water and other conditions that might be favorable to life elsewhere. At the same time, astronomers using both space-based and ground-based telescopes detected Extrasolar planets with increasing frequency.

However, none of these missions—most of which were well under way when the institute was formed—include specific instruments designed to test for life. That makes it hard to judge NAI’s impact over the past decade. “What credit can the NAI take? I don’t have a good quantitative answer,” says Bruce Jakosky, a planetary scientist at the University of Colorado, Boulder, and longtime advocate of the field. And with the exception of a contribution to the future Mars Science Laboratory slated for a 2009 launch, the NASA astrobiology effort is not directly involved in upcoming missions. The Terrestrial Planet Finder, a good candidate for picking up biological signals from Extrasolar planets, has been put on indefinite hold, as has a proposed Astrobiology Field Lab to Mars that could probe beneath the planet’s surface for hidden microbes.

Its ambiguous contributions make astrobiology tremendously vulnerable as NASA attempts to finish the space station, build a new launcher, and set up a base for humans on the moon—all without significant budget increases. Whereas space and earth sciences have formidable political allies, astrobiology so far has proved too small, too scattered, and too new to fight off budget threats. Griffin has proposed cutting astrobiology funding in 2007 to half of its 2005 level, and NAI has repeatedly delayed its next team competition. Without a new round of winners, there will be no teams left by 2008.

That decline runs counter to the conclusions of a May report from the National Academies’ National Research Council that called astrobiology “an outstanding example of the development of a successful new interdisciplinary area” and recommended continued robust funding. However, Griffin says that it’s not his job to nurture a fledgling field that won’t help him put humans on the moon. Asked at an August meeting of the Mars Society about the impact of the cuts on astrobiology students, he retorted that “if they want to work for government money, they must look at what the government wants—not what they think it should want.”

New life
Despite Griffin’s skepticism, some scientists expect astrobiology to survive and prosper. Last fall, John Rummel took over as astrobiology chief at NASA headquarters. A biologist with a strong affinity for the human space program, Rummel is a respected agency insider. At the same time, Pilcher, a longtime NASA headquarters official, took over as the institute’s fourth director. And his boss is Simon P. “Pete” Worden (see following story), who has big plans for Ames.

Rummel and Pilcher confront a worried batch of researchers as well as a shrinking pool of graduate students. “Plenty of people are getting fed up with the lack of proposals funded,” says Kevin Hand, a graduate student at Stanford University in Palo Alto, California. “People are doing other things ancillary to astrobiology,” he notes, while they wait for NASA to pump more money back into the effort. And some researchers such as Nealson are skeptical that the program can be redirected to make it more relevant to exploration-focused NASA.

There is a chance Congress may come to the rescue. Whereas Republican legislators regularly defended U.S. President George W. Bush’s push for a new launcher and human exploration of the moon, Democrats have spoken out against raiding the science budget to pay for those projects. And some members of the overwhelmingly Democratic California delegation—including Representative Anna Eshoo (D–CA), who represents the area around Ames and is a close ally of new House Speaker Nancy Pelosi (D–CA)—are aware and concerned about the fate of astrobiology.

In the meantime, scientists soldier on. Thanks to an NSF grant, D’Hondt traveled to the South Pacific last month to study deep-sea microbes. But he is worried that the NASA cuts may inflict long-term damage to the field. “We won’t be able to produce the scientists needed for future space missions,” he warns.

Not everyone is so pessimistic. Even if the institute becomes a victim of the current budgetary storm, many scientists think that the field will survive. “Given the incredible nature of the questions posed by astrobiology,” says Hand, “I’d be doing this if I had to pick up dimes from the street.”

—ANDREW LAWLER
Worden remains bent on radical changes for the troubled lab. Ames and its famous neighbor, Google, last month agreed to an innovative technology-sharing deal that will make NASA’s enormous archives of Earth and space data accessible to the public. The deal could pave the way for Google Moon to join Google Earth and Google Mars. And Worden hasn’t given up on smaller, faster, and cheaper: He has wrangled $10 million from his bosses to begin thinking about small spacecraft that could journey to asteroids and the outer solar system as well as the moon. He hopes to scale up the program once there’s more money for such activities. In the meantime, he’s pursuing contracts from other federal agencies to help the center’s 2,500-strong workforce weather the current NASA budget crisis.

