Poland's contribution to space exploration

50 Years in Space

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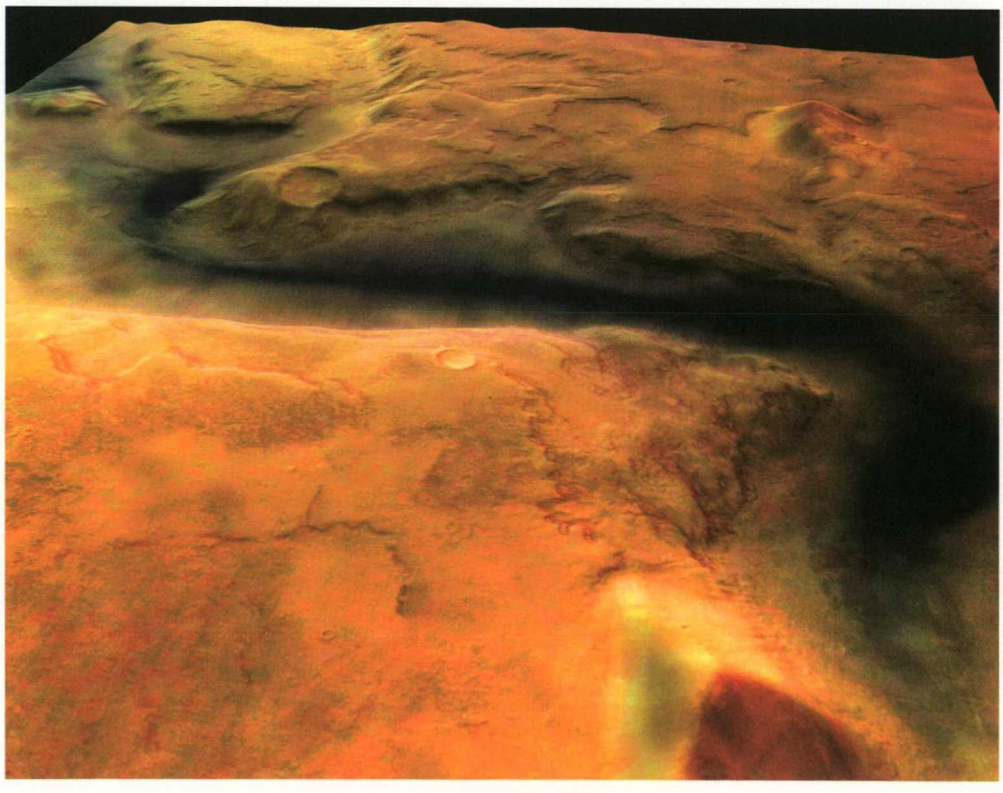
We have now reached the 50th anniversary of when mankind first began exploring space – the traditional start of the "space era" came with the launch of the first artificial satellite on 4 October 1957, followed by the first manned spaceflight on 12 April 1961. Nowadays we rarely stop to notice how many aspects of our daily lives are derived from this half-century of space research

Space science or space research developed in the latter half of the 20th century – as a new, interdisciplinary field of the modern natural sciences, merging various elements of inquiry and application across physics, astronomy, geophysics, geodesy, chemistry, and even biology and other disciplines. At present, space research is seen as one of the basic mechanisms driving technological advance. Initially, spectacular achievements in conquering space were spurred by the rivalry between the United States and the Soviet Union. Nowadays such rivalry is slowly giving way to cooperation, and space exploration is ever more clearly becoming a key stimulator of economic growth, as probably the most productive field giving rise to new technologies and advances in many fields of research.

Human activity in space

Human activity in space to date can be classified into at least four types:

- activity focused towards the Earth itself, assisting various fields of Earth science and



ESA/DLR/FU Berlin (G. Neukum)

The Mars Express probe detected sources of water ice on Mars's north pole. An important role in this discovery was played by a high-resolution Fourier spectrophotometer constructed at the Space Research Center, Polish Academy of Sciences. This picture taken by Mars Express shows the Reull Vallis canyon on Mars, which was most likely once carved out by running water

their applications in meteorology, telecommunications, navigation, ecology, etc.,
- activity harnessing the unique conditions of space (e.g. vacuum conditions and weightlessness) for carrying out experiments in physics, chemistry, biology, medicine, etc., and also performing various production tasks,
- activity focused on the Earth's surroundings, surveying various bodies in the Solar System and interplanetary space,
- activity aimed at gleaning a better awareness of the wider Universe, through astronomical observations performed beyond the Earth's atmosphere.

