Can ESA Shrug Off Malaise?

The European Space Agency, beset by budget woes and dissension, has a new director who plans to improve technology and form partnerships with industry

Twenty-two years of age may be a bit young for a midlife crisis, but the mood at the European Space Agency (ESA) bears all the hallmarks. Until last year, the agency had launched a series of high-profile science missions without a single failure, including Giotto, which recorded spectacular closeup images of Halley's comet; the SOHO solar observatory, now studying the sun in exquisite detail; and the Infrared Space Observatory, which is unveiling the early days of galaxies. But in the past 3 years it has been beset by budgetary woes, staff cuts, dissension among its member countries, and, more recently, a spectacular mission failure. At the same time, the world has changed around ESA. A resurgent NASA threatens to eclipse ESA's achievements, and a wave of mergers is transforming the European space industry and its relations with the agency. "There was a feeling that ESA had lost its way," says Dave Dale, director of technical and operational support.

Taking control. ESA head Antonio Rodotà, who took office in August.

Now ESA officials and scientists hope to put their soul-searching behind them. At the beginning of last month, Italian electrical engineer Antonio Rodotà took over as the agency's new head, replacing Jean-Marie Luton, the former head of the French space agency who had led ESA since 1990. Rodotà, who oversaw a wide-reaching reorganization of the Italian space company Alenia Spazio as the company's managing director, is the first former industrialist to hold the ESA job. He is determined, he told *Science*, to forge a new relationship between ESA and industry and restore ESA's technological edge.

Rodotà faces both internal and external pressures, however. He must still the turbulence in Luton's wake and persuade the 14 member countries, with often competing political and economic aims, that they need to work together. He also faces a stiff deadline: ESA is under orders from its members to prepare a strategy for the agency's future, to be presented to a meeting of member countries' ministers in 1998. Despite the challenges, the courteous and quietly controlled Rodotà seems unruffled. "I have spent almost all my professional career in industry, and I will draw from this experience to inject new ways of working in the agency," he says. And although Rodotà is still something of an unknown quantity, he has brought an air of optimism to the agency, says Mike Cruise of the University of Birmingham in the United Kingdom, a member of the space program committee.

Next week: The rebirth of planetary science at NASA

Space constraints

Rodotà takes control of an agency with an annual budget of $3.3 billion, about a fourth the size of NASA's, but with a similar range of activities—science missions, technology research, and launcher development. The similarity between the two agencies does not go much further, however. ESA does not have one paymaster, but 14, so budget negotiations are notoriously complicated. Some of ESA's programs—science, infrastructure, and administration—are mandatory for member countries, which share the cost based on their gross national product. The rest—space station, launchers, Earth observation, and telecommunications—are optional, and members are free to negotiate their contributions. And because the agency was set up to carry out missions that were beyond the scope of individual nations, small missions were left to the national space programs.

This system began to falter in the early 1990s, when reunification began to squeeze the German budget, unemployment rose throughout Europe, and the leading space nations, France and Germany, began the budget austerities needed to meet the criteria for a single European currency. Inevitably, space exploration was not high on the agenda of Europe's finance ministers.

Events came to a head in October 1995, when the government ministers responsible for space met in the southern French city of Toulouse to hammer out ESA's budget for the next several years. Member countries were in no mood for largess, and the science program budget was frozen at least through 1998, so it would effectively lose about 3% per year to inflation.

The budget cuts forced the science program to make some tough planning decisions, canceling plans for a Mars mission and postponing others. Adding to the pressure was the loss last June of the Cluster mission to study the magnetosphere when the inaugural Ariane 5 rocket blew up during launch. Only recently has a revised program of missions begun to take shape (see sidebar).

And, although ministers gave final approval at Toulouse for two big programs—the European contribution to the space station and the Ariane 5 rocket—they encouraged Luton, then the director-general, to continue the cost-cutting exercises he has initiated in the so-called ESA transformation program. Luton's reorganization has resulted in substantial job losses: 20% overall since ESA's heyday in the early 1990s, and about 12% in the past 2 years, leaving the agency with a staff of 1800. "We have had voluntary redundancies, retirements, and some nonvoluntary redundancy," says Karl Reuter, secretary to the director-general's Cabinet. The turmoil has left a strong residue of resentment, and it prompted the staff association to send a petition in December 1996 to ESA member governments expressing a lack of confidence in management.

