Hermes, and the latter's performance levels and configuration,
- the European data relay satellite is exploited in support of the Columbus in-orbit/ground communications requirements.

b) To ensure the establishment of technical, operational and programmatic interfaces with the International Space Station, consistent with the objectives of the Columbus programme.

2.4 *Growth*

The primary growth objective of the programme is:

- To ensure that the elements of the programme have the capability for growth by either on-orbit upgrading of subsystem and payload equipment and/or by addition of completely new elements required to lay down and evolutionary path towards the objective of an autonomous infrastructure.

2.5 *Economic and industrial objectives*

The primary economic and industrial objectives of the programme are:

- To minimise the Columbus development programme cost by optimising design commonality features across the space segment elements and, where feasible, in conjunction with the other European infrastructure programmes.
- To cost optimise the overall Columbus development programme schedule, within the constraints of the overall programme timetable, by phasing the individual element development schedules to allow for follow-on production benefits in the case of the later elements.
- To implement an effective industrial structure and management approach to meet the needs of the programme and which allows for proper control and visibility.
- To ensure an equitable industrial return for industries within the participating States.
- To enhance the European industrial know-how in all the critical

technologies involved and to minimise the need for procurements outside Europe.

– To prepare the basis for an expanded industrial role in the exploitation phase of Columbus elements.

3. *Programme content*

The overall content of the Columbus programme comprises activities related to the development of a space segment, a ground segment, as well as activities related to initial launches, initial operations preparation and utilisation preparation. The major features of these elements and activities of the programme are briefly described below, along the lines of an overall approach consisting of two phases, as specified under each element or activity description.

3.1 *Space segment*

3.1.1 *Baseline description*

The space segment comprises the following elements representing the European participation to the Space Station international cooperation:

– an attached pressurised module, launched by the space Shuttle and permanently attached to the international Space Station;

– a platform in a polar orbit, launched by Ariane-5;

– a man-tended free-flyer, consisting of a resource module and a pressurised module, launched by Ariane-5 in a low Earth orbit, capable of automatic operations and of man-tended servicing at the Space Station or in combination with Hermes.

The space segment activities are planned to commence at the beginning of 1988, with the main industrial contracts being progressively implemented in line with the programmatic phasing in two parts, as indicated below for each element. The currently targeted launch dates for the space segment elements, taking into account the schedule constraints of the Space Station, Ariane-5 and Hermes programmes, are:

Attached module	–	last quarter 1996
Polar platform	–	first quarter 1997
Man-tended free-flyer	–	first quarter 1998

These target dates will be reviewed at the end of phase 1, and could be adjusted in the frame of the provisions described under section III(d) of the present Declaration.

The overall Columbus space segment development programme will be made up of individual sub-programmes for each of the flight elements and common subsystems, supported by lower level subsystem and equipment development programmes. It will be technically phased to ensure the maximum benefits from implementation and subsystem and equipment commonality across the elements and, where feasible, in conjunction with other programmes. The technical phasing between the attached pressurised module and the MTFF

development programmes will also be arranged to allow for the cost benefits of follow-on production.

The space segment development programme includes, under a prime contractor scheme, the design, development, manufacturing, integration, qualification and acceptance of all space segment hardware and software, including ground and airborne support equipment. The overall programme milestones for phase 1 are as follows (indicative timetable):

– Start of phase 1	Jan 1988
– Request for quotation for C/D contract	Jun 1988
– Industrial proposal for C/D	Oct 1988
– Space segment system review	End 1988
– Phase C/D contract to industry	Feb 1989
– Final space segment system review	End 1990

The various reviews to be performed during phases 1 and 2 will be scheduled at equipment, subsystem, element and system level, as appropriate, to ensure a controlled implementation of the overall space segment development in compliance with programme requirements and, when appropriate, with the equivalent milestones of the Space Station programme.

In particular, the dates planned for the Final Acceptance Review (FAR) of the flight hardware, linked with the above-mentioned target launch dates, are the following:

– for the APM	:	end 1995
– for the PPF	:	mid-1996
– for the MTFF	:	mid-1997

3.1.2 *Common tasks for all baseline elements during phase 1*

The tasks which are common to all elements include:

– Detailed System and S/S Design for each element in the form of System Design Requirements.

– Detailed Definition of all Requirements down to and including equipment specifications for all elements.

– Detailed technical plans for the implementation of all elements.

– Definition of interfaces to launcher, servicing and logistic vehicle (e.g. Hermes), system ground segment and payloads.

– Definition of technical and operationally interface documentation with the international Space Station.

– Initiation of long lead item procurement process (as required).

3.1.3 *Elements description and related activities*

The summary description of the Columbus space segment elements and activities is as follows:

a) *Attached Pressurised Module*

The Attached Pressurised Module is a pressurised cylindrical

laboratory module with complete basic functional outfitting, to be launched by the Space Shuttle and permanently attached to the international Space Station manned base. It has a diameter of about 4 m, a length equivalent to 4 standard Spacelab segments and will be used primarily for materials science, fluid physics and compatible life science missions.

The internal architecture is arranged in a 1 g configuration with lateral racks, a floor/subfloor area and an overhead area. By its environmental control and life support system the module provides a shirt sleeve environment to the astronauts. The equivalent volume of about 40 single racks (approximately 23 cu.m) is dedicated to payload accommodation. The presently envisaged initial payload mass of up to 3000 kg to be launched together with the APM depends on the actual performance of the Space Shuttle system; the maximum payload mass which can be installed in operational conditions is 10 000 kg. The module will be outfitted with European and internationally provided payload facilities and will require manned intervention for its operation. The accommodation of a scientific airlock for the exposure of dedicated payloads to space is envisaged.

The APM will be serviced via the standard Space Shuttle logistics support flights to the Space Station manned base. Servicing will be accomplished by the astronauts for internally mounted items and by the Space Station remote manipulator system and crew EVA for external items.

The Attached Pressurised Module is dependent on the Space Station manned base for primary technical resources like power and communications links, environmental and life support and astronaut habitation. Total power consumption of the APM is approximately 20kW including about10 kW average to payload. Communication link capability in the range of 100 Mbps downlink and 25 Mbps uplink is provided. Heat rejection is performed by transfer of waste heat to the centralised Space Station radiator system.

During phase 1, activities related to the Attached pressurised Module will cover:

- Detailed Design Analysis on box level
- Breadboarding and testing of critical equipments
- Manufacturing of the structural model for testing
- Manufacturing of critical units at Engineering Model standards
- Perfomance of Preliminary Design Review (PDR)
- Implementation of PDR results in the design (including feedback to MTFF design)

The PDR and the implementation of the relevant results in the design will be achieved by late 1990 and constitute the phase 1 end milestone for the APM.

b) *Polar platform*

The unmanned polar platform will be stationed in a 800–850 km sun synchronous polar orbit with a morning descending node and will be

used primarily for earth observation missions; the possibility of accommodating payloads in other disciplines will be considered. The platform is planned to operate in conjunction with one or more additional platforms provided by NASA and/or other international partners and will be sized to accommodate European and internationally provided payloads (including payload support equipment).

The final configuration of the polar platform and the key associated engineering parameters will be defined in the course of phase 1 of the programme, as will the optimised payload capacity.

In the current baseline the platform will have an initial unserviced operational life of approximately 4 years; the possibility of an in-orbit servicing capability will be examined.

The polar platform, in its current baseline, together with its installed payloads, will be launched by Ariane-5.

