At the helm of NASA's troubled space science program, Ed Weiler scrambles to carry out research in an era of soaring costs and uncertain politics

NASA's Street Fighter Takes on Tangled Space Science Program

Less than a month after taking over as acting space science chief at NASA, Ed Weiler had a tough call to make. Should he delay the $1.5 billion Chandra X-ray Telescope so that engineers in a California factory could work out the remaining bugs? Or should he ship Chandra cross-country to the Kennedy Space Center in Florida, cross his fingers, and hope for the best?

A delay would add millions to the cost of the mission, disrupt the intricate space shuttle schedule, and anger researchers eager to do science. But as the long-time program scientist of the Hubble Space Telescope effort, whose faulty mirror had to be corrected in space, Weiler knew that haste might have even more serious consequences. His instincts told him to wait. "I overruled three independent review teams" who recommended shipment, he recalls. "It just did not feel right to me."

Admiring Weiler's chutzpah, NASA Administrator Dan Goldin immediately made him permanent space science associate administrator, with authority over NASA's $2.4 billion program in planetary sciences, astronomy, astrophysics, and solar and terrestrial physics. And Weiler's caution has been vindicated by the near-flawless performance for Chandra, launched in July 1999.

Weiler's job hasn't gotten any easier, however. Under his watch, two Mars probes failed in a very public and very embarrassing fashion, forcing him to completely revamp NASA's Mars management and strategy. He's also watched as the cost of virtually every major mission being developed has soared, prompting him to delay or cancel programs. Two weeks ago he bit another bullet, announcing an unprecedented open competition to find a cheaper way to go to Pluto after deciding earlier this fall to suspend a mission being planned by the Jet Propulsion Laboratory (JPL) in Pasadena, California. "He's got a lot of problems," says John Huchra, an astronomer at the Harvard-Smithsonian Center in Cambridge, Massachusetts.

It's small consolation that most of those problems were sown long before Weiler took over. The ambitious plans made in the mid-1990s—to explore Mars and the outer solar system, to search for extrasolar planets, and to expand dramatically the number of small missions—now seem hopelessly optimistic. And the impending Republican takeover of the White House and Goldin's likely departure only heighten the sense of uncertainty. "I'm afraid the new Administration will be a little surprised by the mess they are being handed," says one executive branch official.

Unlike political appointees such as Goldin, Weiler is a civil servant who can ride out changes at the White House. But that job security also means he must explain the mess to his new bosses. "Little did I know what I was getting into," he says ruefully.

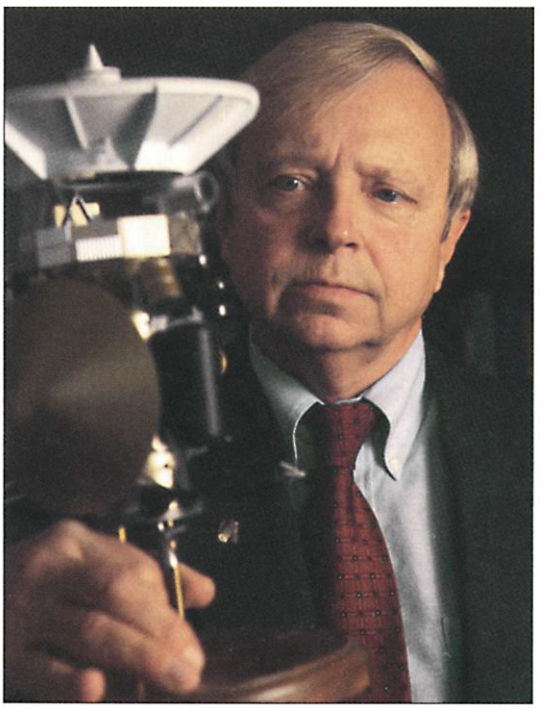
Brass knuckles

Weiler, 51, grew up in a working class neighborhood in Chicago, where he built a small telescope and decided by eighth grade that he would be a NASA astronomer. He worked his way through college, winning his Ph.D. in astrophysics from Northwestern University in nearby Evanston. He also got a taste of the military and the media, serving as an Army policeman while in the reserves and covering space missions as a summer intern at a public television station. He launched his scientific career as a postdoc at Princeton University under famed astronomer Lyman Spitzer, spiritual father of the Hubble, before taking over operations for a Princeton space-based telescope called Copernicus.

