SPACE SCIENCE

Europe Set to Work on Hubble's Replacement

NASA scientists and engineers working on the Next Generation Space Telescope (NGST) got a boost from across the Atlantic last week. On 15 September in Paris, the European Space Agency's (ESA's) top science advisory committee recommended that the agency become a major partner in the project. The recommendation puts NGST—along with a handful of other missions the committee also endorsed last week—one short step away from officially becoming part of Europe's space program.

"We couldn't be happier," says Bernard Seery, NGST project manager at NASA's Goddard Space Flight Center in Greenbelt, Maryland. ESA's involvement is "critical to NASA's being able to achieve the objectives of NGST," agrees Rick Howard, NGST's project executive at NASA headquarters in Washington, D.C. In the past, funding problems have threatened to curtail European participation in the space telescope (*Science*, 31 January 1997, p. 606). But now, says ESA's science director, Roger Bonnet, "it is clear that both the Americans and the Europeans are very keen on this mission."

The NGST, an 8-meter optical and infrared telescope scheduled to be launched around 2008, is on NASA's drawing board as a replacement for the aging Hubble Space Telescope. ESA's contribution would consist of a Near Infrared Multi-Object Spectrograph, an instrument for measuring the distance to remote galaxies, and a midinfrared camera-spectrometer to be built by several European countries. The agency will also help construct and operate the spacecraft itself.

Such active participation is a "must for astronomy in Europe," as it will secure European access to NGST, says Giovanni Bignami, science director of the Italian Space Agency. ESA plans to spend 180 million euros (about $150 million) on the telescope, but individual countries are expected to chip in additional money, Bignami says. The 180-million-euro figure is the maximum that ESA rules allow the agency to spend on any of its "fleximissions"—projects that the agency develops simultaneously and only later schedules for launch. ESA introduced fleximissions a year ago as a cost-cutting measure (*Science*, 1 October 1999, p. 21).

Along with the NGST partnership, three other fleximissions won approval from ESA's Space Science Advisory Committee (SSAC) in Paris. LISA, another NASA collaboration, is an orbiting laser interferometer for detecting gravity waves. Solar Orbiter will study the sun from a close-in orbit. Eddington, a satellite designed to search for extrasolar planets, is a "reserve mission" to be launched if future funding and the schedules of NGST and LISA permit. Two other fleximission candidates—MASTER, a planned study of Mars and asteroids, and STORMS, a satellite designed to monitor storms in Earth's magnetosphere—were turned down but may still win approval later. In addition, the SSAC selected the next two "cornerstone missions" in its Horizons 2000 science program: Bepi-Colombo, a spacecraft that will orbit Mercury, and GAIA, a mission to determine the positions of stars with high precision. The projects, budgeted at 550 million euros (about $470 million) each, are scheduled to be launched in 2009 and 2012. All the proposals still need the go-ahead from ESA's Science Program Committee, which will meet on 11 and 12 October. In the past, the committee—made up of representatives of European governments—has generally approved projects recommended by the SSAC.

Hot prospect. Solar Orbiter is one of six missions a European Space Agency panel approved last week.

CREDITS: ESA

–ALEXANDER HELLEMANS

Alexander Hellemans writes from Naples, Italy.

EUROPEAN SCIENCE

Research Behemoth Slated for Overhaul

BRUSSELS—Disaffection with the European Union's (E.U.'s) flagship research effort has found a sympathetic ear in the program's upper echelons. Last week, the E.U.'s top two research officials said they are pushing for big changes in the successor to Europe's 5-year, $17 billion Framework 5, including stronger efforts to coordinate research across the conti-

ScienceScope

Attractive Facility Their darling faces no competition, but congressional supporters of the National High Magnetic Field Laboratory in Tallahassee, Florida, are pulling out all the stops to win another 5-year grant from the National Science Foundation (NSF). Last week a Senate spending panel dropped a heavy hint favoring renewal, exploding a normally secret review process.

