

NEWS IN FOCUS

BIOFUELS How Brazil's ambitious ethanol drive has sputtered **p.646**

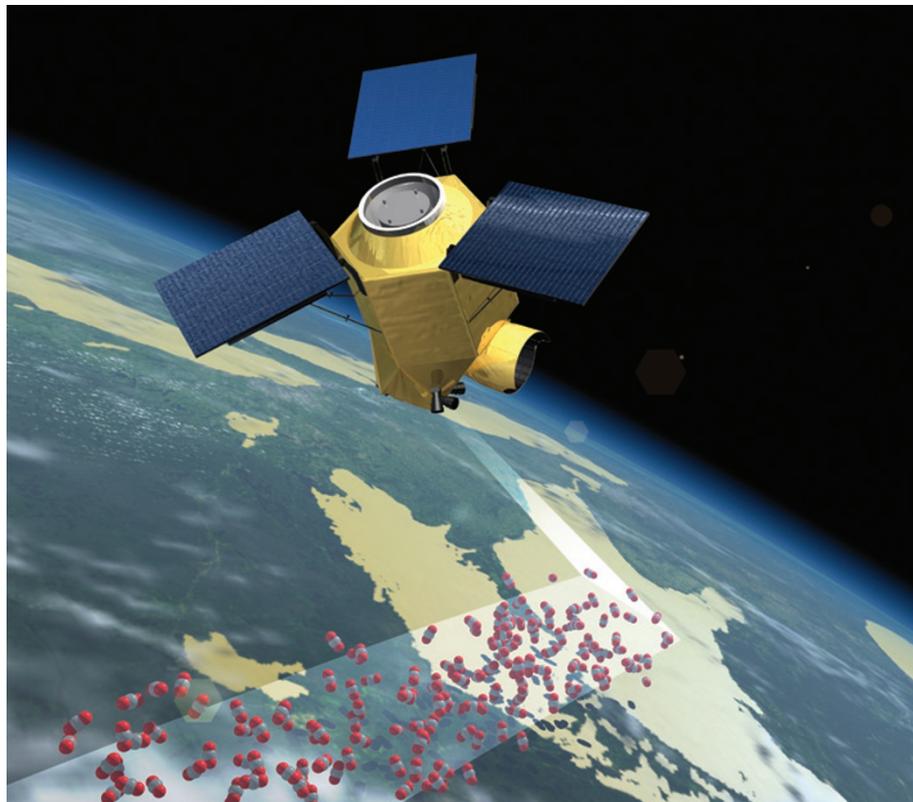
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ASTRILUM



ESA's funding shortfall is bad news for CarbonSat, a mission aiming to track atmospheric carbon dioxide.

FUNDING

Space budget blow to climate science

Economic difficulties take their toll on European Space Agency's Earth-observation programme.

BY EDWIN CARTLIDGE

For Europe's space chiefs, the outcome of last week's European Space Agency (ESA) budget negotiations was better than expected, given the continent's economic troubles. But for Volker Liebig, ESA's head of Earth observation, there is a sting in the agreement. The multi-year budget that member

states approved — which falls some €2 billion (US\$2.6 billion) short of ESA's proposed spending of about €12 billion — could force him to postpone or cancel a mission aimed at pinning down the mysterious carbon sinks that are slowing the rise of greenhouse gases in Earth's atmosphere.

Ahead of the budget negotiations in Naples, Italy, on 20–21 November, Liebig had hoped to

secure around €1.25 billion for new research satellites. With France, Italy and Spain contributing much less than expected, he received €1.9 billion for Earth-observation projects. But €808 million has already been allocated for a new generation of weather-forecasting satellites, leaving him with little more than €1 billion for research missions. "We have to discuss with scientists in the next few weeks what to do," Liebig says. "But we will not be able to develop all the science satellites we wanted to."

Most vulnerable, he says, is a planned €250-million climate-change mission scheduled for launch in about 2018. One of the two contenders for the mission, CarbonSat, would map atmospheric concentrations of carbon dioxide and methane at high-enough resolution to investigate a long-standing puzzle: why only about half of the CO₂ emitted by human activities remains in the atmosphere. Scientists assume that the rest is absorbed largely by the oceans and plants, but ground-based monitoring stations are too few and far apart to pinpoint the sinks.

Satellites could fill in the gaps in the picture, but in April ESA lost contact with Envisat, the one satellite providing such data (see *Nature* **484**, 423–424; 2012). Neither Japan's existing Greenhouse Gases Observing Satellite nor NASA's Orbiting Carbon Observatory-2 (OCO-2), scheduled for launch in 2014, will map greenhouse-gas concentrations in as much detail as CarbonSat, which would survey the whole globe with a resolution of 4 square kilometres. "The information that it would collect is essential for developing, implementing, and monitoring greenhouse-gas-emission policies," says atmospheric physicist David Crisp of NASA's Jet Propulsion Laboratory in Pasadena, California, who is the science team leader of OCO-2. "A timely launch of this satellite should be among the highest priorities of ESA."