Such activity has relied on man-made instruments launched into space. To date, more than 4,500 rockets have been launched, carrying nearly 32,000 objects of various sorts away from the Earth. The number of satellites and space probes that are now active, i.e. still carrying out the tasks they were designed for, is estimated at about 800. Several man-made objects have already managed to move significantly further away from the Sun than the most distant planet in our Solar System. Human-constructed devices have also operated on 6 heavenly bodies (the Moon, the three planets Venus, Mars, and Jupiter, the asteroid Eros, and Saturn's moon Titan), one of which, the Moon, has been visited by humans. More than 450 individuals (including 46 women) have been in space, with the record-holder having spent a total of 750 days in orbit over three flights.

Largest projects

Among the most significant and particularly interesting projects for the exploration of space, we can list the following:
- studying the moon, most spectacularly through manned landings on its surface,
- using space probes to study all eight planets in the Solar System plus their satellites,
- observing the Universe through the Hubble Space Telescope and other space-based astronomical instruments, enabling electromagnetic radiation to be registered and analyzed in all spectral ranges,
- constructing Earth observation and communications satellite systems and bringing them into common use,

Space Research Center archives

The scanner of the Polish-designed Planetary Fourier Spectrometer (PFS) aboard the Mars Express probe

- creating the Global Positioning System (GPS) for pinpointing locations and mobile objects anywhere on the Earth's surface, regardless of weather conditions or the time of day,
- building and operating the International Space Station, an orbital laboratory designed to perform a wide range of tasks, slated to become fully functional in 2010.

Poland in space

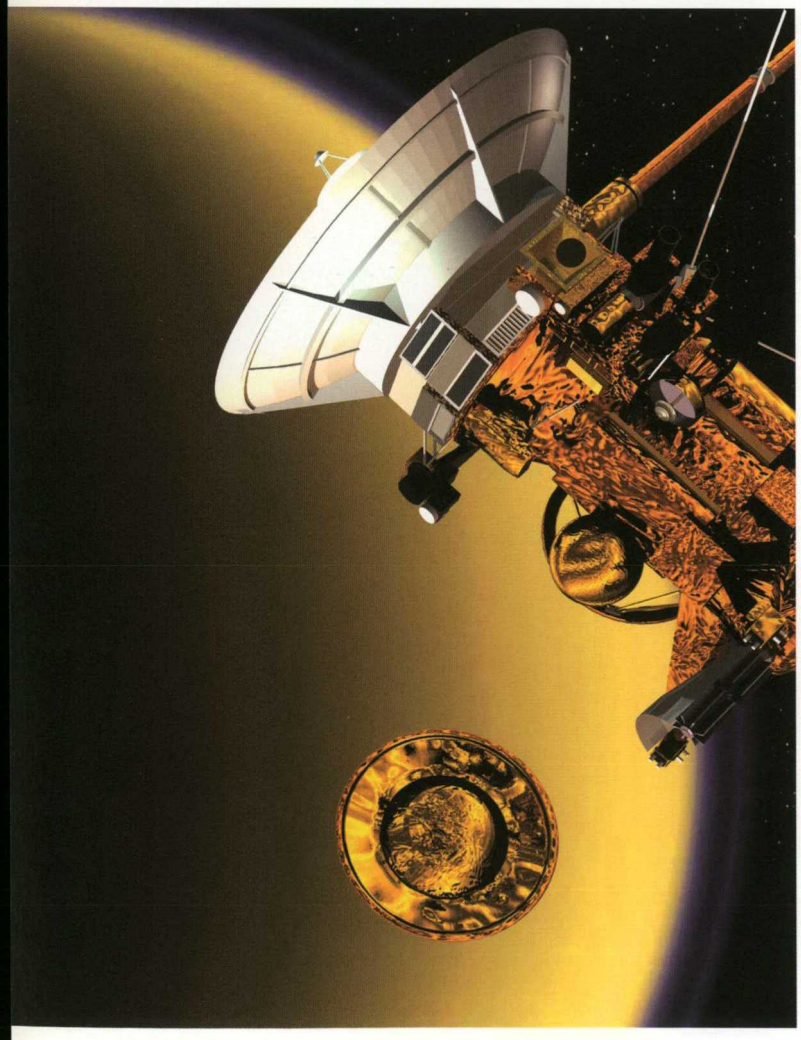
Poland has contributed to world space research almost from its very outset - beginning with observations of the first artificial satellites, mainly for geodesic purposes, and the construction of small Meteor rockets (reaching a ceiling of 100 km) for meteorological study of the atmosphere. The establishment in 1967 of a joint program for space research and exploration among the so-called socialist states, called INTERKOSMOS, offered Poland its only chance at that time to actively participate in space experiments aboard Russian missiles and satellites. A Polish-built scientific instrument was launched into space for the first time in 1970 on a Vertikal-1 missile. The first Polish orbital experiment was carried out in 1973 aboard the Interkosmos-Kopernik 500 satellite (commemorating the 500th anniversary of Nicolaus Copernicus's birth). A satellite communications station in Psary near Kielce was put into stable operation the same year, thus incorporating Poland into the international telecommunications system.

