

**Please recycle.** ESA wants to make its one-shot automated transfer vehicle (ATV) into a reusable craft.



SPACE

## Cloudy Future for Europe's Space Plans

A string of successful missions had the European Space Agency riding high and making ambitious plans, but the worldwide financial downturn may bring it back to Earth

Doing science in space is, above all, expensive, so space researchers often find their careers hanging on the decisions of government ministers rather than grants committees. In Europe, the pinnacle of this nail-biting process happens roughly every 3 years when the European Space Agency (ESA) convenes a meeting of politicians from its member states to agree on budgets and approve new programs.

With the dark cloud of a global economic crisis overhead—Germany, for example, last week confirmed that it was in a recession—ministers will gather in The Hague, the Netherlands, next week for the latest such meeting. The air of uncertainty leading into this gathering contrasts starkly with the last, which was held in Berlin in 2005, when ESA got almost everything it asked for (*Science*, 16 December 2005, p. 1749). This time round, governments are tightening their belts, and the run-up to The Hague conference has seen wrangling over funding for even well-established ESA programs. “Earlier in the year, it looked like this meeting would be straightforward. Now it looks to be a very crucial and very tricky one,” says space scientist Mark Sims of the University of Leicester in the United Kingdom. “Economic times are difficult.”

In contrast to NASA, whose budget is set by the U.S. Congress every year, ESA works on a roughly 3-year cycle. This gives projects added stability, if approved, but it also means that a lot rides on each ministerial budget meeting. Getting 18 different governments, with differing priorities, to agree on something can be like herding cats. “Germany and Spain are the most ambitious at the moment and want bigger roles. Other countries are retrenching,” says Mike Healy, head of earth

observation, navigation, and science with the aerospace company EADS Astrium.

The wildcard in the pack is Italy, which contributed generously in 2005 but has since had a change of government and consequently a new chief for the Italian Space Agency, industrialist Enrico Saggese. Apparently following a shift in emphasis ordered by Italian Prime Minister Silvio Berlusconi, Saggese has so far emphasized national space projects, and it looks as though he will not have a lot of new money to put on the table in The Hague.

Italy's and other nations' reluctance to increase their contributions to ESA means that next week's negotiations will be tense. At risk will be some high-profile future missions, including ExoMars, an ambitious mission to the surface of the Red Planet, and Kopernikus, an effort to turn environmental monitoring into an operational service. “Ministerials sometimes bring surprises, both pleasant and unpleasant ones,” says Sims. “We all cross our fingers and hope our missions will survive.”



**Copy charges.** ESA members are happy to pay for environmental monitoring Sentinels, but not the backup craft.

### Costly options

In recent years, ESA's stock has risen as the agency has completed a series of high-profile science missions, such as planet mappers Mars Express and Venus Express, the Huygens lander on Titan, the Rosetta comet chaser, and space telescopes Integral and XMM-Newton. All were funded through ESA's science program, one of the agency's mandatory programs in line with its gross domestic product. Because all 18 member states have to agree to the program's total budget, large increases are rare. At the 2005 meeting, officials were pleased to get annual increases of 2.5%, just above inflation, after years of flat funding. “We've had a small growth in purchasing power,” says ESA Science Director David Southwood.

With inflation now above 4%, next week ESA will ask for 3.5% yearly increases in the science program's €396 million annual funding, which, if as expected the recession forces inflation down, should give some wiggle room. “The issue for me is how fast we can introduce the new missions selected earlier this year for further study,” says Southwood. These include a mission to the outer planets, an x-ray observatory, and the first space-based gravitational-wave interferometer. Southwood is expecting a tough debate next week. “The battle is between the majority who are happy to go along with [the increase], and one or two who feel they can't afford it.”

Yet the fighting may be even fiercer over ESA's optional programs, to which member nations can contribute as much, or as little, as they like. In deep trouble is the

ExoMars mission. Part of the Aurora program to send a series of probes to Mars and possibly the moon, followed by crewed missions, ExoMars was well-supported in 2005 and given a budget of €650 million. Since then, researchers have kept adding new capabilities, and ExoMars's costs have snowballed. In spring 2007, a program committee gave the ExoMars team approval to move ahead with an expanded mission, including an orbiter, a static base station, and a rover with a drill to get samples from below the surface. Cost estimates are now at about €1.2 billion, and managers figured that ministers, enthusiastic in 2005, would pony up again in The Hague.

They figured wrong. Italy, for one, will pay no more than the €250 million to €300 million it agreed to 3 years ago in Berlin (40% of the original project), Saggese told the International Astronautical Congress in September. Although other nations, including the United Kingdom, want to increase their contributions, these fall well short of the €1.2 billion needed. "We're not going to get that much, but we could reach €1 billion," says Southwood, who, in a shuffling of portfolios, took over the robotic parts of Aurora a few months ago. Healy says some states want to keep the budget at €800 million and scrap the rover, a decision that could cause the United Kingdom to pull out. "Potentially, it could all collapse," says Sims, "but the implications of not continuing with Aurora would be pretty severe for ESA and Europe."