In another legacy of the Toulouse meeting, ESA has been reviewing its policies for placing industrial contracts. In March, the agency presented the council with a plan to relax the founding principle of *juste retour*, whereby industry in a particular country received a share of total contracts proportional to its government's contributions to ESA. Now member states have agreed to a share proportional to plus or minus 20% of their contribution. "With *juste retour*, you cannot get the best cost," says Jean-Jacques Dordain, an associate director at ESA, who was responsible for loosening the policy.

But many observers say that this 20% flexibility will not be enough. Many European space companies are now multinationals, and they are competing not with each other but with U.S. companies. Says Giuseppe Veredece, first vice president of the Italian conglomerate Finmeccanisa, which owns Alenia Spazio, "In my opinion, we have no more time to talk about geographical return. We must speak about competition." Smaller member nations, however, in particular Spain and Sweden, are reluctant to abandon *juste retour*.

Revised Space Science Program Brightens ESA's Horizon

The malaise affecting the European Space Agency (see main text) has hit the science program especially hard. First there was the October 1995, decision by ESA member governments to freeze the science budget until at least 1998. Then, in June 1996, the Cluster mission, a flotilla of four satellites for studying Earth's magnetosphere, was lost when its Ariane 5 launcher failed. But the gloom is finally beginning to lift.

In June, ESA's science directorate presented the Science Program Committee (SPC) with a revised version of its Horizon 2000 Plus 10-year science strategy. The new strategy has recut the budgetary cake, reducing the cost of some missions so that the entire schedule of launches can go forward. It even leaves room for some welcome additions. Among them: a resurrected Cluster mission; a European role in the Next Generation Space Telescope (NGST), the successor to Hubble; and a possible Mars orbiter. European space scientists will discuss the plan at a meeting next week, and the SPC will be asked for its endorsement in November.

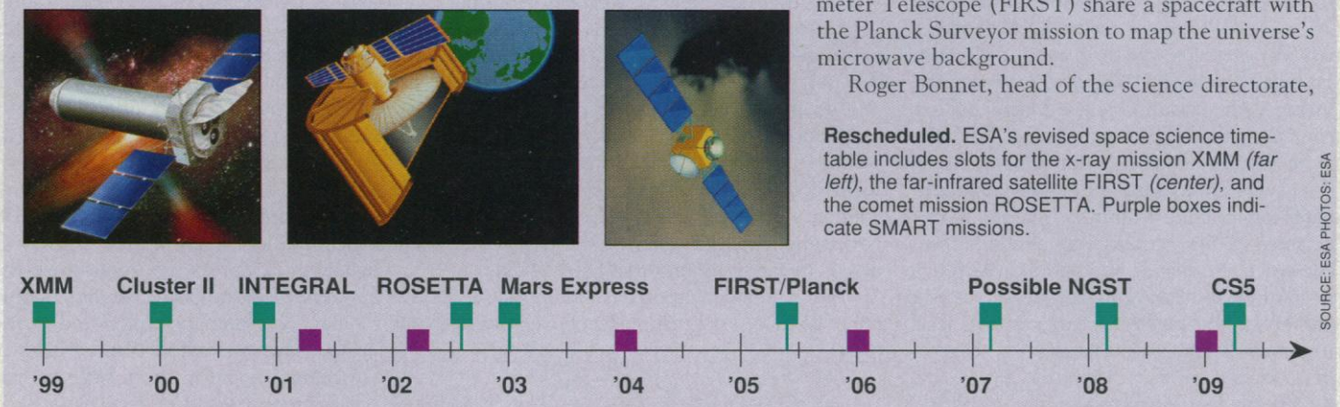
The SPC is likely to back the plan, says Hans Balsiger, its chair. "The revised Horizon 2000 Plus program is a good proposal in the circumstances." He adds, however, "I need to be careful about how positive I am. This is, after all, a desperate attempt to keep some flexibility."

Flexibility was key to resurrecting the Cluster mission (*Science*, 11 April, p. 193), which will rely on spare instruments and on the willingness of some member countries to shoulder the cost of rebuilding instruments they had already paid for. The plan also calls for adopting NASA-style "smaller, faster, cheaper" missions, designated F missions. The first of them will be the Mars orbiter, called Mars Express, which may carry spare instruments from the failed Russian-led Mars '96 mission.

Money for the Mars mission and for the NGST will come from splitting the fourth of ESA's so-called medium missions, which is so far unspecified, into two. ESA engineers are also studying the possibility of having the Far Infrared and Submillimeter Telescope (FIRST) share a spacecraft with the Planck Surveyor mission to map the universe's microwave background.