Poland's first (and so far only) astronaut spent several days on board the Salut 6 or-

bital station in 1978. In 1984, Polish instrumentation traveled out on an interplanetary probe for the first time: our involvement in the VEGA mission, an element of one of the largest international research undertakings (known as International Halley Watch) organized to study the famous Halley's comet on its approach close to the Sun in 1986 amid great interest, proved that our intellectual and technical potential could ensure Poland the role of a significant partner among countries involved in space research.

The Space Research Center, a scientific institute of the Polish Academy of Sciences, ensures our country's involvement in many space missions that are attractive from the research perspective. As examples we can mention:

- the Cassini mission launched in 1997 - one of its key elements involved landing the Huygens probe on the surface of Titan, Saturn's largest moon, on 14 January 2005, carrying an apparatus designed in part by the Space Research Center, Polish Academy of Sciences: a sensor for measuring the temperature and thermal properties of the moon's atmosphere and surface,
- the Integral high-energy astrophysical laboratory launched into Earth orbit in 2002, designed for studying the most mysterious objects in the Universe (such as neutron stars, supernovae, black holes, active galactic cores), equipped with an instrument built in part by the Space Research Center, Polish Academy of Sciences (the Copernicus Astronomical Center, Polish Academy of Sciences, is also involved in preparing the research program for the Integral project and analyzing the data obtained),
- the Mars Express probe, which has since 2004 been observing and measuring the atmosphere and surface of Mars - including by means of a Fourier spectrometer which the Space Research Center, Polish Academy of Sciences, made a significant contribution to,
- the Rosetta probe launched in 2004 to study the comet 67P/Churyumov-Gerasimenko - a lander is slated to set down on the surface of the comet's surface in 2014, with one of its main elements being a penetrator designed and built by the Space Research Center, Polish Academy of Sciences, together with a device which will be lodged tens of centimeters deep to study the physical and chemical properties of the (probably) icy surface of the comet's core.



ESA-D. Ducros

An artist's impression of the Huygens probe separating from the Cassini spacecraft, to land three weeks later on the surface of Titan, Saturn's largest moon, carrying instrumentation constructed by the Space Research Center, Polish Academy of Sciences

International cooperation

Space exploration is only possible via broad international cooperation. These days, Poland's chief partner in its space-related activity is the European Space Agency (ESA), an international, inter-governmental organization set up in 1975 to pursue a joint European program for studying and harnessing space and to support the development of modern and competitive industries in ESA member states. The ESA operates in cooperation with the European Union, especially in terms of setting long-term European space policies. While Poland is not yet a fully-

ESA/Astrium – Erik Viktor

The Rosetta probe is carrying a lander slated to touch down on the surface of the comet 67P/Churyumov--Gerasimenko. The lander is equipped with a penetrator with an hammer insertion device, called MUPUS, and constructed at the Space Research Center of Polish Academy of Sciences

fledged member of the ESA, its involvement in the Agency's R&D programs has been facilitated by bilateral agreements since the 1990s. The third and most extensive such agreement (the "European Cooperating State Agreement Between the European Space Agency and the Government of the Republic of Poland") was signed in April 2007, drawing our country – alongside the Czech Republic, Hungary, and Romania – into the special Programme for European Cooperating States (PECS). This enables our research institutions to take formal part in ESA programs and gives industrial companies a chance to seek public contracts on the European space market, paving the way for developing cooperative links and for catching up in terms of the market experience our country lacks.

The European Space Programme currently under development, with the fundamental aims of broadly harnessing the opportunities satellite technologies currently offer the European economy and ensuring Europe's autonomy in its space activity, concentrates on developing the Galileo satellite navigation system and the GMES system (Global Monitoring for Environment and Security). Participation in PECS has given Poland the opportunity to take active part in the implementation of the European Space Program, not just in terms of research (as it has so far been doing) but also in the field of economically harnessing space technologies. ■

Further reading:

www.nasa.gov
www.esa.int
www.kosmos.gov.pl
www.cbk.waw.pl

Space Research Center archives

The Polish-built MUPUS instrument (Multi-Purpose Sensors for Surface and Sub-Surface Science)