During phase 1, activities related to the Polar Platform will cover:

- detailed systems analysis
- detailed analysis of in-orbit operations and supporting ground control systems
- detailed design definitions of the PPF to Ariane-5 interfaces in the form of an agreed ICD ("interface control document")
- freezing of the servicing option
- detailed subsystem performance and final design definitions
- finalisation of PPF to Instrument Interface agreements
- detailed design of equipment and breadboarding of critical elements (including commonality feedback to MTFF)

Freezing of the servicing options and design commonality with the Resource Module of the MTFF will be the object of a design review which will be established before the end of Phase 1. The detailed system design of the PPF will be subject to a design review to verify its compliance with all requirements and to freeze its configuration for phase 2. This review will constitute the controlled milestone of this element.

c) *Man-Tended Free-Flyer*

The man-tended free-flyer (MTFF) will fly in co-orbit with the Space Station manned base using a microgravity optimised orbital strategy. It will be used primarily for materials sciences, fluid sciences and compatible life sciences and technology missions and will accommodate automatic and remotely controlled payloads which need a long duration, undisturbed microgravity environment.

The MTFF consists of a pressurised module with a diameter of about 4 m and a length equivalent to 2 standard Spacelab segments for the accommodation of payloads and an unpressurised resource module which provides the main utilities and services required by the MTFF and its payloads. Maximum payload accommodation capability in rack mounted inside the pressurised module in an operational condition is 5000 kg; maximum volume available to payload is equivalent to about 20 single racks (approximately 10.5 cu. m).

The internal architecture of the MTFF pressurised module with lateral racks, a floor/subfloor area and overhead area is similar to that of the APM. Average power available to payload will be about 5 kW. Thermal control is performed by a combined active/passive thermal control system. Communication links with a capacity of about 100 Mbps downlink and 25 Mbps uplink will be provided.

The MTFF will be serviced in-orbit by Hermes at approximately 6-month intervals. Initially, and until Hermes is available, this servicing will be performed at the Space Station. The MTFF will use the Space Station main base also for major external maintenance every 3–4 years. The MTFF will have the capability to transition later to a fully autonomous European servicing scenario, should this be decided upon.

The MTFF, together with an initial payload of up to about 2000 kg, will be launched by Ariane-5.

During phase 1, activities related to the man-tended free flyer will cover:

- system studies addressing short, medium and long-term utilisation and operational objectives, deriving initial, growth and autonomy scenarios
- detailed system analyses of the MTFF and MTFF/external interface items based on system level requirements and scenarios. Examples include:
  - MTFF/Ariane-5 launch dynamics analysis.
  - MTFF activitation sequencing analysis.
  - MTFF payload support analysis.
  - MTFF operational power, heat rejection, stability, propulsion, data/communications analyses.
  - MTFF microgravity environment analyses.
  - MTFF reliability, related PA analyses.
  - MTFF/Space Station interfaces analyses.
  - MTFF logistics analyses.
  - MTFF/Hermes servicing performance analyses, including attitude control, resource (power, communications, etc.) needs.
  - MTFF/Hermes servicing tasks analyses, including preventative/corrective maintenance, growth accommodation, consumable replenishment and payload tasks.
- specification generation down to equipment level
- subsystem design and analysis to the level necessary to confirm the validity of the equipment requirements
- generation of an MTFF payload accommodation handbook
- advanced technology development and demonstration (up to the level of representative software/hardware test beds), namely in the servicing techniques, in the automatic payload operations, etc.

At the end of phase 1, the detailed system design of the MTFF will be subject to a design review to verify its compliance with all requirements, including servicing, and to freeze its configuration for

phase 2. This review will constitute the controlled milestone of this element.

3.2 *Ground segment*

The development and implementation of the decentralised operations infrastructure will be subordinate to an ESA Central Design Authority which will ensure the overall system coherence and integrity.

The Columbus ground segment comprises the following elements:

- a central mission control (CMCC)
- decentralised element control facilities:
  - Manned Space Laboratories Flight Control Centre (MSCC) responsible for:
    - AMP and MTFF payload operations coordination
    - such portions of the APM system control which will be performed in Europe, as to be agreed between ESA and NASA
    - MTFF systems control
  - APM, PPF, MTFF control centres
- astronaut training facilities and related simulators (for the APM and the MTFF)
- simulation facilities, needed for sustaining engineering, mission control, as well as payload integration for APM, PPF, MTFF
- development support facilities.

The building up of the ground infrastructure will be accomplished in four steps:

a) *During phase 1,* covering the first two steps, the activities will cover:

- *Concept-activities*

A consolidated and integrated concept for an overall Columbus ground segment architecture including the operations concept, facilities requirements and preliminary hardware and software definition will be derived during this step, common to all the elements and lasting approximately 6 months.

- *Detailed definition activities*

Detailed design of the facilities will be accomplished during this step which will be implemented for the individual Columbus elements in parallel activities with staggered initial dates. The average duration is, for each element, 24 months.

b) *During phase 2,* the activities are planned to cover:

Procurement activities

Equipment will be installed and integrated according to a policy to be agreed, based on the conclusions elaborated by the Central Design Authority. The planned durations of the procurement activities are between 24 and 30 months.

Validation activities

All facilities need to be validated and accepted in order to ensure overall mission compatibility. This activity will be performed, for the various elements, in the 12 to 18 months preceding their initial launch.

3.3 *Initial launches*

The programme's overall financial envelope includes the costs of the initial launches and the associated launch services required for the orbiting of the Columbus elements, i.e.

- one Shuttle launch for the APM
- two Ariane-5 launches for, respectively, the PPF and the MTFF

The relevant spending will be part of phase 2.

3.4 *Initial operations preparation*

3.4.1 *General description of activities*

The initial operations preparation of the Columbus C/D programme comprises the preparation of mission control and operations support for the Central Mission Control Centre (CMCC) and for the respective Element APM, PPF and MTFF Control Centres.

These activities shall ensure that the ground segment is ready approximately 18 months before the launch of each element.

The initial operations preparation activities comprise:

- sustaining engineering and operations support to mission control:
  - establishment of operations plans and procedures
  - initial staffing and training of ground operators and astronauts
  - implementation of the related data bases and data handling systems

The complete ground system shall be tested and validated, including hardware, software, procedures, performance and interfaces.

- integrated logistics support:
- establishment of an integrated logistics concept capable of supporting the requirements throughout the lifetime of the Columbus system
- preparation of maintenance, supply support for spares, consumables, transportation and storage support equipment, etc.

It is assumed that the initial operations preparation activities will be followed, up to the launch and the orbital insertion (or, for the APM, the docking to the Space Station), by a phase of integrated mission preparation – to be funded within the Columbus exploitation programme – which comprises:

- integrated mission and ground segment preparation and validation, including final integration of specific payloads
- ground processing for the initial launch
- post-delivery engineering and logistic support

3.4.2 *Initial operations preparation activities during phase 1*

The Initial Operations Preparation activities during the first three years of the development programme comprise the preparation of

mission control and operations support for the Central Mission Control Centre and for the Attached Pressurised Module. Some initial activities on integrated logistics support, which comprises the establishment of an integrated logistics concept and the preparation of maintenance, supply support for spares, consumables, transportation and storage support equipment etc., are also included.

3.5 *Utilisation preparation activities*

The utilisation tasks to be performed during the Columbus development programme, as from the start of phase 1, are defined below.

3.5.1 *Interfaces between the users and the system*

This task comprises:

- the setting-up of a user access organisation allowing for easy and clear access to the different Columbus elements.
- a continued interaction with the elements design and development concerning user requirements.
- the control of payload-to-system interfaces.
- the introduction of a standardisation policy relating to instrument development, qualification and acceptance, safety rules, payload servicing, etc.
- the definition of payload environment (microgravity, contamination, EMC).

3.5.2 *Utilisation information system*

The setting-up of a powerful Columbus utilisation information system is essential for a successful and efficient use of the system. A consistent and controlled documentation scheme will be established comprising all documents and handbooks required. They will be distributed and controlled via an electronic information system.

- Payload data base

The electronic storage of data from selected payloads, mission parameter, etc. is included in this task.

- Testbeds and simulators

Existing testbeds such as the astronauts workstation, data management testbed and at later stages mock-ups and simulators will be used for user familiarisation and later to support instruments development.

