The almost forgotten Mission of K.D. Flade: MIR 92

German and Russian space managers and scientists expressed high satisfaction and pride after the successful completion of the joint space mission MIR92. Thanks to the smooth technical operation of the flight the German Cosmonaut and payload specialist Klaus-Dietrich Flade could carry out and complete all 14 experiments as planned during the mission.

17.03.1992 - 25.03.1992
Soyuz TM - 14 to
MIR Space Station
https://en.wikipedia.org/wiki/Mir

MIR92, the first flight of a West-German science cosmonaut to the space station MIR was from a scientific, but also from a political standpoint certainly one of the most challenging missions. MIR92 was also a fine example for the new opportunities offered by the cooperation between Russia and West-Germany in the field of space research exploration [1].
The first contacts for initiating the MIR 92 mission involving the German Astronaut K.D. Flade dates back to the days of the Soviet Union and was based on an agreement between the Federal Ministry for Research and Technology (BMFT) and the former Soviet Union on extended scientific and technological cooperation.
Predestined by his historic flight on 26th August 1978 [2] Sigmund Jaehn advocated for an intensive cooperation between Russia and the reunited Germany in the field manned space flight after the fall of the Berlin Wall (1989). Jaehn's many years of experience with the Russian space program was an indispensable element for the preparation and the final success of the Russian-German MIR missions.

> "With his work Sigmund Jaehn embodies the transition to a peaceful cooperation in space", said the German Research Minister Ms. Bulmahn at the 25th anniversary of the first flight of Sigmund Jaehn.

With reliable punctuality the 310-ton Soyuz rocket lifted off from the Baikonur Cosmodrome on 17th March 1992 at 16:00 hrs local time . Many VIP's from Germany had been flown in for this launch event including Research Minister Riesenhuber who kept his fingers crossed for K.D. Flade and his two Russian colleagues Alexander Kaleri Viktorenko and Alexander Kaleri, his co-travelers to MIR.
All stages ignited as planned and after separation of the Soyuz capsule from the launch vehicle the two-day transfer phase to the Mir station orbiting at an altitude of 380 km could be initiated. As a test pilot K.D. Flade was impressed by the professionalism and smoothness of the launch phase, he described the launch as "benign". In order to save fuel the approach to the space station was gradually carried out following a helical path to the MIR station. During this approach phase K. D. Flade carried out some “life science” experiments already. During the 34th orbit the Soyuz capsule approached the MIR station for final docking which could be monitored by the ground controllers via real time tv transmission. The final latching of the two vehicles took place on March 19th at 16:00 hrs Moscow time.
One orbit later the hatches were opened and the new arrivals were greeted warmly by the cosmonauts A. Volkov and S. Krikalew waiting for them in the MIR station. The two cosmonauts Alexander Volkov, onboard since October 1991 and Sergei Krikalev, resident since May 1991, arrived as Soviet citizens at the station and returned as Russian citizens with the Soyuz TM-13 on 25 March 1992 together with K.D. Flade. During their stay onboard the MIR station Boris Yeltsin was elected president and in August 1991 his famous Moscow-putsch against Gorbachev failed, finally leading to the collapse of the Soviet Union in December 1991. Also due to this turbulent political circumstances Krikalev's stay had to be extend unplanned by half a year and he could only return after 311 days, on 25th March 1992 with K.D. Flade back to Earth.
After a short familiarization period K.D. Flade immediately began carrying out his extensive test program in close cooperation with the scientists on the ground and his back-up astronaut Reinhold Ewald acting as "CapCom" (exclusive voice interface with the Cosmonaut K.D. Flade) in the Russian control center ZUP. Several small problems could be resolved quickly by Flade thanks to his extensive knowledge and skills in handling the experiment equipment. On the science expert's advices in the control centers some experiments could be repeated interactively or changed in the further course or even be expanded as necessary. Flade was working up to 16 hours a day making optimum use of his onboard stay, rarely could he enjoy the fantastic views of the Earth's surface, which all cosmonauts appreciated so much.

