German Ground Station Weilheim (ZDBS)
50 Years of Operations

On November 20, 1967, the then Federal Finance Minister Franz Josef Strauss (from 1978 onwards Minister-President of Bavaria), laid the foundation for the first German satellite ground control station at Weilheim. After Germany had decided in the 1960s to become active in aerospace research by developing and establishing a national space program, DVL - the German Research Institute for Aviation, one of the forerunner organizations of today's DLR, the German Aerospace Center – was entrusted with the planning and implementation of the central station for the German satellite ground control system, designated as "Zentrale deutsche Bodenstation" (ZDBS).
As location the high plateau at Weilheim-Lichtenau was selected because the forest area and its surroundings had only thin population with no major industries present.
For Strauss this event was the symbol for Germany entering the space age, but it also was a stark symbol for Bavaria transforming from an agricultural country into the world of modern technology.

Just two years later, AZUR, the first German research satellite was launched successfully and Weilheim started its data acquisition and tracking operations by acquiring the first tracking pass of AZUR after lift-off. The control of the satellite was the responsibility of the DLR's newly built satellite control center (German Space Operations Center –GSOC) in Oberpfaffenhofen. With this successful first mission the new German ground operations system put its capacity under proof. Over 170 satellite missions have since been supported by ZDBS and GSOC.
Today, the ground station has become an essential communication link between the Earth and low earth orbiting (LEO) satellites as well as for deep space scientific probes and commercial satellites in geostationary orbit (GEO), thus demonstrating its outstanding versatility and importance for European space exploration and exploitation.
Other space agencies or commercial satellite operators are booking "antenna time" regularly for their missions or are utilizing the equipment for compatibility test purposed before commissioning the satellites into orbit.
In addition, the station also supports research work - e.g., in the area of developing and testing future-relevant transmission technologies for large amounts of data.

Highlights
Deep Space Network
Especially the Weilheim 30m antenna as part of an international ground network supported numerous deep space missions. Built in 1974 for the German-American Sun probe HELIOS and operated for over more than 10 years for HELIOS, it was integrated into NASA's deep space network. During the "cruise phase" of the Voyager probes (start 1977) the 30m antenna "accompanied" and collected data from the two Voyager probes during their long journey to Jupiter. ESA's first comet mission Giotto was supported from July 2, 1985 onwards under ESA contract during critical mission phases.
The current deep space mission using the 30m antenna support is the Hayabusa-2 mission of the Japanese space agency JAXA, travelling to an asteroid and attempting to return material samples back to Earth.

High Data Rate Exploitation
In order to meet the ever-growing demand for radio transmissions, on the one hand attempts are made to use available frequencies more efficiently, i.e., to transport more information on the same transmission channel, on the other hand to use previously not accessible higher frequency ranges. Especially the Ka-band measuring system commissioned in 2012 investigates how to use the higher frequencies in Ka-band at about 18-31GHz for earth observation satellites. Beyond the Ka-band frequencies optical communication techniques for satellites are researched, which means frequencies 10,000 times higher than the conventional ranges are investigated. This work is conducted by specialized DLR research institutes and supported by the ground station Weilheim complex with its existing experience, infrastructure and equipment.

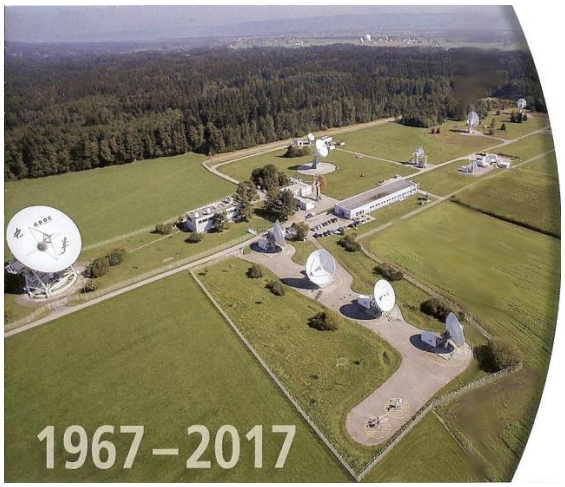
EDRS Antenna Management Center (AMC)
The European satellite system EDRS (European Data-Relay System) should improve the data transmission contacts for future LEO imaging and high data rate missions. Multiple EDRS satellites in geostationary orbit will collect the data of LEO satellites which turn would forward the received data to a permanently visible ground station. Currently the first satellite, EDRS-A is in orbit. The second, EDRS-C, is scheduled to be

launched in 2018 to be followed by at least one more, EDRS-D.
To use this system for the enormous amounts of data observation missions produce, the data transfer between the served satellites and EDRS is facilitated by laser connection. The connection between the EDRS satellites and the ground uses Ka-band frequencies, which enable transmission of high data rates, but is affected by weather conditions in the atmosphere. Nevertheless, in order to guarantee stable data transfers at all times a total of four ground antennas distributed over three ground station locations are provided for the two satellites EDRS-A and -C. The stations are distributed Europe-wide: two antennas are located in Weilheim and one each in Redu (Belgium) and Harwell (England).

In Orbit Testing (IOT)
To test a satellite already in orbit (In Orbit Test - IOT), a ground antenna system which characteristics are known very precisely is needed, so that every deviation between expected and measured values can clearly be determined and it must be guaranteed, that this deviation is not caused by equipment in the ground system. The Ka-band measuring system put in operation in 2012 meets these high quality standards. Besides the functionality of the satellite also the required quality of the services provided by the satellite can be certified.

Situational Awareness
Currently a very interesting research project at the ground station Weilheim is called IoSiS (Imaging of Satellites in Space).This is a RADAR based system which can map satellite systems in space. Satellites Positioned in populated orbits are under constant threat to either collide with another satellite or with so-called space-junk material.
Within the framework of the project IoSiS, the DLR institute for high-frequency technology and radar systems developed and installed a radar system at Weilheim. The system theoretically achieves a spatial resolution of up to three centimeters and thus would be able to provide accurate information about the condition of satellites as well as potential threats for them. From April 2017 to the end of June 2017, an IoSiS measurement campaign was used to investigate what had been achieved so far and how the quality of data can be ensured and optimized in the future.

Center for Satellite Based Crisis Information System (ZKI)
The Center for Satellite Based Crisis Information (ZKI) is a service of DLR's Remote Sensing Data Center (DFD). In crisis situations anywhere in the world, action must be taken quickly to help people in need.
The ZKI is one of the world's largest main information processing centers of satellite data to be used in critical situations. It supports the forces involved in natural disasters and humanitarian emergencies with need-based thematic mapping and visualizations (floods, tsunamis, earthquakes etc.) .
For this purpose ZKI has organized a 24/7 operation setup. The products will be tailored and made accessible to the specific needs of national and international decision makers, situation centers and aid organizations. The necessary satellite capacity can be used at any time. The ground station Weilheim also provides a 24/7 service, allowing ZKI's access to appropriate satellite data at any time.




6,8m Antennas
Ka-Band (2)


9m Antenna
S-Band


11m Antenna
Ku-Band


13m Antenna
Ka-Band


15m Antennas
S-Band (2)


30m Antenna
Multi-Band

Reference:
“Satellitenbodenstation Weilheim“, Anniversary Brochure, Nov. 2017, DLR-RM