3.5.3 *Promotion*

The promotion activity for preparation of Columbus utilisation is essential, in order to inform the users on a broad basis and to identify and interest new users, in particular from the commercial sector.

3.5.4 *Astronaut office*

This task deals with all items related to astronaut activities, including selection criteria, astronaut selection, training and assignment. It includes coordination of astronaut activities for interim flight opportunities.

3.5.5 *Utilisation cost*

The refinement of utilisation cost prediction and control of the cost will be a continuous activity. A major objective will be to identify areas

susceptible to reduce the cost. The establishment of a charging policy is another important task under this heading.

3.5.6 *Relationship with international partners*

During phase C/D the utilisation plans of the four international partners (ESA, NASA, NASDA, Canada) need to be established and integrated into a composite plan. Scientific advisory structures need to be established, to guarantee best scientific results and to allow for scientific cooperation where desirable.

3.5.7 *Mission definition*

This heading comprises support for the decision process of payload selection; resources allocation; analytical payload grouping and accommodation and elaboration of integrated payload timelines; assessing and solving whenever possible of compatibility issues; integration of the utilisation planning with systems operations.

3.5.8 *Mission implementation definition*

This task comprises the definition of procedures, software and ground hardware for:

- training of users and astronauts
- payload integration (including compatibility problems)
- payload operations and servicing

3.5.9 *Development of specific flight hardware*

For payload operations, servicing and integration a number of specific flight hardware items will be developed, such as:

- interface elements
- common equipments (e.g. for sample preparation and diagnostics)
- automation and robotics equipment

First prototypes of this hardware are part of this programme.

3.5.10 *Flight testing*

Flight testing has the following objectives:

a) Utilisation objectives:

- test procedures
- test flight hardware
- test payload servicing techniques
- train teams (users, operations organisation)
- train astronauts

b) Participation to build up a Space Station user community, by offering to the users, and especially the ESA user directorates, additional experiment opportunities.

The contents of the flight testing activities will be based on participation to the already planned flights of the ESA user programmes (EURECA flights for instance) and of Member States (D-2, D-3, ORBIS...) and international partners.

4. *Revision clause*

4.1 In the case it is necessary to adjust the content of the Columbus

development programme, if Article II of Resolution ESA/C-M/LXXX/Res. 2 (Final) of 10 November 1987 for participation in the International Space Station takes effect, the corresponding provisions of this Annex will be revised by a two-thirds majority of all the participating States, provided such a majority represents at least two-thirds of the contributions to the Columbus development programme. The programme content will be adapted to the new situation within a time limit compatible with the execution of the programme, so as to allow, in particular, the main industrial contracts to be placed.

4.2 Any revision which may take place at the time of transition from phase 1 to phase 2 in accordance with the provisions of Article III(c) of this Declaration, will be made by the same majority as the one described under section 4.1 above.

4.3 In all other circumstances, the provisions of this Annex may be revised by unanimous decision of the participating States.

ANNEX B

Financial provisions

I. *Financial envelope of the Columbus development programme*

I.1 The financial envelope of the Columbus development programme amounts to 3713 MAU at mid-1986 prices and 1987 conversion rates. The indicative breakdown, based on the current budget structure, is as follows:

	MAU
Staff expenditure	108
Running expenditure	33
Facilities	8
Capital expenditure	252
Development	3078 *
Direct expenditure total	3479
Administrative and site costs	142
Variable support costs	51
Fixed support costs and investments	41
Indirect expenditure total	234
GRAND TOTAL	3713

1.2 *Sub-envelope for phase 1*

The firm sub-envelope allocated to phase 1 of the development programme amounts to 669 million accounting units, at the same economic conditions. The indicative breakdown, based on the current budget structure, is as follows:

	MAU
Staff expenditure	33
Running expenditure	10
Facilities	2
Capital expenditure	14
Development	536
Direct expenditure total	595
Administrative and site costs	45
Variable support costs	16
Fixed support costs and investments	13
Indirect expenditure total	74
GRAND TOTAL	669

At the time of the decision to move on the phase 2, the participating States shall determine the firm sub-envelope for this phase, within the

* This figure includes amounts as currently estimated for the space segment (2400 MAU), the initial launches of the space elements (287 MAU), the initial operation preparation (186 MAU) and the utilisation preparatory activities (205 MAU), which include the relevant part of the original "CUPP". It is assumed that the integrated mission preparation activities for the space elements will be funded under the future Columbus exploitation programme.

development programme financial envelope, and how it should be broken down on the basis of the budget structure in force at the Agency. Without prejudice to possible subsequent application of the provisions of Article III.4 of Annex III to the Convention, the participating States may, on that occasion and by a unanimous decision, revise the development programme financial envelope.

In the event of a cost overrun, the provisions of Article III.1 of Annex III to the Convention shall apply.

II. *Scale of contributions*

The participating states shall contribute to the Columbus development programme's financial envelope in accordance with the following scale:

Participant	*Scale*[1] *%*
Germany	38.0
Belgium	5.0
Denmark	1.0
Spain	6.0
France	13.8
Italy	25.0
Norway	0.4
Netherlands	1.3
United Kingdom	5.5
Sweden	1.0
Not covered	3.0
Total	100.0

[1]) In the contributions of the participating States to the above financial envelope, on the basis of this scale and the geographical distribution of work stemming therefrom, account shall be taken of measures that are in line with Chapter IV, section 5, of Resolution ESA/C-M/LXXX/Res. 1 (Final), adopted on 10 November 1987, which are intended to compensate for the imbalances recorded at the end op 1987 and are defined by the amounts required at that time to bring each return coefficient to 1. These measures will be applicable to the period 1988–1990. In addition, a register containing the respective compensation measures for the period 1988–1990 will be maintained by the Executive ("special account of compensation measures"), and will be continuously adjusted so that the value of the compensation measures can be made available to the Member States. The Executive will report regularly on these compensation measures to the IPC.

This column also takes account of the effects of the anticipatory compensation measures decided by Council meeting at ministerial level in Chapter IV, section 3, of Resolution ESA/C-M/LXXX/Res. 1 (Final), which are intended

to prevent future imbalances arising by applying compensation of 2% of the development programme's financial envelope between States with prime-contractor responsibilities or major responsibility for a significant part of the programme, and those not having this type of responsibility. These measures will be applicable from 1991 until the end of the work. A special report on these anticipatory measures will be made before their implementation.

III. *Arrangements for examining the geographical distribution of work and for revising the scale of contributions*

1. During the first two years of execution of the development programme, the Agency shall seek to allocate the work between the participating States in accordance with the geographical distribution of work resulting from the compensation measures referred to in section II above, and shall present a report demonstrating that all options for reallocating work to the said participating States have been exhausted.

2.1 The geographical distribution of work shall be reviewed once the industrial structure for the programme is clearly defined or, at the latest, after 24 months from the entry into force of this Declaration; the conclusion of this review will lead to a correction of the situation through a redistribution of work, otherwise through revision of the contribution scale, on the basis of the industrial structure that is known and planned for the continuation of the programme. Allowance will be made for the need to guarantee a geographical return of at least 0.90 for the participating States concerned at the end of the programme, while determining how a better distribution of work over all the programmes could as far as possible prevent a revision of the contribution scales.

2.2 This review will be conducted subject to negotiations with the participating States concerned, it being understood that neither a surplus of financial cover nor a structural deficit for the programme shall result. Should a State be unable to agree to its revised contribution rate, the share of work allocated to its industry would be reviewed.

2.3 This new scale shall serve as a point of reference for the geographical return target.

IV. *Schedule of payment appropriations*

The schedule of payment appropriations shall reflect firm annual ceilings for the first three years of the programme (1988–1990), corresponding to its phase 1. At the time when phase 2 is started up, the schedule will become firm for the first four years of phase 2. Subsequently, before the end of each current budget year "n", the participating States shall fix the amount of the ceiling for year "n + 4", in order at all times to have firm annual ceilings for the three years

following the current year, and shall examine the payment estimates entered for the subsequent years, it being understood that the call-ups of contributions may exceed the indicated figures should the provisions of Article III.4(a) of Annex III to the Convention be put into effect.