CarbonSat's competitor for ESA funding, FLEX, would also help to pin down carbon sinks, by measuring the faint fluorescence generated by plants during photosynthesis — a measure of how efficiently they absorb carbon. "The last thing we want to do is to destroy

the forests or whatever is absorbing almost half of the CO₂ that we are emitting," says Crisp. "Wouldn't it be good to know where these ▶

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For more from the ESA ministerial meeting, see: go.nature.com/dinqbq

► processes are occurring?”

However, there was better news for other ESA programmes. Europe's Ariane 5 rocket launcher, which is more expensive than competitors, was the focus of fraught discussions: Germany argued for a more powerful and versatile upgrade, whereas France maintained that it would be better to switch straight to a new and more economical launcher. Following late-night discussions, ministers decided to fund both designs over the next couple of years and to review progress in 2014.

They also reached a deal on how to pay for Europe's contribution to operating the International Space Station between 2017 and 2020. The costs will

be covered in kind by a German-backed plan to provide the propulsion and avionics for NASA's Orion manned spacecraft. ESA also agreed to Russian involvement in its twin ExoMars missions, an ambitious programme of orbiters and landers scheduled for launch in 2016 and 2018. NASA pulled out of the project earlier this year.

But ESA's science programme faces a squeeze: it will receive €508 million a year for the five-year period from 2013 to 2017. Although slightly higher than its 2012 funding of €480 million, thanks to the contributions from new member states Poland and Romania, after inflation is taken into account this effectively amounts to a cut. Willy Benz

of the University of Bern, chair of ESA's Space Science Advisory Committee, says that this could force the agency to delay a future large mission; cancel mission extensions for existing probes; or cancel smaller missions.

Benz thinks that the science programme got less than expected because in hard economic times spending is channelled towards activities that can more directly boost industry, such as designing and building new launchers.

"I would say that the budget outcome was the best we could have hoped for given the economic circumstances," says Benz. "But if you cut budgets in the science programme, you cut science. There is only so much you can save by reducing travel or not making phone calls." ■



Brazil has struggled to sustain its production of biofuel from sugar cane.

Domestic consumption of liquid ethanol this year has been 26% lower than for the same period in 2008. Forty-one of the country's roughly 400 sugar-cane ethanol plants have closed over that time. The price of pure ethanol at the pump is so high that in most states it is cheaper to fill up flexible-fuel cars with petrol blends that contain about 20% ethanol. The shift back to fossil fuels, combined with rapid growth in the number of cars on the roads (see 'Fuelling Brazil's transport boom'), has worsened city smog and caused emissions in the transport sector to spike at about 170 million tonnes of CO₂ in 2011, up from less than 140 million tonnes in 2008. "We are increasing the world's GDP: we are buying more oil and spending more on pollution-related health care," jokes Ildo Sauer, who studies energy policy at the University of São Paulo and is a former director of the state oil giant Petrobras.

Brazil's ethanol roller coaster is a sobering example of what can happen when climate and energy planning clash with economic decision-making. It began with the 2008 economic crisis, which stanchied new investments in the sector just as it was expanding rapidly, and deep in debt. Rather than developing new plantations, the industry fell back on harvesting cane from older, less-productive sites, and average yields plummeted from 115 tonnes per hectare in 2008 to 69 tonnes this year. Combined with two bad harvests, this has forced Brazil to import some 1.5 billion litres of maize (corn) ethanol from the United States over the past 2 years.

But the killer blow came when the government decided to freeze the price of petrol and diesel to keep inflation under control, leaving biofuels less competitive. On the very night that current President Dilma Rousseff gave the closing speech of the Rio +20 conference in June — the final agreement of which promised to phase out fossil-fuel subsidies — the government said it would be reducing a federal fuel tax to zero. "We have taken away jobs from agroindustry, stalled growth and worsened the air of our cities for the sake of inflation control," says Luiz Horta, a bioenergy

ENERGY

Growth of ethanol fuel stalls in Brazil

Shortages are a sobering lesson from a biofuels pioneer.

BY CLAUDIO ANGELO IN BRASÍLIA

"A new moment for mankind." That was how Brazil's former president, Luiz Inácio Lula da Silva, described his country's biofuel boom in March 2007. Back then, Brazil was the poster child of ethanol fuel, its output second only to that of the United States. Fermenting the sugars in the country's abundant sugar cane produced a motor fuel that lowered carbon dioxide emissions, and many saw

Brazil as a model for how the world could shed its addiction to oil, creating jobs along the way.

Five years on, Lula's vision has tarnished. Biofuels are falling from grace around the world as critics charge that devoting millions of hectares of agricultural land to fuel crops is driving up food prices and that the climate benefits of biofuels are modest at best. But the fall has been hardest in Brazil, where government policies have compounded the effects of the global economic downturn.