Roger Bonnet, head of the science directorate, also plans to glean money from the budgets of larger missions for small spacecraft to test key technologies. Dubbed SMART missions, they will cost a mere $54 million each. The first mission will test solar electric propulsion, which uses electric current from solar panels to accelerate an ion beam. This technology could allow ESA's Mercury mission, currently scheduled for launch in 2009, to be launched later and still arrive earlier, leaving room in the schedule for an additional large mission.

Although the plan is giving researchers some hope for the future, it faces plenty of uncertainties. Most important, it assumes member governments will thaw the frozen science budget after 1998. Without a thaw, delays and even mission cancellations are inevitable. "There is a limit," says Bonnet. "There are no miracles; we cannot go on taking cuts." –H.G.



Rescheduled. ESA's revised space science timetable includes slots for the x-ray mission XMM *(far left)*, the far-infrared satellite FIRST *(center)*, and the comet mission ROSETTA. Purple boxes indicate SMART missions.

SOURCE: ESA PHOTOS: ESA

In the hot seat

Into this ferment steps Rodotà, who has less than a year to come up with a coherent strategy for ESA. Next month, the agency will begin consultations and discussions. If Rodotà has his way, he says, ESA's future philosophy will be "to invest rather than to spend"—forming partnerships with industry to develop technologies and fly specific missions.

A product of Italy's space and defense industries, Rodotà is best known in the industry for reorganizing Alenia Spazio. During his 6-year tenure as managing director, Rodotà oversaw a merger and then concentrated Alenia's manufacturing in three "centers of excellence"—Rome (telecoms and science), Turin (space platforms), and L'Aquila (payloads). He also led the company into the construction of small satellites. Such changes prompted Loral Space Communications and Qualcomm, two large U.S. firms, to accept Alenia into a consortium to provide global mobile phone coverage by satellite.

Rodotà plans to make a similar push for improved technology at ESA, he told *Science*. NASA's access to the rich harvest of technology developed by the Strategic Defense Initiative and the Department of Defense has created a widening technological gap, he and other ESA managers believe, especially in sensors and new lightweight materials. To close the gap, ESA is debating copying NASA and mounting a series of small technology-proving missions.

Rodotà hopes that many of these technologies, along with telecommunications and Earth-observing missions, will be developed in partnership with industry. He has not decided what form these new types of partnerships would take, but suggested that the agency should consider the European Union's model, in which the EU pays no more than 50% of development costs for technology projects, or the French space agency's approach, in which the agency and industry set up joint ventures, sharing the risk. Alternatively, he says, the agency could help industry gain access to capital, "not as a banker, but perhaps by being a respected group that says whether a project is technically sound."

Reaction in industry to Rodotà's statements so far has generally been favorable. "This confirms what people in industry had hoped, that he would bring a different perspective," says Pat Norris of the British software company Logica and a member of the U.K. Industrial Space Committee, a trade association.

But Rodotà's biggest challenge will require the skills of a diplomat, not an industrialist: restoring harmony among the 14 member states. For some, like Germany, ESA is still the key to their ambitions in space, while others, like France, are hedging their bets by sustaining a strong national space program. Says Roger Bonnet, head of the science directorate, "We need to rediscover a European approach. If we do not, ESA will disintegrate." Adds Rodotà: "There is a consensus that Europe cannot carry on the way it has, fighting one another. ... The message I am sending is that there is no room for rivalry."

–Helen Gavaghan

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MARINE SCIENCE

Australia Enters Deep Water In Devising Management Plan

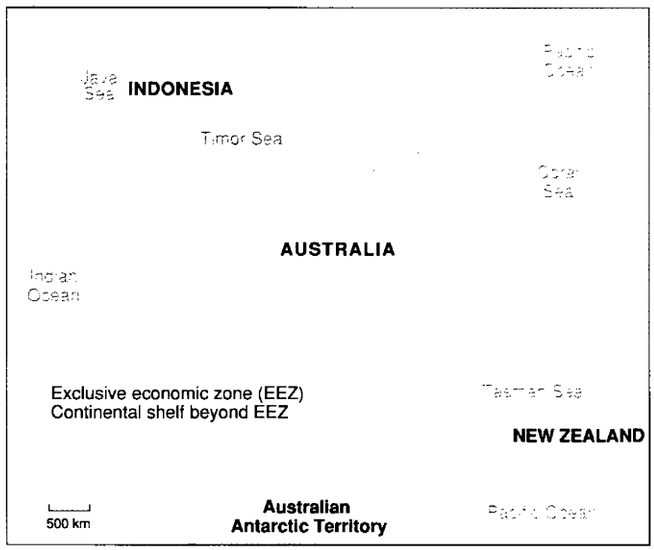
MELBOURNE—Like a gigantic bird of prey, the six-seat *Partenavia* methodically traces a path 137 meters above the waters of Moreton Bay near Brisbane on Australia's eastern coast. Sitting in the cockpit, Helene Marsh and her team from the School of Tropical Environment Studies at James Cook University in Townsville are looking for dugongs, the 2.9-meter-long marine mammals that are an endangered species. But that's not all she can see. The east coast dugong population, which has shrunk by half in the past decade, serves as a marker for the health of the sea grass that nourishes them. And the sea grass, known as the canary of the sea for its ability to signal changes in the marine environment, is losing out to the activities of farmers and developers.

