D-1 REPORT
THE FIRST GERMAN SPACELAB MISSION

Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt (German Aerospace Research Establishment)

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16. Abstract

Introduction of a new popular magazine on the D1 mission, The first West German Space misison. The D1 project office publishes the magazine. The German sponsored astronauts are to study the gravitational effects of reduced gravity on the human-generated processes of the environment. Other areas of concern are boundary surface and transport phenomena, physical chemistry and process engineering, metals and composite materials, and single crystals.

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D1-REPORT /1*

October 1984

D1-Report

On October 14, 1985 the American space transport ship "Columbia" will be launched in Cape Canaveral for a one week space flight mission.

The special feature of this mission: With respect to the scientific goals and the on-board work of the astronauts it is under German direction and is therefore called "D1".

In the space laboratory SPACELAB the two German payload specialists Dr. Reinhard Furrer and Dr. Ernst Messerschmid as well as the Dutch Dr. Wubbo Ockels together with their American colleagues, the Air Force Officer Dr. Guion Bluford and the lady astronaut Dr. Bonnie Dunbar will conduct an extensive program of scientific experiments. Here support and direction will be provided by a ground control center which, for the first time, is not located in the USA, but rather in Germany, the "German Space Operations Center" (GSOC) in Oberpfaffenhofen near Munich. Here Dr. Ulf Merbold, the first German citizen in space, as expert and colleague will maintain contact with the science astronauts in orbit.

The D1-Report, whose first issue is in front of you today, one year before the launch, will report in monthly sequence concerning everything worth knowing in connection with this space mission: Regarding the development of the project, the orbiter and the laboratory, the scientific experiments, the astronaut crew and their

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* Numbers in margin refer to pagination in original German text.

training, the events in the preparation for the space flight, finally of the launch and the development of the mission itself.

The D1-Report is issued by the project direction under the cooperation of the press sections of some organizations who are essentially participating in the D1-project:
Federal Ministry for Research and Technology (BMFT)
German Aerospace Research Establishment (DFVLR)
MBB/ERNO
Dornier.

The first German Spacelab mission "D1"

The Federal Republic of Germany had a controlling share in the development of the European space laboratory SPACELAB. For its initial flight the cargo space of the American space shuttle toward the end of 1983 a German science-astronaut, Dr. Ulf Merbold, was the first member of a European-American crew on board the spaceship.

Thus the impending Spacelab mission "D1" signifies the proper continued conduct of the scientific and technological utilization of space at a national level. Here for the first time a completely equipped research laboratory will be operated in earth orbit under German direction. This project is supported within the framework of the German space program by the Federal Ministry for Research and Technology and is under the project direction of the German Aerospace Research Establishment (DFVLR).

Despite the German responsibility for the scientific operation during space flight "D1" the conduct of the mission as well as of the different experimental programs are possible only under international cooperation. Here the space transport system space shuttle with the pilots and the space laboratory SPACELAB developed and built in Europe will be made available by the American space association NASA under a cost reimbursement arrangement.

During the mission the flight of the space shuttle will be controlled by Houston/USA, while the operational support of the science-astronauts and the scientific payload will be realized for the first time by a manned space flight from the control center CSOC (German Space Operations Center) of the DFVLR in Oberpfaffenhofen near Munich. Almost all experiments of the D1-mission make use of the extensive microgravity in orbit and beyond that profit by the presence of scientists during the conduct of the experiments. On earth gravity is present everywhere; it cannot be shut off for research projects requiring absence of gravity. It affects practically all natural and also most of the human-generated processes of our environment. Investigations during the previous German space program have provided suggestions as to the physical, chemical, technological, and medical-biological areas, in which more intensive research work can be of value under conditions of long-duration microgravity.

Here we are dealing with an expansion of scientific knowledge up to the conceivable economic utilization of new technological processes.

Therefore research projects from the areas
boundary surface- and transport phenomena,
physical chemistry and process technology,
metals and composite materials,
single crystals and materials for electronic applications
occupy the foreground of the D1-mission. In addition a systematic study of biological processes is conducted under the special conditions existing in space. Experiments are conducted all the way into the area of human physiology to see whether and to what extent gravitation affects functional processes on earth. The reaction of the human organism to microgravity is studied in many ways: space orientation, daily rhythm, heart-circulation system, and metabolism. One hopes /2
to gain from this not only basic knowledge concerning the understanding of the creation and evolution of life on earth, as well as to be able to evaluate the discovery of space as occasional living space of man.