True mavericks are rare among the government’s colorless cadres of generals and civilian bureaucrats. But the 57-year-old Worden, who earned an astronomy doctorate from the University of Arizona, Tucson, has a history of bucking conventional wisdom regardless of its effect on his career. In the 1980s, he was an early advocate of President Ronald Reagan’s Strategic Defense Initiative, an unpopular stance that earned him the sobriquet of Darth Vader in space circles. As a White House staffer under Reagan’s successor, President George H. W. Bush, Worden helped engineer the ouster of NASA chief Richard Truly and his replacement by Daniel Goldin, who touted the smaller, faster, cheaper approach. He then led a tight-knit group of Defense Department officials that applied the philosophy to the successful 1994 Clementine mission to the moon, finding hints of ice at the lunar poles and thoroughly embarrassing NASA and its fleet of large, costly spacecraft.

After the 9/11 terrorist attacks, Worden did a brief and controversial stint as chief of the Pentagon’s Office of Strategic Influence, set up to place stories favorable to the United States in foreign media and on the Internet. But then—Defense Secretary Donald Rumsfeld shut it down after the office came to be seen as simply a propaganda vehicle for the Bush Administration.

Worden’s unconventional ideas often make his superiors nervous—he served for more than a decade as a full colonel before winning his first star. The debacle with Rumsfeld squashed further chances for promotions, so after working briefly for Senator Sam Brownback (R–KS), Worden left the military in 2004 to join the University of Arizona as a research professor. He lost out to his less-controversial civilian friend Michael Griffin when Sean O’Keefe stepped down as NASA administrator. As for the Ames appointment, mutual acquaintances say Griffin is eager for Worden’s help in promoting the president’s new exploration vision but chose to keep him far outside the fishbowl of Washington politics.

Worden spoke recently with Science about his setbacks, plans, and vision for the center.

—ANDREW LAWLER

On budget cuts to life sciences and astrobiology:
The agency has been given certain priorities and missions by Congress and the president. Astrobiology—not that it isn’t superb science—has a lower priority. But there is non-NASA funding—the private sector, other government agencies—and we are aggressively pursuing those options. Is it easy? No. It is much like what happens at a university. I spent the last 2 years as research faculty at Arizona. I didn’t have a tenured position, and you did the work you needed to do. I’m a scientist. If I were king, I’d double the science budgets. I think scientific exploration of the solar system and the universe is really exciting and a key area of our future. I’d love to spend two-thirds of the defense budget on science if I could get away with it.

On tension between Griffin and the science community:
It’s unfortunate there’s a perceived problem. There are clearly a lot of incensed people. Mike’s position—which I support—is that an agency has a set of customers, first and foremost the Congress and the White House. They set priorities. If they want to change those priorities, they can. There has been a tendency [for astronomers] to regard what NASA does as a sinecure.

On how scientists can help:
I’m an advocate of small, fast missions that could do 80% of the capability for 10% of the cost. What would be useful is for the scientific community to prioritize missions within the budget we’ve got, so we can get more science, better science, by doing more smaller missions and fewer bigger ones.

On exploration versus science:
We are faced with a crisis in exploration. The vehicle we have is being phased out for a lot of good reasons, and there’s an investment to make. Once the shuttle is phased out, I would anticipate scientific opportunities will go up quickly with a much more flexible system.

Robot Seeks New Life—and New Funding—in the Abyss of Zacatón

With missions to other worlds in mind, explorers ready an ambitious robot to plumb a deadly sinkhole, looking for new life—or at least the bottom

Thirteen years ago on a sunny spring morning, two divers prepared to descend into what could be the world’s deepest water-filled pit: northeastern Mexico’s El Zacatón, a 180-meter-wide limestone sinkhole filled by hydrothermal springs. The water is 30°C, teeming with strange microbes, and pitch-black below the first 30 meters. One diver was Sheck Exley, then holder of the world’s scuba depth record; the other was his friend Jim Bowden, a top underwater caver. They wished each other luck, adjusted their masks, and began freefalling down separate safety lines. Ten hours later, Bowden surfaced with a new world record—925 feet (282 meters)—without ever finding the bottom. Exley did not surface. Three days later, his body was pulled out, tangled in the line. No one knows what killed him.

The sinkhole’s depth remains unknown; sonars work poorly in narrow spaces, so readings peter out at about 330 meters. But this week another team is preparing to replumb the mysteries of Zacatón—this time, with an audacious new robot made to probe both its geology and biology. The NASA-funded Deep Phreatic Thermal Explorer (DEPTHX) is designed to navigate and map deep underwater tunnels, spot living things, grab them, and bring them back—all without direction from the surface. If it survives its first voyage in March, DEPTHX will be a major advance in robotics and exploration of extreme environments. If it survives NASA budget cuts, it could be a model for probing Jupiter’s moon Europa, where Zacatón-like cracks or holes in the icy surface may offer the best chance of finding extraterrestrial life.

Compared to other autonomous underwater vehicles (AUVs), DEPTHX is “well ahead,” says Gwyn Griffiths, head of the National Oceanography Centre underwater lab in Southampton, U.K. But like other