In the event that the amount of the ceiling for year "n + 4" is different from that appearing in the previous schedule, the new ceiling shall be fixed by a two-thirds majority. In the event of a cost overrun at the time of the decision to undertake phase 2, Article III.1 of Annex III to the Convention shall apply.

In the case it is necessary to adjust the content of the Columbus development programme, if Article II of Resolution ESA/C-M/LXXX/Res. 2 (Final) of 10 November 1987 for participation in the International Space Station takes effect, the schedule hereafter will be revised by a two-thirds majority of all the participating States, provided such a majority represents at least two-thirds of the contributions to the Columbus development programme.

Taking account of the above, and it being understood that the schedule will be subject to reexamination before the start of phase 2 of the programme, which could lead to its revision at a double two-thirds majority, the schedule of payment appropriations needed for the Columbus development programme (in MAU at mid-1986 prices and 1987 conversion rates) is as follows:

PHASE 1			PHASE 2								TOTAL
1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
141.4	231.6	296	395	461	460	471	488	450	213	106	3713

V. *Revision clause*

The provisions of this Annex may be modified by a unanimous decision of the participating States, with the exception on the one hand of the scale shown in section II above, for changes in which the procedures set out in section III shall apply and on the other hand, of the schedule described in section IV above which contains the modalities of its own revision.

ANNEX C *

Legal regime

1. *Objectives*

The purpose of this Annex is to establish the legal arrangements necessary for ensuring a link between the Intergovernmental Agreement among the United States and Member States of the Agency, Japan and Canada, and, on the one hand, the Memorandum of Understanding concluded between the Agency and NASA, and on the other, the present Declaration.

2. *Transitional period*

In the event that the Intergovernmental Agreement enters into force after work covered by this Declaration has begun, the participating States accept that the Agency shall participate in the international space station programme and shall apply the provisions of the intergovernmental Agreement and the Memorandum of Understanding from the time of their signature, to the extent necessary for the Agency to carry out its responsibilities as a "cooperating Agency" under these Agreements.

The participating States recognise the invocability against them of the measures tobe taken by the Agency, within the framework of its rules and procedures, on the basis of the Intergovernmental Agreement and the Memorandum of Understanding.

3. *Registration – jurisdiction and control*

The participating States shall delegate to the Agency the authority to register in their name and on their behalf, space objects developed under this programme and particularly those identified as a European contribution in Annex I of the Intergovernmental Agreement. The Agency shall act as a State of registry within the meaning of the United Nations Convention on regsitration of objects launched into outer space, of 26 November 1974.

The participating States accept that the Agency, acting in their name and on their behalf and to the extent necessary for it to carry out its responsibilities, shall exercise powers of jurisdiction and control over the elements attached to the crewed base of the space station after these have been assembled, and over the other elements when they are placed in orbit, within the limits defined in the Intergovernmental Agreement and in accordance with the directives issued by the participating States. The Agency shall draw up proposals to this end, which shall also be notified to the relevant subsidiary bodies for their opinion.

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* This text is of a preliminary nature and will be reviewed and finalised in due time by the participating States.

4. *Astronauts*

The Agency shall set up a team of astronauts and draw up an "Astronauts' Handbook" defining the arrangements for selecting, training and qualifying astronauts, whether or not they are Agency staff members, and for conducting experiments.

Astronauts who are not Agency staff members shall be seconded to the Agency for the duration of their mission, including the period of training carried out by the Agency.

On board the inhabited international space station base the astronauts shall be governed by the code of conduct agreed between the cooperating Agencies and submitted in advance to the participating States; this code shall be an integral part of their contract with the Agency. The astronauts shall be placed under the authority of the flight commander of the inhabited base. Moreover, the Agency will develop a code of conduct for the European astronauts who service the MTFF.

5. *Liability for damage*

If a third party to the Intergovernmental Agreement holds a participating State liable for damage, the participating States shall agree to assist that State in accordance with the provisions of Resolution ESA/C/XXII/Res. 3 of 13 December 1977. The Agency may intervene in the procedure if so authorised by the applicable law. Any compensation for damage that a participating State may have to pay following legal or arbitration proceedings, would be shared between the various participating States in accordance with the scale of contributions in force at the time when the damage occurs.

6. *Consultations*

The Agency shall inform the participating States regularly of all consultations it holds with NASA and the other cooperating agencies, and shall assist the participating States in the procedures for consultation and periodical review of the implementation of the intergovernmental Agreement; these procedures shall if necessary be opened with the other partners in the space station.

7. *Ownership of the elements and equipment*

The Agency shall be the owner, in the name and on behalf of the participating States, of the European elements of the international space station as well as of the equipment funded under the programme on board any specific station element. If a transfer of ownership is envisaged, the participating States shall consult together and the Agency shall inform NASA, in accordance with the provisions of the Memorandum of Understanding.

8. *Information and data*

The Agency shall take the necessary steps to ensure the confidentiality of the technical information made available to it by an experimenter for the purpose of his experiment being integrated and used on the

space station. These provisions shall include in particular obligations of discretion and confidentiality for the astronauts responsible for conducting the experiment.

9. *Intellectuel property rights (including patents)*
(to be completed)

10. *Exchange of data and goods, including transit through the territory of the participating States*
(to be completed)

ANNEX D

Guiding principles on utilisation
(to be worked out later)

(non-participating States)

- *Selection – priorities – rates – data system*
- Experiment integration

De verklaring is ingevolge paragraaf IX op 12 februari 1988 in werking getreden.

Het *Koninkrijk der Nederlanden* legde bij aanvaarding op 10 februari 1988 dezelfde verklaring af als voor het programma inzake de ontwikkeling van de Ariane-5 raket (zie hierboven bij I.a).

III. TELECOMMUNICATIE-SATELLIETEN

Declaration relating to a preparatory programme for a data relay satellite system

ESA/JCB/LXVIII/Dec.
(drawn up on 27 January 1986)
(updated on 12 March 1987)

The Participating States mentioned below (hereinafter referred to as "the Participating States")

Convinced of the need for a Data Relay Satellite System for future European Programmes,

Having regard to the Director General's proposal relating to a preparatory programme (reference ESA/JCB(85)66, Rev. 3),

Recalling Resolution (ESA/C-M/LXVII/Res. 1 (Final)) adopted by the Council meeting at Ministerial level on 31 January 1985 on the long-term European space plan and in particular to its chapter II-5,

Having regard to Council Resolution ESA/C/LXXI/Res. 1 (Final) dated 23 October 1985 concerning the execution within the framework of the Agency of a Preparatory Programme for a Data Relay Satellite System,

Having regard to the Convention and in particular to Article VI(b) as well as to Annex III thereto,

I Confirm their interest in a Data Relay Satellite System, and Approve the general objectives set out in Annex A,1 to this Declaration;

II Decide to undertake the execution of a Preparatory Programme for a Data Relay Satellite System (DRPP), and Approve its work content as described in Annex A,2 and 3 to this Declaration;

III Agree to allocate to the execution of the preparatory programme a financial envelope of 32,5 MAU, at mid-1985 prices and 1986 conversion rates;

IV Agree to contribute to the financial envelope of the DRPP in accordance with the scale shown in Annex B to this Declaration;

V Agree on the following arrangements for moving on to the subsequent phases (final definition and implementation phases) of the programme:

a) the participating States shall, on submission of a dossier prepared by the Agency, review the programme and examine the technical and financial proposal for the subsequent phases of the programme; they shall in due course submit a recommendation to the Council concerning adoption of the corresponding Resolution;

b) besides this, the interested participating States shall draw up a Declaration on the subsequent phases of the programme;
c) a participating State that is not in a position to subscribe to the Declaration or the subsequent phases of the programme shall notify the Director General of this in writing.