The only experimental package independent of gravity deals with the synchronization of clocks on earth and in orbit, a task which is of significance for the highly accurate navigation via satellites. Here the desired accuracy of position determination is so great that relativity effects must be taken into account during the measurement of time.

Beyond that the D1-mission is also intended to clarify technical-operational questions concerning the controlled return of experimental payloads, concerning the repeat deployment capability of the test equipment as well as concerning the possibilities for the scientists to take part in on-board experiments.

For the first time the predominant part of the experiment integration into the SPACELAB systems and also the training of the science-astronauts takes place directly in the Federal Republic of Germany: at MBB/ERNO in Bremen or in DFVLR Research Center Cologne-Porz, the permanent seat of the astronauts during the preparation for the space flight.

Mission data:

Planned launch date: October 14, 1985

Duration of the space flight: 7 days

Orbit:
inclination angle 57°
orbiting time 87.5 minutes
altitude 324 km (during flight over central Europe)

Scientific payload: 2700 kg

No. of experiments: about 70

Crew:
3 pilots from NASA,
2 mission specialists from NASA: Guion Bluford and Bonnie Dunbar,

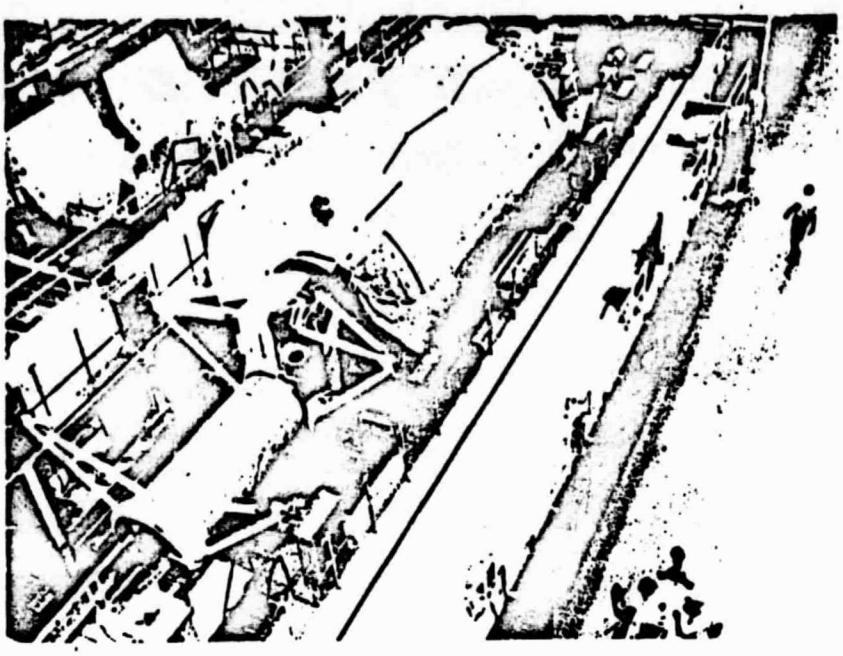
3 science-astronauts:
the two Germans Reinhard Furrer and Ernst Messerschmid from the DFVLR as well as the Dutch Wubbo Ockels from the ESA;
the German Ulf Merbold from the ESA is as a substitute with equal training and equal qualification a part of the science-astronauts.

Europe's space laboratory SPACELAB
Data, facts, technical concepts

SPACELAB is Europe's contribution to the American space transport system space shuttle; a multi-purpose platform for industry and science developed and built by the German space industry, to be used for manned and unmanned missions. The reusable space laboratory - the planned operational capability is considering 50 missions or a deployment duration of more than ten years - offers to research and technology the possibility to utilize the special physical conditions of space. These are microgravity (absence of gravity), vacuum increasing as the distance from the earth gravity field increases as well as the effects of heat (sun-side) and cold (shady-side).

The outstanding advantages, achievable neither in satellites nor during short-duration rocket preprograms, consist of the direct access of man into the course of the experiment. Regulation and control are provided only by the payload specialists on-board, but also by the experimenters on the ground. Just as important is the return of the experimental units to the ground with the then following intensive evaluation of the results as well as the repeat capability of the experiments during subsequent deployment.

