tists. Satellite surveillance and other limited intelligence suggest that Iraq, in the past few years, has been restoring labs such as Daura, building facilities, and shuffling materials from site to site. A high priority will be to investigate ostensibly civilian labs. As long as outsiders lack hard evidence, notes a U.N. inspector, "Saddam knows it presents a moral dilemma" to destroy equipment at such facilities.

A lesser priority is to check out defector accounts. Last month, for instance, *The Washington Post* described a defector's report of a new lab devoted to the Ebola virus. Some are dubious. "In my experience, 95% of information from defectors has come to nothing," says the senior weapons inspector. Another U.N. investigator, however, notes that there have been at least 10 instances in which Iraqi defectors produced "exactly correct, highly valuable information." Even the small chance that Iraq is running an Ebola lab is a chilling prospect.

Iraq could have acquired new strains of pathogens since the Gulf War despite the embargo, say experts. At the International Congress of Bacteriology and Applied Microbiology in Paris last month, one scientist asked a weapons inspector about the danger of sharing biological samples with colleagues in Iraq. The question, says a prominent virologist who was present, made him wonder how many researchers might have been—and still are—naïvely sending pathogens to Iraqi collaborators.

If Iraq can obtain the right materials, experts agree, it retains the capacity to produce biological weapons. One U.N. inspector says he has a database of 600 names associated with the bioweapons program, including 30 key scientists. The vast majority, he believes, remain in Iraq. Iraq can also make its own spray driers and fermenters; "maybe these look like tin cans," says the senior weapons inspector, "but you don't need high tech to produce anthrax."

As analysts wait for a diplomatic breakthrough that might let them back into Iraq, they wonder how well the West has been able to read the traces left behind by Iraqi military scientists and technologists. "They have shown themselves to be masters at exploiting discontinuities in the inspection process," says Pearson. And the longer the current discontinuity lasts, the harder it will be to penetrate Iraq's hidden capabilities.

–RICHARD STONE

PROFILE CLAUDIE HAIGNERÉ

France's Highflier Comes Down to Earth

As an astronaut, Claudie Haigneré performed experiments in space; back here on Earth she's now working to advance the research agenda of an entire nation

PARIS—On a sunny August day 6 years ago, French astronaut Claudie Haigneré and two Russian cosmonauts sat squeezed into their narrow, padded seats aboard a Soyuz space capsule, perched atop a towering rocket at the Baikonur space center. Below them, the barren steppes of Kazakhstan stretched endlessly in every direction. Although Haigneré had been training as an astronaut for more than a decade, this launch—the 1996 Cassiopeia mission to the space station Mir—was her first venture into space. Yet, Haigneré says, she was too busy carrying out her long list of prelaunch tasks to be afraid. "Then came the countdown," she recalls. "5, 4, 3, 2, 1, liftoff! At that moment, I had a feeling of total exaltation and liberation."

Haigneré was instantly rocketed into stardom as one of France's most exalted celebrities. Her reputation was boosted yet again in October 2001, when she moored another Soyuz capsule to its docking port on the international space station (ISS), becoming the first European woman to visit that orbiting installation. But in June, Haigneré hung up her space suit. In the new conservative government of President Jacques Chirac and Prime Minister Jean-Pierre Raffarin, Haigneré is now minister of research and new technologies, charged with getting France's stagnating research effort off the ground. As an astronaut, she was trained to pilot a Soyuz spacecraft back to Earth in case the ISS crew had to make an emergency getaway. As science chief, she has already had to make her first emergency maneuver: steering Raffarin away from slashing France's research and development budget to help deliver on a promised tax cut (*Science*, 9 August, p. 917).

Rescue mission. Haigneré helped head off a reported 7.6% slash in the science budget.

CREDIT: FRANÇOIS MORI/AP

Many researchers have privately expressed surprise that Haigneré has entered politics by accepting a government post. Haigneré says that she herself was "surprised" when, immediately after June's legislative elections, Raffarin telephoned to ask her to take the research job. But she does not see her acceptance as a partisan choice. "For me, science is not something left-wing or right-wing. We are talking about a shared national goal and about the construction of European research."

Haigneré, known as Claudie André-Deshays before her marriage to French astronaut Jean-Pierre Haigneré last year, was born in May 1957 in the Burgundy town of Le Creusot. Her passion for space was kindled on 20 July 1969. As a 12-year-old girl camping with her family on France's Mediterranean coast, Haigneré gazed with rapture at television images of astronaut Neil Armstrong stepping onto the moon. "I looked at the image on the TV screen and then at the moon in the sky," Haigneré recalls. "Something inaccessible, that had been just a dream, suddenly became a reality." After graduating from high school at age 15, she entered medical school, eventually qualifying in sports, aviation, and space medicine, as well as rheumatology. Later she earned a graduate degree in biomechanics and physiology of movement, and in 1992 she was awarded a doctorate in neuroscience.

It was in 1985, when France's National Center for Space Studies put out a call for astronaut applications, that Haigneré seized the chance to realize the dream she had had as a 12-year-old. She was one of seven candidates chosen from more than 1000 applicants and the only woman. She spent 11 years on the ground as a space scientist, coordinating numerous scientific experiments on joint French-Russian space missions. When she finally got her own chances to fly in 1996 and 2001, she carried out a large number of experiments her-

self, including a study of how frog embryos develop in weightless conditions and the way the human inner ear responds to gravity-free conditions.