His talents soon caught the attention of NASA managers at Washington headquarters. "He could handle engineering and management, was straightforward and honest, and had a good grasp of the problem of communicating science," says former NASA astronomy chief Nancy Roman, who hired Weiler in 1978. A year later, Weiler began what turned out to be a 20-year gig as Hubble program scientist.

His outspoken and tenacious manner may have ruffled the soft-spoken Southern engineers who dominated the culture at NASA headquarters. But Weiler earned his stripes by keeping the Hubble program alive during the dark times following its launch in 1990. One thankless job was appearing before congressional committees outraged by the spherical aberration that had blurred Hubble's vision. "We got beaten up," he says. "We were fighting for our lives, and there were people in our own [astronomy] community saying, 'Shut this darn thing off.'"

He also sparred with Hubble scientists, whom he pushed hard to release data that would demonstrate the program was producing good science. That push irritated some researchers, who complained that they might be overstating the importance of the results (*Science*, 4 June 1993, p. 1416). But to Weiler, getting pictures out quickly was an act of political survival, as well as a responsibility of those supported with public funds. Indeed, he first visited JPL as a reporter, and he toyed with the idea of a broadcasting career during a summer media internship at a public television station in



On a mission. As Cassini speeds toward Saturn, NASA's Ed Weiler must navigate political forces on Earth.

CREDIT: RICK KOZAK

San Diego. "But the station people told me there was no money" in journalism, he says, "and that I was better off being a scientist."

Weiler's tenacity impressed other researchers. "He kept the community organized, kept up support, and was always on top of the scientific rationale," says Shelby Tilford, a retired senior NASA scientist. "He was the most intense fighter for a program I ever saw." Adds one astronomer who knows him well: "He's all brass knuckles. Ed is a street fighter."

Artist's conception of Pluto

Crash course

But that single-minded focus led some scientists to worry about his suitability as head of the entire space science program. "The concern at first was that he would be too parochial," says Claude Canizares, an astrophysicist at the Massachusetts Institute of Technology and a principal investigator for Chandra. "We all had that concern," adds Tilford. But the events of the past few years have given Weiler a literal crash course in other fields, especially planetary science. The disastrous failures of both a Mars orbiter and lander in 1999 forced him to order a revamping of the agency's entire scientific, managerial, and technical strategy for Mars. "Mars was a nightmare," he says. Most researchers believe that a new and far less ambitious plan, unveiled in October (*Science*, 3 November, p. 915) is more realistic and balanced. And while some complain it is too timid, Weiler says "I will take on anyone" who maintains the old plan was doable.

With a new Mars strategy in place, Weiler now must grapple with the prosaic but more far-reaching effects of the failures—rising costs. He traces the problem to the heady days of 1996, when researchers claimed evidence of past life in a Mars meteorite. Vice President Al Gore convened a White House conclave to discuss the implications of life beyond Earth, and an array of new missions—such as one to Jupiter's intriguing moon Europa—was planned to search for life and its origins. The following year, JPL's Mars Pathfinder bounced to a landing and sent out a tiny rover which captured the public's imagination. "There was a cockeyed sense of optimism," says one Mars researcher.

That optimism translated into unrealistic cost estimates, however. "Basically, all the programs proposed in that era are overrun," says Weiler. JPL, which specializes in planetary probes, was one of the worse offenders. An investigation into the Mars failures reported this spring that insufficient testing and oversight were major causes. In reaction, program managers across the agency are estimating more conservatively. But that leaves Weiler with the unpleasant task of choosing which missions should live and which should die.