VI Agree that the preparatory programme work can start as soon as the subscribed contributions amount to 90% of the financial envelope referred to in paragraph III above. It is understood that the work will be initiated only on the basis of the level of submitted contributions;

VII Agree that this Declaration shall be open to subscription until 29 May 1986, final date by which those participating States who are not able to accept the provisions of this Declaration shall declare so and thus cease to be participating States.
The Declaration is subscribed by the following participating States:

(Participant)	*(Date)*	*%*
Belgium	28.05.86	5.00
France	28.05.86	5.00
Germany	08.04.86	20.69
Italy	07.05.86	20.69
Spain	28.04.86	5.0
Switzerland	27.01.86	2.0
United Kingdom	29.05.86	20.69
Sweden	09.10.86	2.4
Austria	17.11.86	0.83
Netherlands	12.03.87	2.0

ANNEX A

Data Relay Satellite System Preparatory Programme (DRPP)

1. *Objectives of the DRS*

The basic objective of the overall Data Relay Satellite programme is to set up a cost-effective infrastructure, in space and on the ground, in support to future European spce programmes, which will provide, in a time frame compatible with the needs of users, the following near-continuous services:
- Transfer of data to and from low earth orbiting spacecraft and from launchers to ground controllers
- Transmission of video and voice between low earth orbiting spacecraft and their ground control stations

– Provision of telemetry and telecommand links between ground controllers and spacecraft in orbit
– The capability to carry out ranging operations for orbit and position determination of spacecraft and, possibly, launchers during ascent.

2. *Objectives of the DRPP*

The particular objectives of the DRPP are to:
– Establish and define in detail, the preferred configuration of the Data Relay Satellite System (DRSS) space and ground segments to provide cost-effetive data relay, information transmission, telemetry, telecommand and ranging services, to foreseen European space programmes including, in particular, Columbus, Ariane 5, Hermes and Advanced Earth Observation satellites;
– Investigate the feasibility, and determine the costs versus benefits, of incorporating European DRSS elements into a possible global data relay satellite system, in cooperation with other organisations:
– Study, during the course of the programme, technology elements that require development activities, and initiate these to ensure their timely availability in support to the overall programme;
– Obtain, by the end of the programme, a technical baseline for the space and ground segments which will need to be developed, implemented and operated in subsequent phases, along with cost and schedule assessments for these.

3. *Description of the Preparatory Programme*

In order to satisfy the objectives as set out in 2, the preparatory programme will contain three basic elements:
System Definition Studies
The System Definition Studies will begin by addressing mission, space segment, and ground segment aspects of a DRS system, and determining the inter-relationships between these, so that, later in the studies, detailed trade-offs can be performed in order to arrive at a preferred overall system approach that best meets foreseen needs in the most most effective manner. Mission aspects covered will include refinements of previous studies in order to arrive at firm and well substantiated estimates of probable user requirements and mission models.
Studies will also be carried out, in accordance with defined international regulations & standards, in order to select the best RF frequencies for the space-to-ground links, and the best RF frequencies and/or optical wavelenghts for the space-to-space links.
A determination will be made of the feasibility and cost versus benefits of developing a system that is compatible with other systems, notably the TDRS system of the U.S., and that being planned by Japan.

Studies of space segment configurations will be carried out which will provide estimates of the size, mass, power and costs of both GEO orbit and user terminal payloads (and possible demonstration payloads) in order to provide selected capacities at certain RF frequencies and/or optical wavelengths, resulting from the above mission investigations. Assessments will also be made of a number of system implementation scenarios, including experimental, pre-operational, and operational systems.

Ground segment aspects will be addressed in detail for both centralised and de-centralised solutions. The effect of various mission and space segment assumptions on the ground segment will be determined. Estimates will be derived of the costs of the hardware and software needed in the ground segment, to control the DRSS operations, to schedule usage of the system, and to receive, process, disseminate, and archive data.

Supporting Studies

During the course of the System Definition Studies, a number of specialized topics will be identified which may need to be pursued in greater depth than possible within the main studies themselves, in supporting studies, whose timing will be phased to be compatible with that of the definition studies proper. Examples already identified which fall into this category are:

- Modulation & Coding Techniques
- Multiple access at S-Band
- Comparison of S-band antenna technologies
- Array Antenna Software
- S-band telemetry and telecommand for Ariane-V and Hermes.

Initiation of critical Technology Developments

The System Definition Studies will identify areas in which specific technology developments must take place in order to be available when needed for the development and implementation of the overall DRS system. These will be initiated within the DRPP. In addition, a number of key technology areas have already been identified for which development activities must commence early, in order that results can be available in support to trade-off and/or detailed design definition studies, and to reduce programme risks. These are as follows:

- DRS Tracking Antenna
- High Speed Codec (CODER-DECODER)
- Solid State Ka Band Power Amplifier
- User Terminal Developments

User terminal developments will be initiated in the following areas:

- Antenna,
- R.F. communications unit or transceiver,
- Modem,
- Deployable/Retractable Boom Mechanisms.

4. *Industrial Policy*

In order to achieve the benefits of competitive bids for the later development phase of the DRSS programme, it is considered that the System Definition Studies should be carried out by two different industrial groups in parallel. Likewise, the initial technology developments should each be carried out under two parallel contracts, at least to the point where competitive binding offers can be obtained for further development and for procurement of future flight hardware. Single contracts for the continued development could then be awarded thereafter.

The supporting studies, on the other hand are expected to be specific in nature and to not, in general, lead to direct follow-on studies or hardware procurement. These studies can therefore each be carried out under single contracts, without parallel studies being required.

5. *Time Schedule*

It is expected that activities within the preparatory programme will cover a period of about two and one half years.

6. *Revision*

The provisions of this Annex may be revised by a unanimous decision of the Participating States.

ANNEX B

Financial provisions

1. *Financial Envelope*

The financial envelope for the execution of the Data Relay Satellite Preparatory Programme (DRPP), referred to in paragraph III of the Declaration, amounts to 32.5 MAU, at mid-1985 prices and 1986 conversion rates. The indicative breakdown of this amount, based on the current budget structure, is as follows:

Staff Expenditure	2.2	
Running Expenditure	0.9	
Facilities	0.1	
Investment	0.4	
Development		
System Definition	7.0	
Supporting Studies	4.0	
Technology Initiation	10.0	
S/T Direct Expenditure		24.6
Administrative Support	3.2	
Variable Support	2.7	
Fixed Support and Investment	2.0	
S/T Indirect Expenditure		7.9
TOTAL EXPENDITURE		32.5

II. *Scale of Contributions*

Each participating State will initially contribute to the financial envelope in accordance with the following scale. This scale of contributions will be retroactively adjuste once, at the end of the programme, to reflect the actual geographical distribution of industrial contracts awarded during the programme.

Participating States	*Scale of contributions* (percent)
Austria	0.83
Belgium	5.00
France	20.69
Germany	20.69
Italy	20.69
Netherlands	2.00
Spain	5.00
Sweden	2.41
Switzerland	2.00
United Kingdom	20.69
Total	100.00

II. *Indicative Schedule of payment Appropriations*

The indicative schedule of Payment appropriations for the DRPP, at mid–1985 prices and 1986 conversion rates, s as follows:

Year	*MAU*
1986	5.0
1987	12.2
1988	10.8
1989	4.5
	32.5

IV. *Revision*

The provisions of this Annex may be revised by a unanimous decision of the participating States.

De verklaring is ingevolge paragraaf VI op 29 mei 1986 in werking getreden.