Now, as France's research minister, she has the chance to shape the nation's entire science effort. So far, she has not launched any specific initiatives, most of which will have to wait until the proposed budget is approved by the Council of Ministers in September. But in a number of speeches and policy statements, she has set down her main priorities, including stemming France's "brain drain" by making research careers in France more attractive. "We must liberate the creativity of researchers," she says, for example, by making it easier for them to go into industry or teaching while still retaining positions with basic research agencies such as CNRS. Haigneré also wants to ensure that France takes its rightful place in the European Research Area (*Science*, 29 June 2001, p. 2425). And although she says that fundamental research should always be at center stage in France's science effort, she wants to do much more to boost technological innovation.

Over the past few weeks, Haigneré has been forced to fight a rearguard action against proposed cuts of 7.6% in the $9 billion France spends on nonmilitary R&D each year. The proposal, first reported by the daily newspaper *Libération*, which had obtained an internal government working document, came as a major shock to French scientists. Just last month, they heard President Chirac repeat—in a speech at the Airbus factory in Toulouse—his campaign promise to boost French R&D spending from its current 2.17% of gross domestic product to 3% by 2010.

Although Haigneré and finance ministry officials decline to confirm specific figures, she says she "battled a great deal to get the message across" to Raffarin that such a cut was unacceptable. "The message was understood," Haigneré says. "Things are not as good as I had wished but much better than [they were]." She sees one positive result from the controversy over science budget cuts: "Now everyone is talking about research, which they weren't before!"

If the current government serves out its full term, Haigneré could expect to be research minister for the next 5 years. Since her appointment, she says she has had little time to keep up with her normally rigorous daily exercise schedule. "Being a minister takes a lot of energy, but after a period of adjustment I hope to find a rhythm so that I can stay in [physical] shape." And she has not given up the idea of returning to space one day: "I will never close that door."

–MICHAEL BALTER

ASTROPHYSICS

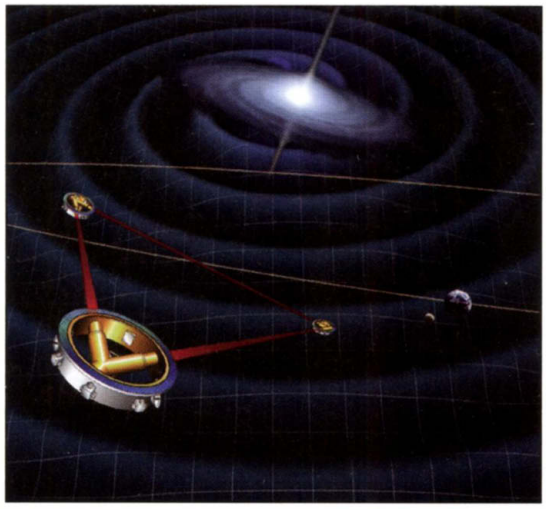
Gravitational Wave Hunters Take Aim at the Sky

European and American scientists are eager to build LISA, a 5-million-kilometer triangle of spacecraft tuned to murmurs from the biggest black hole encounters of all

UNIVERSITY PARK, PENNSYLVANIA—The idea sounds outlandish. Launch three spacecraft into orbit around the sun and spread them into a triangle 5 million kilometers on a side. Use 1-watt lasers and 30-centimeter telescopes to monitor changes in the relative distances of metal cubes that float quietly within each vessel. Gauge variations as small as 10 picometers—yes, just one-tenth of an angstrom. "Invariably, these numbers induce giggles or outright chuckles in the back of the room," says optical engineer Eugene Waluschka of NASA's Goddard Space Flight Center in Greenbelt, Maryland.

However, the next steps are spurring Waluschka and his colleagues past the snickers: Convert the data into details about passing gravitational ripples in the fabric of spacetime, yielding exquisite insights about merging black holes that astronomers can get in no other way. That's the promise of the Laser Interferometer Space Antenna (LISA), a project that has graduated from years of blue-sky dreams to a joint European-U.S. mission gaining momentum toward a planned launch in 2011.

LISA will not supersede the Laser Interferometer Gravitational-Wave Observatory (LIGO) and similar devices on the ground, which are striving to suppress the noises of Earth (see sidebar, p. 1115). Instead, LISA will observe a different part of the gravity spectrum, much as a radio telescope sees aspects of the universe that an optical telescope cannot. Whereas LIGO and its brethren try to detect high-frequency bursts from sudden events, such as off-center supernova blasts or the collisions of two neutron stars or black holes with starlike masses, LISA will tune into deep gravitational murmurs that rumble for months or years. If LIGO listens for the squeaks of cosmic mice, LISA will record intricate whale songs.



CREDIT: NASA/JPL

Small surf. Passing gravitational waves would distort the vast LISA triangle by hundreths of a nanometer.

The vocalists, according to theory, include binary pairs of white dwarfs in our Milky Way so numerous that they generate a persistent gravitational buzz, like the static between AM radio stations. More compelling are small black holes swooping into big ones and the mergers of supermassive black holes at the cores of galaxies—the most energetic events the universe can spawn. "That's the gold-plated objective for LISA," says U.S. project scientist Robin Stebbins of NASA Goddard. "Ten years ago, people didn't even think there were massive black holes in most galaxies. The science of LISA keeps getting better."

That consensus echoed through a recent meeting* of more than 100 researchers here at Pennsylvania State University. Daunting tasks loom, especially getting a firmer commitment from the U.S. government to fund its share of the project. The total cost may rise from today's estimate of $600 million to more than $1 billion by launch. However, design and engineering are under way for a European Space Agency (ESA) satellite flight in 2006 to validate crucial LISA technology in the microgravity of space. "People are ready to cut metal," says astrophysicist L. Samuel Finn of Penn State, the meeting organizer. "It's no longer an academic exercise."

* 4th International LISA Symposium, 19–24 July.