ESA's current plan is to delay ExoMars's launch from 2013 to the next window in 2016 to get some breathing space to reconfigure the mission. Next week, ESA will ask member states to indicate their level of funding for ExoMars, and the mission's managers will spend the next year talking with potential partners, such as NASA and the Russian Space Agency, about sharing costs. Sims thinks that teaming up with the United States could work well. NASA is already planning a rover mission for 2016. Together, the two agencies could launch a series of Mars probes culminating in a joint sample-return mission the following decade. "It could be quite a good marriage of capabilities," he says.

Storm clouds are also gathering over Kopernikus (formerly GMES), the environmental monitoring program. Kopernikus is one of two large collaborations between ESA and the European Union (E.U.). It aims to provide operational data on Earth, the oceans, and the atmosphere for government

agencies, businesses, and other users. ESA's role is to provide the hardware: the ground infrastructure for processing data and delivering it to users, and a series of five spacecraft, dubbed Sentinels, each with different sensors. Sentinel-1, for example, provides all-weather radar imaging, whereas Sentinel-2 will produce multispectral images like the U.S. earth-monitoring satellite Landsat, and Sentinel-3 will monitor land and sea-surface conditions with a radar altimeter and temperature and color sensors.

ESA is looking for €850 million in funding from 2009 to 2018 to continue construction of the first four Sentinels, with launches beginning about 2011, and to make Kopernikus an operational system. But a spat has broken out over who pays for what. Each of the Sentinels will be followed by a duplicate, or b-unit, put in place to ensure continuity of data. "We need a certain budget from countries that paid for a-units to make b-units," says ESA earth observation chief Volker Liebig. But some countries

to the station. At the moment, each ATV is discarded after delivering its cargo, but ESA wants to give it a reentry capability to return material to Earth. Support for ISS varies among member states; the United Kingdom, for example, takes no part in human space flight. "This will be a challenging issue," says David Parker, head of space at the U.K.'s Science and Technology Facilities Council. "Some want funding to go up, some down."

There is also likely to be a new round of discussion about astronaut-carrying spacecraft. ESA has long struggled with this topic: A planned minishuttle called Hermes was canceled in 1993, and the 2005 Berlin meeting nixed a plan to develop a shuttle called Clipper with Russia. As a result, ESA astronauts must hitch a ride on the U.S. shuttle or Soyuz. Next week, ministers will consider another ESA-Russian proposal, this time for a capsule that looks similar to Orion, NASA's shuttle replacement. But EADS Astrium will also present a rival plan for a crewed vehicle based on an evolution of the ATV and lofted with Europe's Ariane V rocket. Decisions are unlikely at this meeting, but ministers may approve seed money.

#### In with the new?

Several entirely new programs will also be put to the ministers in The Hague. One is a climate change initiative that will demand no new spacecraft but will involve recalibrating archival data so that they can be compared with newly acquired data from the latest satellites. That project, whose

budget from 2009 to 2014 would be €170 million, will "build on what we have ... to create [a] long time series of essential climate variables," says Liebig. "It's not a trivial task to calculate these data sets," he adds.

Another plan calls for €50 million between 2009 and 2011 to investigate a space situational awareness system: a network of telescopes that will track all current and decommissioned satellites, space debris, and near-Earth objects and monitor space weather to give Europe warning of any threats to its satellites or ground infrastructure. At the moment, Europe must rely on warnings from other space agencies. ESA now feels it's time to take on that responsibility itself.

While researchers keep their fingers crossed, the negotiators will be trying to get the best possible roster of programs with the money available. Says Parker: "That's the genius of Europe: finding compromises."

—DANIEL CLERY



**Deflated.** ESA managers got carried away with ExoMars. Funders now want it scaled back.

don't want to pay up, arguing that the customer, i.e., the E.U., should pay for them. There are precedents: For each new generation of European weather satellites, ESA makes the prototype and EUMETSAT pays for the rest. "Most member states are concerned about the funding of b-units," says Healy.

As *Science* went to press before The Hague meeting, Liebig said that he was still "in full negotiation" with member states looking for a compromise. "I'm optimistic we won't be undersubscribed. [The environment] is still high on the [political] agenda," he says.

The extent of ESA's partnership with NASA on the International Space Station (ISS) is also up for discussion next week. ESA's Columbus laboratory module was delivered to ISS earlier this year (*Science*, 30 November 2007, p. 1374), and ESA wants more funding for microgravity research there and to upgrade the automated transfer vehicle (ATV) it has already built for delivering cargo