The MIR92 Crew at the beginning of K.D. Flade's stay on MIR [3]

Alexander Wolkow
Born 1948, Gorlowka
Flights:
Sep-Nov 1985
Nov-Apr 1988-89
Since Oct 1991 on MIR
Return with K.D. Flade
(25.March1992)

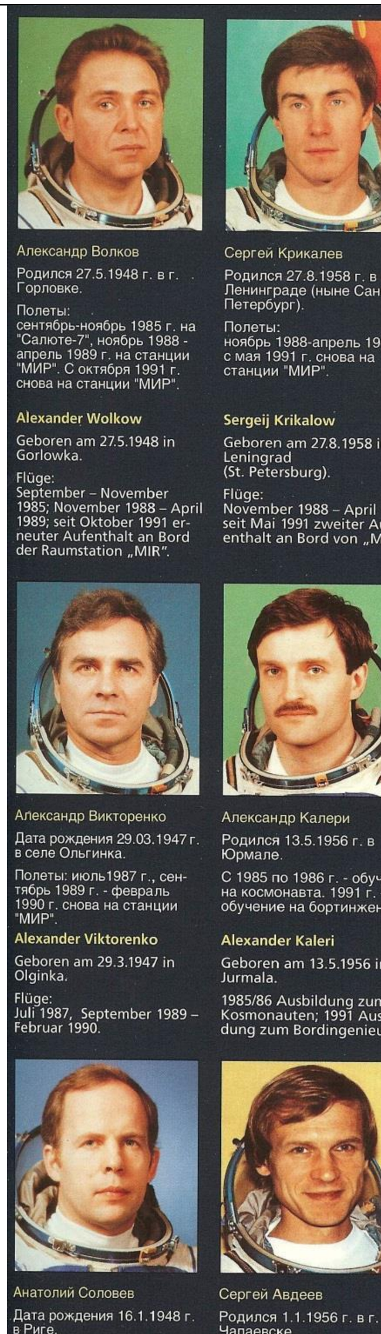
Sergeij Krikalow
Born 1958, Leningrad
Flights:
Nov-Apr 1988-89
Since May 1991 on MIR
Return with K.D. Flade
(25.March1992)

Alexander Viktorenko
Born 1947, Olginka
Flights:
July 1987
Sep-Feb 1989-90
To MIR with K.D.Flade
(17.March1992)

Alexander Kaleri
Born 1956, Jurmala
Training:
1985-86 Trng Cosmonaut
1991 Trng MIR Engineer
To MIR with K.D.Flade
(17.March1992)

Anatoli Solowjow
Born 1948, Riga
Flights:
June 1988
Feb-Aug 1990
To MIR: 27.Jul1992
(Crew replacement)

Sergeij Awdejew
Born 1956, Tschapajewsk
Training: Since 1987 as
Cosmonaut
To MIR: 27.Jul1992
(Crew replacement)



K.D. Flade
Testpilot
Born: 23 Aug1952
Büdesheim

Astronaut:
Payload Specialist
(left)

Reinhold Ewald
Physisist
Born: 18.12.1956
Mönchengladbach

Backup Astronaut
for K.D. Flade
Payload Specialist
(right)

Flew on MIR97
10Feb-2Mar 1997
MIR fire accident:
23. Feb 1997

Salutations and interviews between cosmonauts and high-ranking politicians in the control centers were additional important PR events. Small gifts and various symbolic objects such as a miniature model of the Cologne Cathedral and copies of important writings of space pioneers H. Oberth and K. Ziolkovsky were exchanged on board between the cosmonauts.

K.D. Flade worked intensively on the biomedical experiments in which he mostly was the object under examination himself. Several times he tested his physical and mental state (see experiments list at the end of the article). The scientific experiments and measuring devices especially developed German industry were later further improved to be used in hospitals for the benefit of patients. Special attention was given to this mission by the young television viewers because K.D. Flade presented a short lesson with the help of the main character of the popular "Nosy-Mouse" tv program: a 20 cm small rag doll mouse which floated repeatedly through the space station, first clad in a spacesuit and later without the spacesuit, Flade and his Russian comrades vividly explaining the main MIR systems as well as the causes and effects of weightlessness.