Declaration on the in-orbit technology demonstration programme
ESA/IPC/LXXXVII/Dec.1
(drawn up on 30 September 1986)
(updated on 25 June 1987)

The participating States referred to below (hereinafter referred to as "the Participating States"),

Recalling that the Agency conducts as part of its activities a space technology research and development programme aimed at making available the technologies necessary for execution of the European space programmes,

Having regard to the Director General's initial proposal for an in-orbit technology demonstration programme (ESA/IPC(85)53),

Considering that such a programme will ensure the timely availability of certain advanced technologies for the success of European space programmes by providing the means for demonstration and qualification through flight testing,

Recalling the Resolution adopted by the Council meeting at ministerial level on 31 January 1985 (ESA/C-M/LXVII/Res. 1 (Final) - Chapter II.6),

Having regard to Council Resolution (ESA/C/LXXIV/Res. 5 (final) of 27 June 1986, approving the execution within the framework of the Agency of the in-orbit technology demonstration programme,

Having regard to Article V.1 (b) of the Convention and to Annex III thereto,

I. Express their interest in an in-orbit technology demonstration programme and approve the general objectives of an initial phase of this programme as set out in sections 1 and 2 of Annex A to this Declaration;

II. Decide to undertake the execution of an initial phase covering the period 1986 to 1990, and approve its work content as described in section 3 of Annex A;

III. Agree:

a) to allocate to the execution of the initial phase an indicative financial envelope of 19.52 million accounting units (at mid-1985 prices and 1986 conversion rates),

b) to contribute to the cost of executing this phase in accordance with the financial provisions described in Annex B to this Declaration;

IV. Agree to carry out in due time a programme review to examine the desirability of moving on to the next phase of the programme, the technical content of that phase and the related financial provisions, this review being based on the Agency's assessments of the progress of

the initial phase. If desirable, they will in due course submit a recommendation to the Council concerning the execution of the next phase of the programme and the most appropriate legal form it might take;

V. Agree that work in the initial phase, relating to the principal expriments described in ESA/IPC-TDP (86)5, may begin as soon as the amount of contributions subscribed reaches 70% of the indicative financial envelope referred to in section III(a) above, on the understanding that work on a given experiment will be started only when the financial cover of such work is ensured by the level of subscribed contributions from the participating States involved;

VI. Agree that the work on additional experiments to be carried out under the initial phase can be undertaken under this programme only with the agreement of the participating States, and only when their funding has been guaranteed by the States concerned;

VII. Agree that the present Declaration shall be open for subscription until 28 November 1986, the final date by which the participating States may notify the Director General that they are unable to accept the provisions of the present Declaration, and thus cease to be participating States.

This Declaration is subscribed by the following States:

State	*Date*
Switzerland	30 Sep 1986
Italy	28 Nov 1986
Spain	28 Nov 1986
Belgium	9 Mar 1986
Netherlands	23 Mar 1987

ANNEX A

Objectives and content of the in-orbit technology demonstration programme

1. *Background*

An increasing number of advanced space technologies require in-orbit demonstration as the final stage in their development before they can be integrated without excessive risk in new projects or embraced by industry in commercial ventures.

Such in-orbit flight verification has been done in the past on an ad-hoc basis. The increasing need for flight verification, the advent of

new flight opportunities which allow in-orbit demonstration at a relatively low cost, and the need to maintain Europe's competitiveness, have led to the plan for a dedicated programme of in-orbit tests.

2. *General objectives*

The objective of the programme is effectively to enhance the two major objectives of ESA's technology research and development activities, namely to:

- ensure timely availability of the necessary technology for all Agency programmes;
- maintain a high level of competence in space technology in Europe;

by providing the opportunity to demonstrate, test and/or verify those advanced space technologies that cannot effectively be proven by means of ground simulation. The programme is intended as a service to the European space industry and to future European space programmes. It will provide systematically scheduled flight opportunities, and include assistance in the preparation and integration of payloads, as provided for in paragraph 3.1 below. It will also provide the same services, against full reimbursement of the costs entailed, to firms or bodies needing to test their experiments in flight. The special procedures for achieving this last objective are described in the implementing rules governing the programme. The technology experiments will involve critical development hardware at equipment or sub-assembly level.

3. *Technical content and schedule of the initial phase of the programme*

The initial phase of an in-orbit technology demonstration programme covered by this Declaration will be executed in the period 1986 to 1990.

The Director General shall endeavour to ensure the utilisation of the technologies included in the in-orbit technology demonstration programme in the course of the realisation of European space programmes.

3.1 *Payloads*

During the initial phase it is planned to provide in-orbit testing and demonstration of the principal experiments listed in document ESA/IPC-TDP(86)5.

These experiments have been selected on the basis of proposals resulting from an Announcement of Opportunity (AO). The criteria applied in this selection were as follows:

(i) the results of the in-orbit testing are likely significantly to reduce the technical and financial risk in future European space

programmes, or can assist European industry in commercial activities;

(ii) a flight test will considerably increase confidence in the performance of a new technology compared to ground testing;

(iii) in-orbit testing, possibly in combination with ground testing, is more cost-effective than ground testing alone.

3.2 *Tasks included in the programme*

The in-orbit technology demonstration programme contains the following major activities:

(i) Accommodation analysis
Analysis of payload accommodation in order to define integration and operational procedures and to carry out studies necessary to prepare continuation of the technology demonstration programme beyond its initial phase is also included.

(ii) Experiment adaptation for flight
The technology experiments will have been developed outside the technology demonstration programme, within the framework of technology research and development programmes funded by ESA, national bodies or private industry. The hardware resulting from these programmes will usually not meet all design and safety requirements for flight hardware. The technology demonstration programme will, therefore, provide the adaption necessary to meet the additional requirements for flight, the interface hardware necessary to mount the experiments on on a carrier, and in some cases also the special instrumentation necessary to measure the experiment performance. This task will also include some support for post-flight experiment performance analysis.

(iii) Carriers and payload integration
This heading covers integration of the technology experiments in a payload complement, including ground testing and full preparation for the carrier, e.g. Get-Away Special canister, Hitchhiker Spacelab and so on.

(iv) Launch/retrieval
Launch and retrieval services and the associated activities, e.g. safety documentation, transport to and from the launch site, data retrieval.

4. *Revision clause*

The provisions of this annex may be revised by a unanimous decision of the participating States.

ANNEX B

Financial provisions

I. *Financial envelope*

The indicative financial envelope for the initial phase of the in-orbit technology demonstration programme referred to in section III of the Declaration amounts to 19.52 MAU at mid-1985 prices and 1986 conversion rates.

The indicative breakdown, based on the current budget structure, is as follows:

	MAU	
Staff expenditure	1.00	
Running expenditure	0.40	
Facilities	0.20	
Capital expenditure	0.40	
Development	15.92	
Direct expenditure		17.92
Administrative and site costs	1.40	
Variable support costs	0.10	
Fixed support costs and investments	0.10	
Indirect expenditure		1.60
GRAND TOTAL		19.52

II. *Scale of contributions*

a) The participating States will contribute to the expenditure resulting from the execution of the work described in Annex A section 3 in accordance with the following provisional scale:

Participating State	Total contribution (MAU)	Initial scale
Belgium	0.35	1.79
Italy	8.12	41.60
Netherlands	2.05	10.50
Spain	2.70	13.83
Switzerland	3.70	18.95
Other participants	2.60	13.33
Total	19.52	100.00

The initial scale will apply provisionally to the calculation of contributions covering expenditure under the 1986 and 1987 budgets on the basis of the industrial return provided for in the participating States.

It will be replaced in 1989 by a revised scale to take into account any changes in the distribution of industrial work so to guarantee an industrial return coefficient of at least 0.9 for all the participating States.

This revision of the scales cannot have the effect of charging to a participating State that has not given its agreement a variation of more than 10% of the rate given in the initial scale.

b) In addition to the financial envelope referred to, additional funding corresponding to additional work may be provided either by the same participating States or by participating States that subsequently subscribe the present Declaration. In the latter case a new financial envelope will be drawn up accompanied by a scale amended to take account of this additional work.

II. *Schedule of payment appropriations*

The indicative schedule of payments in MAU, at mid-1985 prices and 1986 conversions rates, is as follows:

1987	1988	1989	1990	Total
5	2.8	6.3	5.42	19.52

IV. *Revision clause*

The provisions of this Annex may be revised by a unanimous decision of the participating States.