For example, this summer Weiler killed a JPL asteroid microrover mission after its estimated cost tripled. Weeks later he halted work on a flyby of Pluto (*Science*, 17 November, p. 1270). Weiler was concerned that NASA could not afford both the Pluto flyby and a Europa probe after the combined cost of the two missions more than doubled, to $1.5 billion.

Last month, Weiler bowed to pressure from the science community to save the program by ordering an open competition for the mission, once assumed to be the property of JPL. Given that Europa's launch date has slipped from 2003 to the end of the decade or beyond, Weiler now says Pluto is worth saving to ensure a steady flow of outer solar system data after Cassini's 2004 visit to Saturn. "My concern is that if we just do Europa, it is going to tie up the budget so much for the next 8 years that the whole concept of an outer planets program is going to be lost."

Ed Weiler's To-Do List:

Visit Pluto/Europa

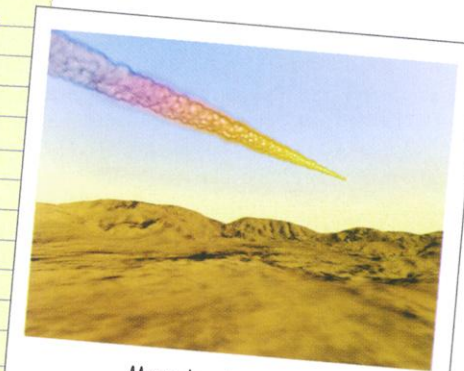
- Hold down costs enough to reach Pluto by 2015 and launch the Europa mission by 2010.

Explore Mars

- Make sure the orbiters, landers, and sample return work, and send smaller spacecraft to gather more data.

Keep the Pipeline Full

- Find a way to start a new generation of missions for a host of disciplines.

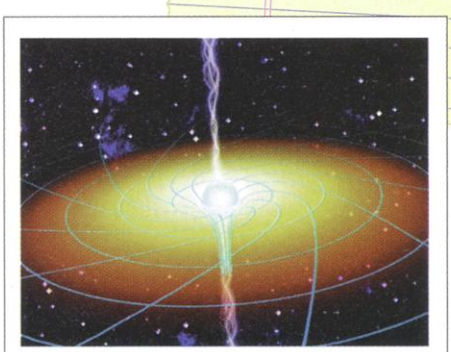


Mars lander streaks toward the surface.

A winner for a launch to Pluto between 2004 and 2006 could be named by fall 2001. But Weiler makes no guarantees about funding the initiative, recognizing that its fate hangs on the new Administration. The Clinton White House was drawn to the possibility of life below Europa's icy crust, preferring it to what one Administration official describes derisively as "a 30-minute flyby of a cold rock." Holding a Pluto competition, Weiler argues, gives the new president and Congress greater flexibility.

Pluto is only one of a handful of tough budget challenges facing Weiler. For example, the price of the Next Generation Space Telescope has been capped at $500 million, but many agency and industry officials expect it to cost more than $1 billion—even as its planned mirror size is shrinking. In addition, NASA's 5-year budget projections do not cover a significant portion of even the more modest Mars program. One sign of the strain is the recent suspension of funding, for at least a year, of finalists in NASA's small explorer program.

These financial quandaries haven't



Constellation-X would study black holes.

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'I Don't Have the Authority to Solve Everyone's Problems'

Ed Weiler, NASA associate administrator for space science, spoke candidly about a variety of issues facing NASA and the community during an interview last month with Science reporter Andrew Lawler.

On the 1999 Mars failures:

"It was a disaster. And it got worse each day: This [item] wasn't budgeted, these guys weren't talking to those guys, project scientists weren't being listened to. [More] money would have made a difference, but not all the difference. There was a serious management communication problem—the fact that a low-level [employee] is afraid to go to top management, the fact that [JPL Director] Ed Stone didn't know what was going on. It was not his fault; people weren't telling him. And I understand why they didn't call [NASA] headquarters. Headquarters already had sent them all the money. So why bother?"