The program management and responsibility for Flade's scientific experiments rested with the German Space Agency at Cologne (called DARA at that time). DARA and DLR in Cologne also were entrusted with German Astronaut's selection, training and payload operations of all fourteen German experiments as well as with the supervision of the German Cosmonaut during his stay in the MIR station.
A DLR operations team stationed at the Russian control center (ZUP) located in a separate control room but fully integrated with the ZUP operations teams fulfilled and executed all necessary operational tasks.
For all Russian aspects the overall project management was assigned to NPO Energia S. P.Korolev.

However, on special occasions during the MIR'92 mission also real time video sequences of the MIR Video Oculography (VOG) experiment were created and sent directly to the German Space Operations Center (GSOC) at DLR, Oberpfaffenhofen. The same was true for real time telemetry data being transmitted through the ZUP-DLR / GSOC satellite link using the Austrian DATAMIR unit of the MIR telemetry system and ZUP ground data processing facilities. A mission time-lining exercise with ZUP could be successfully executed as well.
This first real-time connectivity between GSOC (Oberpfaffenhofen) und ZUP (Kaliningrad/Moscow) paved the way for more GSOC responsibilities in the European cooperation with the MIR station like the ESA EUROMIR96 (134-days flight of Thomas Reiter – including first EVA of a German Astronaut/Cosmonaut) and the German MIR97 mission, the flight of Reinhold Ewald with the fateful fire accident onboard the station (see ***Note*** below, right).

K.D. Flade during his PR program with the "Nosy Mouse" character.

K.D. Flade and R. Ewald during simulation and training in the Soyuz capsule

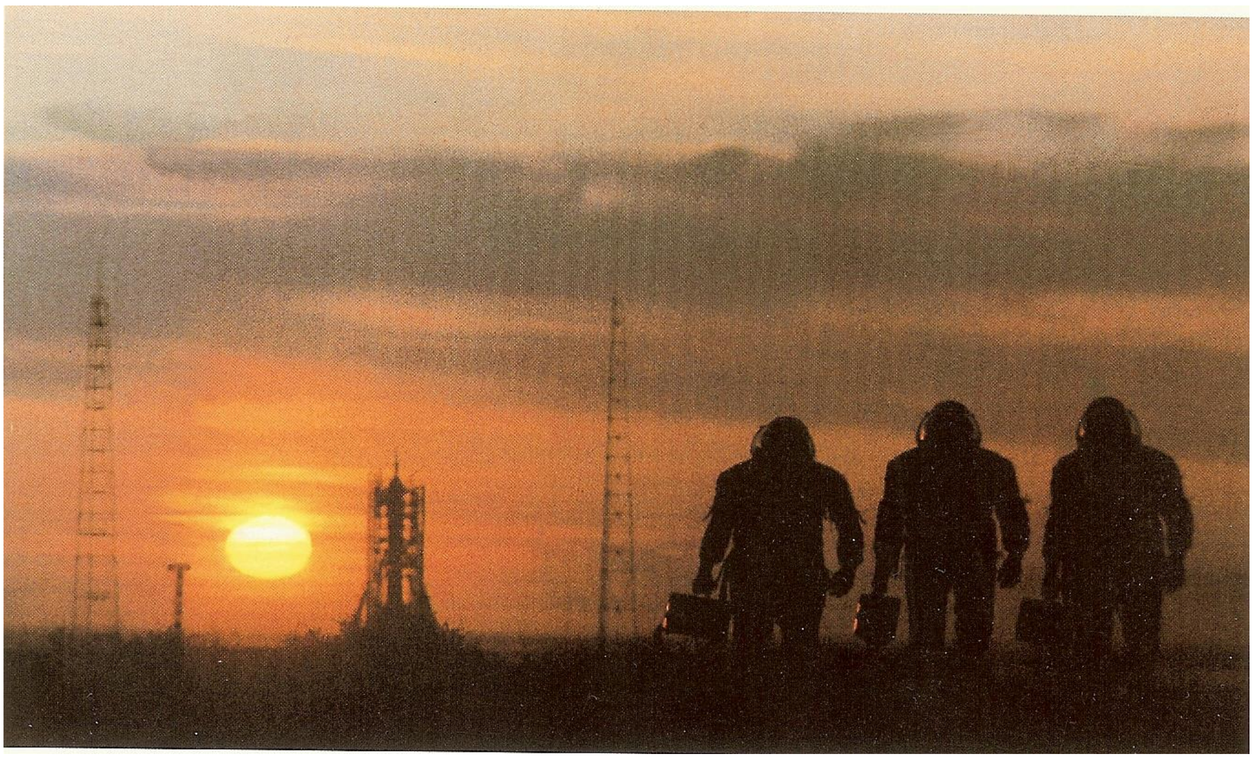
Note
After the breakout of the fire – which occurred during non-station contact with ground control, GSOC established the first voice contact with the MIR crew using its antenna installed on top the GSOC control center building and sending the voice in real-time to ZUP gaining approximately five minutes of extra contact before the Russian network could acquire the link