De verklaring is ingevolge paragraaf V op 15 januari 1987 in werking getreden.

IV. WAARNEMING VAN HET AARDOPPERVLAK

Declaration relating to an Earth Observation Preparatory Programme
(Drawn up on 10 December 1985)
(Revised on 10 June 1986)

The Participating States listed below (hereinafter referred to as "the participating States"),

Having regard to Council Resolution ESA/C/LXXI/Res. 2 (Final) dated 23 October 1985,

Having regard to the Director General's proposal relating to an Earth Observation Preparatory Programme (Ref. ESA/EOPP/PP(85)4, rev. 1 and corr. 1),

Having regard to the Declaration on the Columbus Preparatory Programme (ESA/PB-SL/XLIX/Dec. (Final) rev. 2) drawn up on 28 November 1984, updated on 23 September 1985,

Having regard to the Convention and in particular to Article V.1(b) as well as to Annex III,

1. Approve the general objectives of the Earth Observation Preparatory Programme and its content as set out in Annex A to this Declaration.

2. Decide to undertake the execution of the Earth Observation Preparatory Programme on the basis of the proposal referred to in the preamble.

3. Agree to allocate to the execution of the programme defined in Annex A a fixed financial envelope of 54 MAU at mid-1985 price levels and 1986 conversion rates.

4. Agree to contribute to the aforementioned financial envelope in accordance with the scale shown in Annex B to this Declaration.

5. Agree that the work can start once the submitted contributions amount to 89,84% of the financial envelope referred to in paragraph 3 above. It is understood that the work will be initiated only on the basis of the level of submitted contributions.

6. Agree that this Declaration shall be open for subscription until 28 February 1986, the final date by which those participating States which are not able to accept the provisions of the present Declaration shall declare so and thus cease to be participating States.

The present Declaration is accepted by the following participating States:

Participant	*Date*
Belgium	28.02.86
Denmark	28.02.86
France	24.02.86
Germany	07.01.86
Ireland	10.12.85
Italy	26.02.86
Netherlands	28.02.86
Spain	17.02.86
Switzerland	10.12.85
United Kingdom	25.02.86
Canada	17.03.86
Sweden	10.06.86
Norway	10.06.86

ANNEX A

Objectives and Content of the Earth Observation Preparatory Programme (EOPP)

I. *The objective of the EOPP*

The objective of the EOPP is to prepare the future Earth Observation Programmes identified in the Outline of a Long Term European Space Plan (ESA/C-(84)46, rev. 1), and in the Director General's proposal on this plan (ESA/C–M(85)2).

II. *The contents of the EOPP*

The EOPP shall prepare the following programmes:
- Polar Orbit Earth Observation Programmes (for Land, Ocean, Ice and Atmosphere)
- a Second Generation Meteosat Programme
- Solid Earth Programme(s).

In addition the EOPP shall:
- prepare advanced instruments for development,
- prepare the eventuel provisions of Flight Opportunities for promising payloads.

The activities required will include:
- mission concept studies
- instrument concept and feasibility studies
- ground segment studies
- measurement campaigns (where necessary)
- technology pre-developments
- economic benefitstudies (where applicable)

– phase A studies.

The approaches for preparing the above programmes will be:

– For the polar orbit Earth Observation programmes the first two years of the EOPP will be devoted to studies of different missions concepts, instruments and payload groupings, a detailed comparison among expendable, retrievable and serviceable platforms albeit with the preference for the Columbus Polar Platform element, the conduction of appropriate measurement campaigns and the holding of workshops, so that a comprehensive dossier describing the options studied, related Agency study results and related national work, can be presented to participating States at the end of the first two years. A decision will be made then on the preferred first polar orbit Earth Observation programme to be prepared to Phase A study level in the following 3 years of the EOPP taking account in this of the results of campaigns performed within the EOPP. A decision on the preferred second polar orbit Earth Observation programme to be prepared is planned to be made within 18 months after the first decision.

– The Second Generation Meteosat Programme will be prepared on the basis of the requirements established at the Avignon Workshop, together with any further inputs provided by the Remote Sensing Programme Board. The preparations will be scheduled so that the first spacecraft of an operational series of second generation meteorological satellites defined through EOPP in collaboration with Eumetsat can be launched in 1994 prior to the end of the present Operational Meteosat Programme.

– In the case of the Solid Earth Programme, a major workshop will be held in early 1986 to consider the possible missions, followed by studies of the promising missions in order to provide the information by the end of 1986 on which a decision can be taken on the programme to be prepared.

The number of mission/programme options under investigation will vary throughout the various phases of the EOPP. The depth of preparation and the number prepared will be adjusted to fit within the financial constraints of the EOPP.

III. *Timescale*

The EOPP is scheduled for a 5 years period, with the possibility of extension if the schedule of missions and funding requirements change.

IV. *Revision Clause*

The provisions of this Annex may be changed by unanimous decision of the participating States.

ANNEX B

Financial provisions

I. *Financial Envelope*

The financial envelope in respect to the Earth Observation Preparatory Programme (EOPP) referred to in paragraph 3 ot the Declaration amounts to 54 MAU at mid-1985 economic conditions and 1986 conversion rates. The indicative breakdown of this amount, based on the current budget structure, is as follows:

	MAU	
Staff expenditure	4.2	
Running expenditure	2.1	
Facilities	0.5	
Capital expenditure	0.1	
Development	35.5	
Total direct expenditure		42.4
Administrative support and site services	5.6	
Variable support costs	3.4	
Fixed support and investment	2.6	
Total recharges		11.6
Totaal expenditure		54.0

II. *Scale of contributions*

The participating States will contribute to the financial envelope for the EOPP in accordance with the following scale:

Participant	*%*
Belgium	3,61
Denmark	1,77
France	18,17
Germany	20,00
Ireland	1,40
Italy	11,00
Netherlands	4,84
Norway	1.85
Spain	4,00
Sweden	3,78
Switzerland	3,87
United Kingdom	15,18
Canada	6,00
Not yet covered	4.53
	100,00

In the execution of this programme the Agency shall ensure a fair industrial return to all the participating States.

III. *Indicative schedule of payment appropriations*

The indicative schedule of payment appropriations for the EOPP (in MAU at mid-1985 prices and 1986 conversion rates) is as follows:

1986	1987	1988	1989	1990
6.4	12.6	12.7	12.7	9.6

IV. *Revision clause*

The provisions of this Annex may be revised by unanimous decision of the Participating States.

De verklaring is ingevolge paragraaf 5 op 17 maart 1986 in werking getreden.

V. MIKRO-ZWAARTEKRACHT PROGRAMMA'S

Declaration on the continuation of the microgravity research programme (phase 2)

ESA/PB-SL/L/Dec.1
(drawn up on 9 January 1985)
(updated on 16 March 1989)

The participating States mentioned below (herinafter referred to as "the participating States"),

Recalling the Council Resolution on the microgravity research programme (ESA/C/XLVIII/Res. 1 (Final)), adopted on 21 May 1981,

Recalling the Declaration on a microgravity research programme drawn up on 10 December 1981 (ESA/C/LI/Dec. 1 (Final)) covering an initial period, and its paragraph V in particular,

Considering the results obtained during this initial period, the preliminary lessons drawn from the FSLP and the interest aroused among users by the success of the STS-9 mission (Spacelab),

Considering the development of other programmes that can offer opportunities for microgravity research,

Having regard to the implementing rules of the programme (ESA/PB-SL(81)13, rev. 3, Annex II, rev. 4),

Whereas it is necessary, by reason of the increasing scarcity of flight opportunities for experiments, to implement an extension of this second phase of the programme so that the general objectives appearing in the Declaration of 10 December 1981 may be fully achieved, and having regard to the Agency's technical and financial proposal for such an extension (ESA/PB-MG(87)3, rev. 4),

Having regard to the Resolution adopted by the Council meeting at ministerial level in The Hague on 10 November 1987 (ESA/C-M/LXXX/Res. 1 (Final)), and in particular Chapter III.C.1 thereof whereby the Council "welcomes and endorses the pursuance of the Agency's activities and programmes in the field of microgravity, with the extension of microgravity activities in space, centred around an enhanced programme of utilisation of Spacelab, Eureca and new elements of the space transportation and in-orbit infrastructure".

