Indeed, some researchers are bothered by the exclusivity of CaP CURE's meetings and consortia. For example, its prostate tissue banks at the moment are open only to the four universities inside the foundation's Genes and Family Studies Consortium, which Hood runs. CaP CURE also relies on a hand-picked coterie of specialists as grant reviewers—and much of the money is awarded to their home institutions. "Some people have said that it's an old-boy network, and to some extent they're right," admits Holden, who nevertheless says that the institutions involved with CaP CURE are "topnotch" by any measure.

And although everyone is happy to receive a check 3 months after submitting a grant, some researchers grumble about the limited 1-year duration of the awards. "A year makes people a lot more nervous," says Coffey, and makes it difficult to hire staff.

Meanwhile, although biotech executives praise Milken's promotional and fundraising skills, some are leery of getting too close to him. "Mike Milken, being the head of CaP CURE—and a convicted felon for stock fraud and manipulation—is not someone you can entertain as a supporter of a small start-up company," says virologist Daniel Henderson, CEO of Calydon in Sunnyvale, California. "You can't get quality investors to invest alongside him. So you have to stay away."

Most substantively, some researchers fault the foundation's focus on late-stage disease. Neither the NCI nor the American Cancer Society (ACS) takes that approach. "We like basic research, because time has shown that's where everything has come from," says Dawn Willis, ACS's director of research promotion and communication.

Holden and Milken are the first to admit that their efforts haven't paid off yet for patients in the most dire straits. "You can't say that a patient diagnosed with advanced prostate cancer in 1999 is going to live longer than he would have in 1993," says Holden. Still, many researchers say that CaP CURE has hiked the chances that new therapies will emerge sooner rather than later. "They've seeded the area," says Neubauer. "I think there are some signs that it's starting to bear fruit."

Hood and Lange would agree. After analyzing DNA from families recruited through *Larry King Live*, they have identified a gene that seems to predispose 15% of those men to prostate cancer. They've also uncovered more than 200 molecules that are overexpressed in cancerous prostate cells, and they're talking to pharmaceutical companies about trying to use these to diagnose and even treat the disease. If they and others succeed, Milken's entrance into cancer research may turn out to have been his most important business venture.

—**ERIK STOKSTAD**

SPACE SCIENCE

To Mars, En Masse

A fusillade of probes heading to Mars in the next decade marks a new era in space exploration

PARIS—William Boynton labored for 8 years on the gamma ray spectrometer for Mars Observer, the first instrument he had ever built for space. Then disaster struck: the ill-fated spacecraft was declared missing, presumed dead, as it neared its target in August 1993, taking with it not just Boynton's instrument but a host of others. The $845 million mission had been the first attempt that U.S. scientists had made for Mars in almost 2 decades. When it vanished, the blow was crushing. "It was almost like a death in the family," recalls Boynton. "People in the building were uncomfortable. They didn't know what to say to us."

When Boynton first heard that copies of the Observer instruments were going to be sent back to Mars on a series of missions-on-the-cheap—with his slated to be on the last, due for launch in 2001—he thought it was a crazy idea. But a vibrant new Mars program has made Boynton, and many of his colleagues, converts. At a conference* here earlier this month hosted by the French space agency CNES, scientists described one new Mars mission after another, some major campaigns—the cluster of missions intended to bring samples of the planet back to Earth in the middle of the next decade—and others tiny. Current plans foresee 20 spacecraft making the voyage before 2010, of which five are en route, and a series of "micromissions," which could add many more (see table). The probes will scrutinize everything from subsurface ice to the edge of the atmosphere. No single setback can stymie all the new missions; there are more eggs in more baskets than ever before.

This is not just a matter of more Mars missions; it's a different approach to exploration. The missions are small, the risks are high, and the pace of innovation is quick. For example, the plans for carrying out the sample-return missions, of which the first is just 4 years away, have been completely rewritten in the past 6 months. To some, this continuous evolution is thrilling and satisfying: "It makes the whole program a hell of a lot more robust," says Cornell University's Steven Squyres, principal investigator on the 2003 Surveyor rover mission. Others are unsettled by the ever-evolving effort's breadth. "With the whole variety of different things which are being put forward on the smorgasbord table right now, I don't think things have been sufficiently focused to identify the highest priority goals," says Gerald Wasserburg, a geochemist at the California Institute of Technology in Pasadena.

Adding to the ferment is the increasingly international nature of the effort. While the lion's share belongs to the United States—Russia's program is so diminished that no Russians even made it to Paris—there are Japanese and European missions, and, above all, a critical role for France. CNES is now an integral part of NASA's efforts. Negotiated over the past year, the CNES–NASA deal is a huge boost for both sides: French science minister Claude Allègre satisfies his desire to steer his country's program from manned to unmanned spaceflight, while the United States gets someone else to pick up some of the tab for the sample-return program. "They bring a very high level of commitment and a great deal of technical capability," says NASA's Carl Pilcher. "From a program with very narrow reserves they've allowed us to convert to something much more robust."

According to the latest sample-return plan, the United States will gather the samples and the French will bring them back. The idea is that NASA rovers launched with companion landers every 2 years or so will pack about 40 samples of rock and soil into 15-centimeter-wide canisters mounted on simple three-stage solid-rocket boosters just big enough to put such a canister into a stable orbit round Mars. (The booster was originally designed for the U.S. Navy 40 years ago as a minimal response to Sputnik: Brian Wilcox, the son of that project's manager, happens to work at NASA's Jet Propulsion Laboratory and realized that it would do the sample-return trick quite nicely.)