For the multi-discipline utilization program SPACELAB makes available basic segments, which are integrated in the different flight configurations into the cargo space of the transport system and are returned to earth after a joint mission. The actual laboratory space for the manned missions consists of a cylindrical pressurized



SPACELAB before the first mission (Nov. 28 till Dec. 8, 1983), placed in the cargo space of the orbiter "Columbia". Front: transfer tunnel between orbiter and laboratory, the seven meter long cabin. Behind: a pallet with experimental units.

cabin (with a length of three to a maximum of seven meters), sealed hermetically against the space environment. Up to four payload specialists, who can reach the laboratory from the orbiter via a tunnel, can work therein. In the cabin environmental conditions are similar to those on earth; regulations-/control- and data processing equipment as well as working desk and experimental cabinets are housed in the cabin. The on-board computer plus experimental computer has a 64 K storage volume. The maximum data flux from board to ground is about 50 megabit/sec for telemetry, speech- and video transmission.

Heavy and large-surface measuring instruments and experimental units are to be installed on the three meter long U-shaped pallets (five belong to one flight unit, a maximum of three can be anchored in the cargo space coupled to one another); they are operating directly under the influence of space environment. If the pure

pallet version (unmanned) is used, a supply module (iglu) houses the highly sensitive instruments of the control- and data electronics.

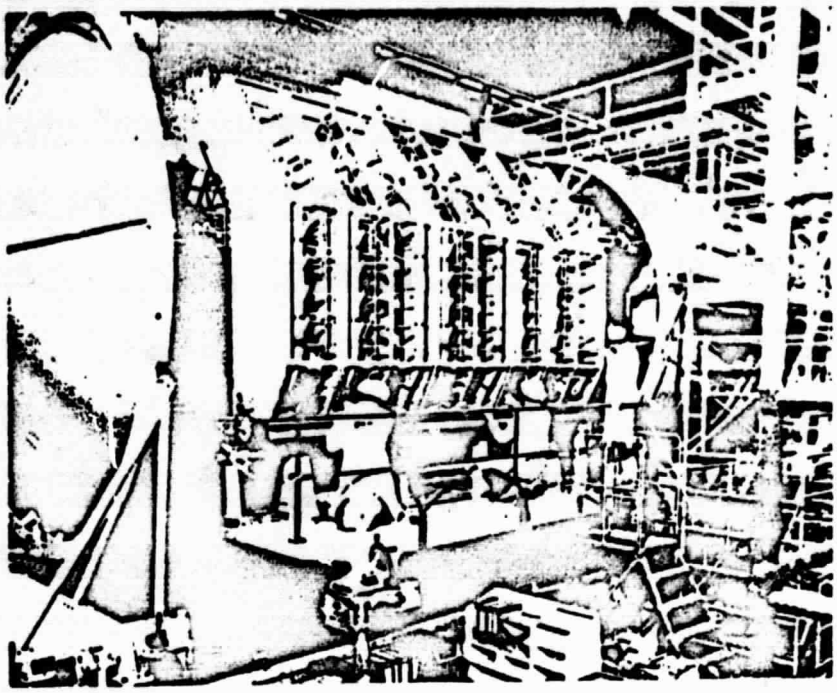
The SPACELAB utilization for technology and basic research (material experiments, process technology, medical/biosciences, remote reconnaissance of the earth and space, communication and navigation) can be subdivided into three main areas.

SPACELAB serves as development- and testing laboratory for new process technologies and for the testing of new materials. The basic systems are utilized as operational platform for earth-related, application oriented tasks with the key points remote reconnaissance of the earth, meteorology, communication/navigation. The payload capacity of one pallet is 3000 kilograms; SPACELAB in the version cabin plus pallets takes on 5.5 to 9.1 tons of payload. The third application area of the SPACELAB segment is devoted to exploration of space (astronomy, astro- and solar physics, extra-terrestrial research).

SPACELAB history

On June 5, 1974 the industrial SPACELAB consortium (12 companies from 10 European countries) under the leadership of MBB/ERNO was awarded the development and fabrication contract by the European space organization ESA. In the years 1980 and 1981 the first flight units (SPACELAB I for manned and SPACELAB II for unmanned missions) were delivered to the American NASA. The cost of the development program was 1.7 billion marks. In July 1984 the SPACELAB follow-up contract was concluded to a major extent. Until now NASA has paid 430 million marks for the identical duplication of the complete flight unit.