Having regard to the Agency's technical and financial proposal for a second phase of the programme (ESA/PB-SL(84)16, rev. 5),

I. Confirm their resolve to continue the programme on the basis of the general objectives set out in the Declaration drawn up on 10 December 1981;

II. Agree to undertake a second phase of work covering the period early-1985 to late 1992; APPROVE the technical content of this work described in Annex A;

III. Agree to allocate for the execution of this work a financial envelope of 203.80 MAU at mid-1983 prices and 1984 conversion rates, and to contribute to it in accordance with the provisions of Annex B, section 2,

IV. Agree that the work on the programme may start as soon as the total of the subscribed contributions amounts to 80% of the financial envelope,

V. Fix at 12 February 1985 the final date by which a participating State may notify the Director General that it is unable to subscribe to the provisions of the present Declaration.

This Declaration is subscribed by the following States:

State	*Date*
Germany	12 Feb 85
Belgium	11 Feb 85
Denmark	12 Feb 85
Spain	8 Feb 85
France	11 Feb 85
Italy	12 Feb 85
Norway	21 Feb 86
Netherlands	19 Mar 85
United Kingdom	12 Feb 85
Sweden	12 Feb 85
Switzerland	12 Feb 85

ANNEX A

1. *General objectives of Phase 2 of the microgravity research programme*

The objective of Phase 2 of the microgravity research programme is experimental research; it aims at promoting in all the ESA Member States the disciplines of the material sciences and life sciences in particular. It is planned to give appreciably equal weight to these two disciplines. International cooperation will be pursued and intensified.

The main guidelines of Phase 2 are as follows:

– making maximum use of the Spacelab module, the pallet and the existing multi-user facilities, developed or being developed by the Agency, such as Biorack, sounding-rocket modules, and the Eureca core payload facilities, and of equipment developed nationally for the FSLP, the German D1 mission and the Sounding Rocket Programme;

– ensuring that this flight equipment is reflown several times within the framework of cooperative programmes;

- designing, developing and launching multi-purpose facilities;
- providing flight opportunities for existing or new individual experiments developed at national level;
- providing experimenters with technical advice and assistance;
- developing supporting technology.

2. *Technical content*

Phase 2 consists of twelve specific activities:
- reflight of Biorack,
- development of the fluid physics facilities to flight status (consisting of the AFPM, the Bubble, Drop and Particle Unit and Critical Point Facility),
- mini-missions (including short duration flight opportunities),
- Anthrorack (human physiology),
- development ofa new multi-user facility for Spacelab (Advanced Gradient Heating Facility (AGHF)),
- pre-development of a Botany Facility,
- supporting technology programme.
- 20% utilisation of the German D2 facilities.
- future studies
- phase B studies
- hardware development
- payloads for Spacelab independent flight opportunities.

3. *Timetable*

Phase 2 of the microgravity research programme covers a period of 8 years starting in early 1985 and finishing in 1992.

4. *Revision clause*

The provisions of this Annex may be revised by a unanimous vote of the participating States.

ANNEX B

1. *Financial envelope*

a The work planned during the second phase of the programme will be carried out within a financial envelope of 203.80 MAU at mid-1983 prices and 1984 conversion rates.

b) The forecast breakdown of this amount is as follows:

	MAU	
– Staff expenditure	13.42	
– Running expenditure	3.80	
– Facilities	0.36	
– Capital expenditure	0.57	
– Development	162.78	
Direct expenditure		180.93
– Administrative support costs and site services	19.08	
– Variable support costs	2.09	
– Fixed support and investment costs	1.70	
Indirect expenditure		22.87
TOTAL		203.80

2. *Scale of contributions*

The participating States will contribute to the expenditure resulting from the execution of the work described in Annex A within the financial envelope referred to above and in accordance with the following scale:

Participant	%
Germany	31.43
Belgium	4.72
Denmark	1.98
Spain	2.00
France	15.73
Italy	17.00
Norway	0.76
Netherlands	4.00
United Kingdom	1.34
Sweden	4.50
Switzerland	3.87
Not covered	12.67
Total	100.00

3. *Indicative payments schedule*

The indicative payments schedule is as follows (in MAU):

1985	1986	1987	1988	1989	1990	1991	1992	TOTAL
3.1	14.8	16.3	31.1	34.7	44.5	48.4	10.9	203.8

4. *Revision clause*

The provisions of this Annex may be revised by a unanimous decision of the participating States.

De verklaring is ingevolge paragraaf IV op 12 februari 1985 in werking getreden.

Bovenstaande verklaringen inzake de niet-verplichte programma's van de ESA behoeven ingevolge additioneel artikel XXI, eerste lid, van de Grondwet juncto artikel 62, eerste lid, onder b, van de Grondwet naar de tekst van 1972 niet de goedkeuring van de Staten-Generaal. Zie terzake tevens het gestelde in rubriek D hierboven.

Voor het op 26 juni 1945 te San Francisco tot stand gekomen Handvest der Verenigde Naties zie ook, laatstelijk, *Trb.* 1987, 113.

Van de op 5 en 7 december 1973 te Neuilly-sur-Seine/Parijs tot stand gekomen briefwisseling tussen de Nederlandse Regering en de Europese Organisatie voor Ruimteonderzoek (ESRO) inzake dienstverlening door deze organisatie ten behoeve van de Astronomische Nederlandse Satelliet (ANS) is de tekst geplaatst in *Trb.* 1974, 50; zie ook *Trb.* 1974, 165.

Van het op 20 november 1975 te Neuilly-sur-Seine tot stand gekomen Protocol inzake wijzigingen van de Overeenkomst tussen zekere Lid-Staten van de Europese Organisatie voor Ruimteonderzoek (ESRO) en de Europese Organisatie voor Ruimteonderzoek inzake de tenuitvoerlegging van een programma betreffende luchtverkeerssatellieten (Aeronautical Satellite Programme) zijn tekst en vertaling geplaatst in *Trb.* 1977, 90.

Van de op 14 januari 1980 te Parijs tot stand gekomen Verklaring van bepaalde Europese Regeringen inzake de produktiefase van de Ariane draagraket, met bijlagen, is de tekst geplaatst in *Trb.* 1982, 1; zie ook *Trb.* 1982, 194.

Van het op 15 juli 1982 te Parijs tot stand gekomen Verdrag tot oprichting van de Europese Organisatie voor Telecommunicatiesatellieten „EUTELSAT", met Bijlagen en Exploitatieovereenkomst, met Bijlagen, zijn tekst en vertaling geplaatst in *Trb.* 1983, 96.

Van het op 24 mei 1983 te Genève tot stand gekomen Verdrag tot oprichting van een Europese Organisatie voor exploitatie van meteorologische satellieten „EUMETSAT", met Bijlagen, zijn tekst en vertaling geplaatst in *Trb.* 1983, 161; zie ook, laatstelijk, *Trb.* 1990, 2.

Van de op 29 september 1988 te Washington tot stand gekomen Overeenkomst tussen de Verenigde Staten van Amerika, de Lidstaten van het Europese Ruimte-Agentschap (ESA), Japan en Canada inzake samenwerking op het gebied van het gedetailleerde ontwerp, de ontwikkeling, de exploitaite en het gebruik van het permanent bemande civiele ruimtestation (Space Station), met Bijlage, zijn tekst en vertaling geplaatst in *Trb.* 1989, 5.

Uitgegeven de *vijftiende* maart 1990.

De Minister van Buitenlandse Zaken,

H. VAN DEN BROEK

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