The French will bring the samples back to Earth, with an orbiter and four "netlanders" to be launched in 2005, on an Ariane 5, which will also carry the second NASA rover. (The Ariane 5, which is considerably bigger than the U.S. launchers that NASA could afford within its Mars exploration budget, is a crucial part of France's contribution.) With the help of ra-

* International Symposium on the Mars Exploration Program and Sample-Return Missions, 1 to 5 February, the Veme.

dio beacons and laser guidance, the orbiter is meant to pick up both sample canisters deposited in Mars' orbit by the landers; if you remember the spacecraft James Bond's nemesis, Blofeld, used to swallow up other satellites in *You Only Live Twice*, you have the general idea. The orbiter will then fire its rockets and head back to Earth, dropping off the sample return canisters over Utah.

Ariane 5 is also vital to another strand of Mars exploration. When it launches communications satellites, the booster often has spare capacity that can be used to lift small payloads—and with the help of a lunar swing by, these payloads can be slung on a Mars trajectory. The U.S.–French team is planning a series of micromissions to get to Mars this way. The first two, included in NASA's 2000 budget request, will be a communications relay satellite to help Mars missions talk to Earth and to each other, and an aircraft that will, if all goes according to plan, fly along some of Valles Marineris, Mars's Grand Canyon, on the centenary of the Wright brothers' first flight at Kitty Hawk. Yes, this is a stunt—but one with some scientific rationale, as the aircraft could identify the composition of the thinly layered deposits that make up the canyon's sheer walls.

Other micromissions discussed at the meeting include derivations of the basketball-sized Deep Space 2 penetrators, which will be hurled at the face of Mars by the Polar Lander spacecraft just before the main craft soft-lands on the planet this December. Four pairs of these probes, each sharing a carrier spacecraft, could fit into the hitchhiker slots on a single Ariane 5—enough to form a network of probes for monitoring Martian seismic rumblings. The standard designs and cheap piggyback launches could keep the cost of such missions to as little as $30 million each.

Such small numbers give the heady feeling that almost anything is possible. But even the leanest missions have a way of growing. The first sample-return flight, for example, was scheduled for 2001, but it had to be delayed to 2003, because the '01 lander had become too complicated and expensive. The '03 lander is also larded with extra instruments to characterize the problems that could face manned missions—how bad is the radiation, for example, and how inconvenient or toxic is the dust. One engineer puts it this way: The program planners "give you an eight pound bag and tell you to get ten pounds into it. You explain, and they come back with a ten pound bag and ask you to put 13 pounds into it. When you complain they look shocked and say 'but we gave you a bigger bag!' "

Some old and wise heads worry that the effort lacks a guiding strategy. "The number of missions and the extent to which we can achieve substantial goals is of concern to me," says Wasserburg. In particular, he sees the experiments aimed at paving the way for human exploration as "absurd." In a decade, he fears, we could end up with a lot of small triumphs but a number of big scientific questions still unresolved. If that were to be the case, it would be disappointing—but far less disappointing than the silence from Mars Observer. —OLIVER MORTON

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A MARTIAN CHRONICLE

Mission (origin if not U.S.*)	Mars arrival	Spacecraft type	Mission goals	Funding status
Mars Global Surveyor	in orbit	Orbiter	Physical mapping, surface composition	operational
Mars Climate Orbiter	Nov. '99	Orbiter	Meteorological and climate studies	in transit
Mars Polar Lander	Dec. '99	Lander	Surface studies of south polar cap	in transit
Deep Space 2	Dec. '99	Two micromission penetrators	Subsurface composition	in transit
Surveyor '01 Orbiter	Oct. '01	Orbiter spectroscopy	Global surface	committed
Surveyor '01 Lander	Jan. '02	Lander with small rover	Surface studies (site to be decided)	committed
Surveyor '03 Lander	Dec. '03	Lander with rover	Sample acquisition and launch to orbit	committed
Mars Express (ESA)	Dec. '03	Orbiter	Global imaging and composition studies	to be decided in May
Beagle 2 (ESA/UK)	Dec. '03	Lander (exobiology focus)	Surface science	not funded
Kitty Hawk	17 Dec. '03†	Aircraft micromission	Detailed mapping/ composition	in budget
Relay satellite	late '03	Communications micromission	Infrastructure	in budget
Nozomi (Japan)	Jan. '04	Orbiter	Aeronomy and upper atmosphere science	in transit
Surveyor '05 Lander	July '06	Lander with rover	Sample acquisition and launch to orbit	committed
Netlander (France)	July '06	Four-lander	Geophysics seismic network	committed
Sample-return vehicle (France)	July '06	Orbiter	Retrieval and return to Earth of '03 and '05 samples	committed
Further micromissions?	mid '06	Orbiters or landers (2 to 24)	To be decided‡	not funded
Surveyor '07 Lander	Sept. '08	Lander with rover	Sample acquisition and launch to orbit	intended
Further micromissions?	mid '08	Orbiters or landers (2 to 24)	To be decided‡	not funded
Surveyor '09 Lander	Sept. '10	Lander with rover	Sample acquisition and launch to orbit	intended
Sample-return vehicle	mid '10	Orbiter	Retrieval and return to Earth of '07 and '09 samples	intended
Further micromissions?	mid '10	Orbiters or landers (up to 8?)	To be decided‡	not funded

* All missions can include participation from other countries.

† Wright brothers centenary is preferred date.

‡ Possible micromissions include: communications orbiters, seismology network, meteorology network, magnetosphere studies from orbit, subsurface penetrators based on Deep Space 2, further aircraft including balloons, microwave sounding, thermosphere studies, aeronomy.