Finally, for K.D. Flade and the two Russian long-term cosmonauts the time had come to return to Earth and they made all logistic preparations for ingress into the return capsule, docked since half a year to the MIR station serving as rescue vehicle. On the morning of March 25th K.D. Flade and the two Russians strapped themselves securely into the return capsule Soyuz TM13, in which about half a year before the Austrian F. Vieboeck was flown to the MIR station. The descent from the MIR orbit only took about three hours, and at 11:50 am Moscow time the capsule landed safely on a parachute in northern Kazakhstan, thus K.D. Flade had nearly spent eight days or exactly 7d 21h 57min in orbit.

Epilogue

The MIR [lit. “Peace”] space station does not exist anymore, it was deorbited on March 23rd , 2001 because Russia joined the International Space Station (ISS) as formal partner and could not afford to maintain the responsibility for tending two active space stations. Of course the “old age” (15 years) of the MIR station (the construction in orbit started February 20th 1986 played an important role for this decision also.

Follow a brief “nostalgic” tour through the archaic MIR space station, starting within the docked Shuttle during one of the visits to the MIR station as agreed in the Shuttle-MIR Program (space station “Phase-1”) between Russia and the USA in 1993.



German MIR92 Experiments

Video Oculography (VOG)	University Berlin	The human vestibular organ is constantly reacting to gravity on earth and it is stabilizing the eye during head movements and motion accelerations. By observing the eye movements with a video camera during ascent (transition into weightlessness) and in the microgravity environment onboard an analysis of the vestibular organ is possible and might allow also to conclude on the cure of vestibular disturbances occurring on Earth like vertigo.
Vestibularis Investigations (Ocular-Vestibular-Investigation, OVI)	University Mainz	The goal was to investigate whether the motion sickness in the onboard microgravity environment is caused by an asymmetry of the vestibular organs and whether the motion sickness is caused by the lack of differentiation between internally and externally caused motions. In addition it was investigated how the visual system compensates the missing vestibular functions during weightlessness.