"The committee strongly supports the laboratory and hopes that the Foundation continues its support," lawmakers wrote last week in a bill that sets the agency's 2001 budget. Although the bill notes that NSF is reviewing the request this fall, a Senate aide says the panel wasn't trying to "influence the decision. But it's a popular project." And lab director Jack Crow says he "had nothing to do with this," although he has encouraged other scientists to write legislators on behalf of NSF's budget because "if NSF does poorly, then I know what will happen to us."

The lab, created in 1990, is asking for a 30% hike in its current 5-year, $88 million grant to accommodate a 60% growth in users. "It's an incredible facility," says physicist Chuck Agosta of Clark University in Worcester, Massachusetts. Agosta heads the lab's user group, which has lobbied for more funding. "But it's a political entity, too," he adds.

Genome Giveaway Does the human genome sell magazines? *Prospect*, a British monthly for intellectuals, thinks genes are so marketable that it has pasted a CD-ROM of the entire "rough draft" onto the cover of its current issue, out this week.

"This is not a scientific publication.... It's just a gimmick," says Tim Hubbard, head of human genome analysis at the Sanger Centre in Hinxton, U.K., one of the world's top DNA sequencing institutions. At the magazine's request, Hubbard helped squeeze the data onto a single CD-ROM and created browsing software that allows users to "click on a chromosome and jump to that bit of DNA," he says. The CD-ROM also contains information on the provisional identification of 10,000 human genes.

Prospect marketing chief Hugh MacLeman, who came up with the idea, says the magazine wasn't aiming for a scoop. "We wanted to get [the genome project] into the public sphere," he says, because "people who don't work in science have little idea about what has been achieved. It may also help sell more copies of *Prospect*."

Contributors: Eliot Marshall, Richard A. Kerr, Jeffrey Mervis

nent and to support innovative projects.

Among other complaints, scientists say that Framework's cumbersome bureaucracy takes too long to hand out grant money and that too little money is set aside for basic research that doesn't fit into such prescribed categories as aviation or infectious disease. In the current Framework, a small fraction of funding is reserved for "generic" projects—far less than in Framework 4. Such criticisms have galvanized the lobbying arm of the new European Life Scientist Organization (*Science*, 15 September, p. 1859). Although the next iteration, Framework 6, won't start until 2003, scientists are pushing hard now, because the E.U. research directorate has begun drawing up the new Framework's contours.

New research chief. Achilleas Mitsos.

Rank-and-file researchers—some of whose complaints were endorsed in an expert panel's report this summer—now have powerful allies in agitating for change. In a speech on 14 September to the European Parliament, research commissioner Philippe Busquin promised that Framework 6 would play a bigger role in coordinating European research. And speaking with journalists last week, the research directorate's new director-general, Greek economist Achilleas Mitsos, predicted that Framework 6 will include a greater proportion of funding for projects that don't fit into the spending pigeonholes.

Mitsos also says that Framework 6 is expected to prime efforts to "link the different national and European Community research programs in a more strategic way." That picks up on Busquin's proposal for a "European Research Area" (ERA)—endorsed this summer by European science ministers—to help coordinate national research efforts in E.U. member states (*Science*, 21 January, p. 405).

Whether Busquin and Mitsos can execute their desired changes is another question. New programs and changes in E.U. policy must be endorsed by all 15 member states, as well as by the European Parliament and the commission. To help navigate this labyrinth, Mitsos's team is preparing a strategic plan, to be issued early next month, that will lay out how the research directorate plans to implement the ERA and develop Framework 6, the first draft of which is due in February.

–ROBERT KOENIG

BIOPHYSICS

For Certain Shrimp, Life's a Snap

For such a shrimp, *Alpheus heterochaelis* gets awfully violent. Whenever a delicious—or dangerous—sea creature skulks by, the dirty-green shrimp slams its snapper claw shut, blasting the visitor with a jet of water. Quite naturally, scientists have attributed the crackle of snapping shrimp colonies, much like the sound of burning twigs, to many claws banging together. But now, an unusual study reveals the shrimp's real noisemaker: bubbles.