On fiscal restraints:

"I had this idea that the associate administrator has hundreds of millions of dollars just waiting to solve problems. So the first thing I did was to look for where [former NASA space science chief] Wes [Huntress] had hid the money. All I found in the desk drawers were a bunch of Mars Observer buttons—no cash, no checkbook. So that was my first hard lesson: I don't have the authority or the ability to solve everyone's problems."

On Spiraling Costs:

"We had a bad habit of overconfidence in estimating costs before we started building hardware. In 1998, the budget for Europa and Pluto was [said to be] $654.0 million. There is no way in [that early stage] you can come up with a four-significant-figure budget. It befuddles me why people are surprised I took action when a [NASA] center said in June 2000, just 18 months later, 'Oops, it's $1.486 billion.' All I did was say we can't do both [missions]—we don't have the money."

On Public Understanding:

"I put myself through Northwestern, [working] at an open house program [at the observatory]. I started meeting the public and got lots of questions about why we should be putting money into science. Frankly, I think all graduate students should be forced to go though that process. The biggest frustration I have with U.S. scientists is that we think we deserve public funding. I wish we lived in a world like that. I agree that, in a healthy culture, science should justify itself. But we don't live in that utopia. And there's a lot of competition out there."

On human space flight:

"If it weren't for human space flight, Hubble would be junk! It saved the space science program. ... I'm a strong supporter of the robotic exploration of Mars first, but in my heart I know we will not fully experience Mars and get all the science we can until a human can get there and lift a rock or drill down. Even more important to the human soul is seeing Mars with human eyes. That is worth something that is not part of being a scientist, but part of being human."

On life in the universe:

"I personally believe the universe is teeming with life. It's incredibly arrogant to say that [our solar system] is the only place in the universe where intelligent life evolved. My biggest regret is that I will not live long enough to see that first contact."

stopped Weiler from touting a new series of missions, however. Two favorites are the Laser Interferometer Space Antenna, which would observe gravitational waves, and Constellation-X, which would study the formation of black holes. He would also like to bring back samples from Mars before the current 2014 date, and land a flotilla of small spacecraft outfitted with geological and astrobiology experiments, called Scouts. "I really want to blanket that planet, and land in some of the really weird places," he adds.

Positive vibes

Some researchers grumble that Weiler and Goldin haven't pushed hard enough for more money to ease the crunch on current programs and to make room for new ones. NASA's space science budget has remained stagnant for a decade, despite successes such as Chandra, widespread publicity on its research findings, and a generally favorable attitude among politicians toward robotic space missions. And this is happening at a time when other science agencies are scoring double-digit increases. Weiler himself proclaims this "a mystery" and a source of great frustration.

But few scientists are calling for his head. There's a feeling in the scientific community that Weiler is their best hope for fixing the problems and finding a way to launch more missions and carry out more science. "He may rub some people the wrong way, but he's doing an excellent job," says David Black, director of Houston's Lunar and Planetary Institute. "He's taken a pretty strong initiative in a variety of fields," adds Lou Lanzerotti, a physicist and engineer with Lucent Technologies in Murray Hill, New Jersey. "I get positive vibes." Adds Huchra: "Overall, the community gives him good grades."

So far, Weiler's trademark bluntness is proving to be an asset. Although not physically imposing at 1.75 meters tall, "Ed can scare and alarm people," says one scientist, particularly people at JPL. But his willingness to say what he thinks (see above) and to defend his turf wins him generally high marks from Congress, the White House, and his fellow agency managers.

That style is in stark contrast to the calm and diplomatic manner of his predecessors, including Wes Huntress, now director of the Carnegie Institution of Washington's geophysical lab. His frank approach is "refreshing," explains one administrator. "He's a straight-shooter, and he's diplomatic enough," adds a congressional staffer.

Weiler doesn't much care if he's liked, and he avoids the socializing that often goes with an administrative job in Washington. He makes it clear that he is ready to use all of his street smarts on behalf of space science in the budget and political battles that lie ahead. He used to keep a copy of Machiavelli's *The Prince* on his desk to tease a colleague that he jokingly labels "Mr. Nice Guy." Being nice is easy, he says, "when you don't have a budget to manage." **–ANDREW LAWLER**

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