Intraocular Pressure (TON)	University Hamburg (Ophthalmology)	The goal was to investigate the influence of the fluid shifts in the body during weightlessness on the intraocular pressure. For this purpose a handheld "tonometer" for measuring the intraocular pressure by the cosmonaut himself was developed. As a spin-off the "tonometer" is used for clinical applications as well.
Human Fluids Redistrubution (KFV)	DLR (Aeromedical Center)	The redistribution of bodily fluids during the flight was investigated by measurements alongside and perpendicular to the main body axis and around the thigh. Various exercises were planned during the measurements as well as the application of under pressure device to the lower body part. The spontaneous reaction of the blood pressure to the sudden changes between weightlessness and gravity (under pressure) could be measured.
Hormonal Parameters in Microgravity environment (HPM a)	University Munich	It was investigated for the first time whether microgravity not only influences bodily fluid distribution and the cardiovascular system but also blood- and lymph volume controlling hormones , the regulation of circadian variations and hormones regulating stress, the gastrointestinal tract, water and electrolyte balance.
Volume-Regulating Hormones (HPM b)	University Berlin	When adapting to weightlessness and re-adaptation after landing the fluid controlling hormones play an important role. By analyzing the blood samples before and after the flight hormonal control dynamics influencing the cardiovascular system and the renal function is investigated in depth.
Isometric Leg Stimulation (ISX)	German Sport University Cologne	In physical labor heart rate and blood pressure actuators can be triggered by receptors located between the muscle cells and will be affected by the local water content of the tissue. Weightlessness may affect them in two ways: by redistribution of body fluid and by changing the structure of the intercellular area. To examine this more closely, heart rate and blood pressure are measured in mild static work the calf.
Measuring of Skin Thickness Layers (HSD)	University Berlin	With ultrasonic probes on forehead and shin of the cosmonaut tissue thickness was to be measured. Of interest was also the question of whether the elasticity of the tissue in humans is modulated dependent on gravity-levels and thus allowing fluid shifts within the body. A failure of this - to be examined - mechanism would cause i.a. edema formation in patients located on Earth. This might illustrate the also important clinical significance of the experiment.
Sleep and circadian rhythm (SUR)	DLR (Aeromedical Center)	The experiment is based on the hypothesis that the internal clock of humans in space produce flatter daytime/night rhythms (e.g., body temperature). Insomnia might result. Even the dream phase could last longer. The German Cosmonaut will record his sleep-encephalogram via electrodes attached to a headband.

Spatial orientation / Space sickness (ROK)	Max Planck Institute (Seewiesen)	In weightlessness there is no “up” and “down” indicated by gravity. In his subjective feeling a human being strives for an orientation in the changed environment - this however depends on the individual type. Some test-subjects experience “up” toward their heads, others in the direction of their feet. The impact of this different behavior on the susceptibility for space sickness will be examined by pre-flight and follow-up examinations as well as by tape protocols furnished by the Cosmonaut during his flight.
Psychological Performance Test (PSY)	DLR (Aeromedical Center)	The adaptation to weightlessness is a burden for the organism that can manifest itself in the form of dizziness, nausea and consequently in reduced performance. For the first time Cosmonauts will be subjected to standardized psychological stress during flight. So it will be examined whether a decreased performance of general nature occurs, or if features such as short-term memory or psycho motoric are specifically affected.
Dosimetric Measurements (DOS)	DLR (Aeromedical Center)	Spacecraft are subjected to a complex radiation field of electromagnetic radiation and particles of solar and galactically origin. DOS is designed to measure the radiation field within the MIR station using nuclear track detectors. The results are incorporated in a research program which examines also the question of the radiation exposure of aircraft passengers on long-distance flights.
Chromosome Aberration (CHR)	University Essen (Institute for Genetics)	Exposure to ionizing radiation induces tissue damage to the chromosomes. An increase in the frequency of such damages is an indication of an increased genetically and for increased cancer risk. This can be determined by examination of the lymphocytes of the blood. Corresponding analyzes before and after flight reveal possible changes in the lymphocytes.
Specific Heat of Super-cooled Melts (TES)	DLR, Humboldt University (Berlin), Academy of Science (Prague), NPO Energia	This experiment is designed to determine the specific heat of molten metal in the region of super-cooling which, in weightlessness can be extend below the melting point. As scientific results new information on the thermo-physical properties of super-cooled melts are expected. These data also play a central role in the basic description of the liquid state.

References:

[1] Enzyklopädie Raumfahrt W. Engelhardt, 2001, ISBN 3-8171-1401-X

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[3] DARA/DLR/NPO Energija MIR 92 Broschüre, Köln-Porz, Februar 1992

[4] Video Oculography Experiment on MIR92 (P. Burfeind, P. Hofmann, A. Kellig, P. Rank, Kayser T hrede GmbH (KT), Munich) http://adsabs.harvard.edu/full/1994ESASP.366..509B