For Marsh and other marine researchers, the dugong–sea grass problem is a symbol of what ails Australian marine science. No single authority is responsible for marine science policy and administration, a situation that has led to well-documented gaps and overlaps in the country's approach to marine issues. In particular, critics say the agencies involved in marine science, a score of fiefdoms ranging from tourism to defense, have been more concerned with self-interest than the common good.

But that attitude is yielding to a spirit of cooperation that bodes well for scientists. Australia was spurred into action by the 1994 U.N. Convention on the Law of the Sea (UNCLOS), under which Australia acquired one of the world's largest marine territories and an international obligation to manage its resources sustainably. Beyond securing Australia's rights to a 200-nautical-mile exclusive economic zone comprising 11 million square kilometers (see map), the treaty puts up for grabs the natural extensions of the continental shelf to 350 nautical miles. To claim its right to the extra territory, however, Australia must collect data to satisfy the United Nations that these regions fit the definition.

Spurred by the challenge, the government's premier science advisory council has devoted two of its recent meetings to marine science. And in April, the government convened two panels, one to develop an oceans policy and the second to draw up a plan for marine science and technology. In June, a report on managing the country's entire scientific portfolio by the government's chief scientist, John Stocker, urged officials to set priorities for the field.

That recommendation has widespread support. "We have a fragmented set of policies that won't do the twin jobs of exploitation and preservation, and there's an urgent need for a coherent policy," says Ken McKinnon, vice chancellor of James Cook University and author of two reports in the past decade on marine science that have castigated the government. He adds: "UNCLOS is the lever that's putting the whole thing on the national plate."



SOURCE: AUSTRALIAN GEOLOGICAL SURVEY ORGANIZATION

Ocean territory. U.N. oceans treaty has extended Australia's borders and has heightened interest in marine science.

The oceans policy group, consisting of representatives from every agency with a marine science portfolio, will take a shot at setting national priorities, as well as coordinating governance issues across local, state, and federal boundaries. That would be a first, says Russell Reichelt, director of the Australian Institute for Marine Science. "Up till now, we've had an ad hoc situation where priorities were set from the bottom up," he says. But those priorities didn't produce a consensus on how to deal with problems across disciplines and jurisdictions.

Working in concert with the oceans policy group are 10 scientists who serve on the marine science and technology plan. They will recommend broad strategies for each priority area set by the government panel and identify areas where more information is needed, says one member, Chris Pigram, chief of the petroleum and marine division of the Australian Geological Survey Organization (AGSO).

High on the scientists' list of concerns is the dearth of knowledge about Australia's marine environment. Preliminary exploration of the continental shelf suggests a wealth of natural resources, from huge oil and gas reserves and mineral deposits to novel deep-sea-floor biota. Over the past decade, AGSO has compiled enough data to claim at least six of the nine areas of extended continental shelf, with the rest to be finished by 2004. But then the agency will have to go back and fill in the details.

Another glaring deficiency concerns coastal ecology. Eighty percent of Australia's population lives along the coast or near estuaries, but the study of these environments is in its infancy. "We don't understand the system enough to manage it," says Alan Butler of the Commonwealth Scientific and Industrial Research Organization's Division of Marine Biology in Perth.

Destruction of fisheries is also a major concern. Seafood exports have doubled in the past 5 years, but Australia's fisheries remain vulnerable due to low natural nutrient levels. Aquaculture could replace the loss of the native Southern bluefin tuna population, but again, research is needed urgently.

Another mystery is the deep-sea communities. Only three studies have ever been done of the marine life of the continental shelf, and these point to large numbers of novel species. But there are concerns that deep-sea dredging and trawling along the country's northwest shelf have already altered the environment.

The size of Australia's marine territory puts a premium on efficient management. "We