On page 2114 of this issue, physicist Detlef Lohse of the University of Twente in the Netherlands and his colleagues report that a collapsing bubble outside the shrimp's claw causes its characteristic clack. According to this new study, *A. heterochaelis* clamps its claw so rapidly that a water jet gushing from the claw first loses and then gains pressure, causing an air bubble in the jet to swell and collapse with a pronounced "snap!" The imploding bubble generates shock waves that stun nearby prey and ward off other shrimp, who have learned to keep their distance. "These bubbles are tiny, but they have tremendous energy," remarks Lohse. Snapping shrimp may be the first animals known to create forceful "cavitation" bubbles, more commonly churned by the propellers of ships.

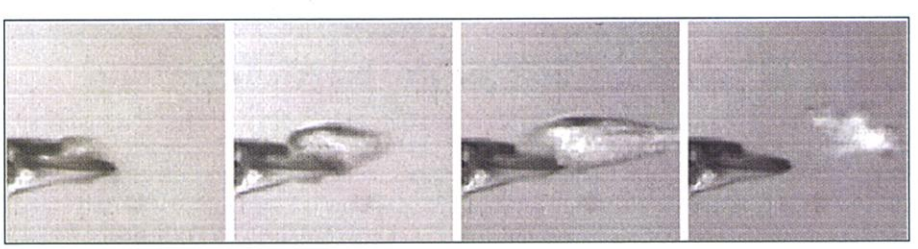
"This is one of those studies that makes you think, 'Damn, I wish I'd done that,' " says physicist Lawrence Crum of the University of Washington, Seattle. "It's a first-class piece of work." (Crum is no stranger to the surprising sounds of nature: He has recorded the underwater gas bubbles that form and then burst with a shriek when snowflakes fall on a lake.) "What's remarkable," Crum says, "is that this shrimp can move its claw fast enough to create a vapor bubble." Shrimp in the study snapped their claws shut at speeds reaching 108 kilometers per hour, Lohse says.

Smaller than a finger, *A. heterochaelis* lives in warm, shallow seawater, often burrowing below coral rubble or among oyster clumps in tide flats. Each shrimp sports one ordinary claw and one snapper claw, which looks like a mottled green boxing glove and can grow to half the shrimp's size. Muscles on each side of the snapper claw slowly contract, cocking the claw open like a revolver—until an unfortunate little crab, for instance, triggers the claw to slam shut. Together, hundreds of trigger-happy shrimp make a colony, snapping day and night. During World War II, the Navy launched some of the first acoustic studies on the shrimp, whose constant crackle drowned out submarine-detecting sonar.

The new study was sparked a few years ago, when Barbara Schmitz, a zoologist at the Technical University of Munich in Germany, was shooting video of shrimp in her lab and noticed the curious flash of a bubble in some pictures. At a 1999 meeting, she approached Lohse, who studies bubble dynamics. They decided to collaborate.

To catch the bubbles in action, the scientists, with Twente researchers Michel Versluis and Anna von der Heydt, tethered seven shrimp on a platform inside Schmitz's lab aquarium. Then they planted a 40,000-frame-per-second camera above, or sometimes below, the aquarium and dangled a hydrophone, or underwater microphone, into the water. Over and over, the researchers tickled each shrimp's snapper claw with a paintbrush, recording its reaction, for a total of 108 experiments.

Every time, the shrimp's claw snapped shut—followed, hundreds of microseconds later, by the loud collapse of a bubble in the ensuing water jet. The video shows an air bubble forming between a shrimp's closing claw and then blasting away along with the water jet before the claw shuts. Some 300 microseconds later, the bubble balloons to about



Bubble blast. On high-speed video, a tiny bubble forms between the shrimp's claw and then blasts away, where it will shatter with a "snap!" The collapsing bubbles stun nearby prey. Top, the trigger-happy *Alpheus heterochaelis* with its snapper claw.

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