At the height of the development interval (1978/79) approximately 2000 technicians, engineers and scientists were working in Europe on the SPACELAB program; of that about 700 alone at MBB/ERNO in Bremen and Ottobrunn (material laboratory for SPACELAB).



View into SPACELAB internal activities, the experiment cabinets equipped with all needed operating systems. The standard cabinets can be rolled in and out individually like a train.

D1-milestones up to the launch

In the coming twelve months the astronauts, mission- and payload specialists picked for the D1-flight will under o an extensive training- and preparation program. Scientists nd technicians, who developed the payloads and who will integra e them, are proceeding in accordance with a time schedule to be maintained equally well. The most important steps to October 1985 are:

- beginning of December 1984: parabolic flights of the science-astronauts with a KC 135 from Johnson Space Center of NASA, Houston, in the USA;
- from February 21, 1985 up to March 6, 1985: mission course test with the integrated payload at MBB/ERNC in Bremen;

- last week in March 1985: coordination work of the D1-crew in the SPACELAB simulator Cologne-Porz and the ground operating crew in Oberpfaffenhofen;
- May 1, 1985: delivery of the tested payload to the Kennedy Space Center of NASA;
- middle of August until the end of September 1985: mission simulation between the German Space Operations Center (GSOC) of the DFVLR and the Johnson Space Center of NASA;
- beginning of September 1985: arrival of the "Columbia" in the Kennedy Space Center;
- September 23, 1985: integration transporter/laboratory concluded;
- September 29, 1985: integration orbiter/SPACELAB with add-on tank and fuel boosters concluded, transport to launching station;
- October 1, 1985: start of the adaptation of the sleep-awake rhythm of the crew to the shift operation times on board;
- October 5, 1985: count-down test with crew and launch team;
- October 7, 1985: start of the quarantine for the crew;
- October 14, 1985: launch of the space vehicle "Columbia" with the first German SPACELAB mission D1 on-board.

The D1-crew

Mission specialists

Guion Bluford, Ph.D., 42,
Air- and Space Travel Engineer,
First Lieutenant in the US Air Force;
since beginning of 1978 in astronaut training of NASA; member of the on-board crew of the eighth space shuttle flight in 1983; from the beginning of 1984 in preparation as crew member for the D1-mission.
Hobbies: reading, photography, sports.

Bonnie Dunbar, Ph.D., 35,
Assistant Professor for Machine Construction, University of Houston; participating since 1978 at NASA in different space flight missions; in astronaut training at NASA since 1980; from the beginning of 1984 in preparation as crew member for the D1-mission. Hobbies: amateur flying, sailing.

Science-astronauts

Dr. rer.nat. Reinhard Furrer, 44,
physicist, university lecturer for physics at the FU Berlin; since the beginning of 1983 in training for the D1-mission at the DFVLR as scientist-astronaut. Hobbies: amateur flying, sailing on the high seas, photography, music.

Dr. rer.nat. Ulf Merbold, 43,
physicist; since 1977 scientist-astronaut of the ESA; in 1983 as a member of the on-board crew of the ninth space shuttle flight, in which the European space laboratory SPACELAB was in orbit for the first time; delegated since March 1984 to the DFVLR and in training for the D1-mission as substitute. Hobbies: amateur flying, skiing, wind surfing.

Dr. rer. nat. Ernst Messerschmid, 39,
physicist, scientific coworker of the DFVLR, lecturer at the Vocational Academy at Stuttgart; since the beginning of 1983 in training at the DFVLR as scientist-astronaut for the D1-mission. Hobbies: sailing, skiing, music.

Dr. (phys./math.) Wubbo Ockels, 38,
physicist; since 1977 scientist-astronaut of the ESA; participated in 1983 as substitute in the initial deployment of the European space laboratory SPACELAB during the ninth space shuttle flight; delegated since March 1984 to DFVLR and in training as scientist-astronaut for the D1-mission. Hobbies: amateur flying, wind surfing, skiing and skating.

Our picture shows (from right to left):
Guion Bluford, Reinhard Furrer, Bonnie Dunbar, Ernst Messerschmid, Ulf Merbold, Wubbo Ockels

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