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Temperature Rise in Last Minutes

By JOHN M. BRODER

HOUSTON, Feb. 2 — Six minutes before the space shuttle Columbia ripped apart, temperatures on the left fuselage spiked by 60 degrees, space agency officials reported today as they detailed a sequence of ominous problems aboard the doomed spacecraft.

In a news conference this afternoon, Ron D. Dittemore, NASA's shuttle program manager, said there were several indications of an unusual increase in temperatures on the shuttle's exterior near the left wheel well. He also said that two minutes before the craft broke up computers detected an increase in drag on the left side, suggesting a rough or missing tile on the shuttle's protective surface.

Mr. Dittemore said the findings did not necessarily point to the cause of the fatal accident, but did provide potentially important pieces of a complex puzzle. He cautioned that the inquiry was barely 30 hours old and was likely to produce many false leads before it produced a definitive account of the disaster.

"I'm confident that even what I tell you today will be fluid and will change from day to day for a while," Mr. Dittemore said. He added that officials hoped to retrieve 32 additional seconds of data from NASA computers that they believed had been received on the ground after controllers lost contact with the crew.

As engineers sought a technical explanation for the disaster, families of the seven astronauts and a stunned world mourned the loss and looked for solace. At places of worship in the astronauts' hometowns — from Spokane, Wash., to Tel Aviv to Karnal, India — thousands grieved for the crew members. Makeshift shrines rose at the Johnson Space Center here and at Cape Canaveral in Florida.

And across eastern Texas and western Louisiana, hundreds of people spent the day recovering debris from the spacecraft and body parts from the crew.

President Bush attended services this morning at St. John's Episcopal Church, across Lafayette Square from the White House. The Rev. Luis Leon, the church rector, said the seven astronauts represented the American drive to explore the unknown. "We grieve because they represented the best in us, because part of us has died," Mr. Leon said.

The White House announced that Mr. Bush would fly to Houston on Tuesday to attend a memorial service for the shuttle crew. But officials said the president's and the nation's grief would not deter him from confronting Iraq over its weapons programs.

National Aeronautics and Space Administration officials promised an exhaustive investigation that would find the cause of the catastrophe. But none raised doubts about the future of the shuttle program or America's commitment to sending men and women into space.

Sean O'Keefe, the NASA administrator, said the space program had suffered "an accident of epic proportion" and announced that he had named an independent board to investigate the accident. It will be headed by Harold W. Gehman Jr., a retired Navy admiral, who led the investigation of the bombing of the destroyer Cole in Yemen in 2000. Congress and the space agency will conduct additional inquiries into the cause of the disaster. All shuttle operations, meanwhile, have ceased.

The White House said today that Mr. O'Keefe would brief President Bush in the Oval Office on Monday and meet later with members of Congress.

A senior administration official said Mr. Bush would propose an increase in financing for NASA in the budget he sends to Congress on Monday. The official said the proposed increase would be to \$15.470 billion for the fiscal year that begins Oct. 1, up from \$15 billion in the current fiscal year and \$14.892 billion last year.

The official said the increase was settled on long before the loss of the shuttle on Saturday, and he said it was too early to say whether the administration might support calls for more money to replace Columbia. But he said an important part of the NASA budget the president will submit on Monday will be a "life extension effort" to upgrade the existing shuttle fleet.

Ari Fleischer, the White House press secretary, said the president remained committed to the space program. "From the president's point of view, the mission of science and the marvels of space exploration will go on," Mr. Fleischer said.

As NASA engineers analyzed data here, hundreds of people, including some astronauts and NASA officials, continued searching a 900-square-mile swath of Texas and Louisiana for pieces of the shuttle. The debris will be sent to Barksdale Air Force Base, near Shreveport, La., for analysis, but officials said it was unlikely that they would find enough of the wreckage to reconstruct the shuttle.

The remains of the astronauts will be sent for analysis to the Charles C. Carson Center for Mortuary Affairs at Dover Air Force Base in Delaware, which has identified bodies in other disasters.

Russia launched a Progress rocket today on a previously scheduled flight to deliver food and fuel to three astronauts, two Americans and a Russian, aboard the orbiting International Space Station. American space shuttles have shared space station resupply duties with Russian unmanned rockets.

But the shuttles perform another critical duty: using their rockets to keep the space station in orbit. The Russian Interfax news service last night quoted one unnamed Russian space expert as saying that "closing down the International Space Station this year is inevitable," even if shuttle flights are halted only briefly.

Engineers studying the disintegration of the shuttle have focused on the craft's left side from the beginning. A piece of hardened foam insulation from the external fuel tank broke off 80 seconds after the Columbia lifted off at Cape Canaveral on Jan. 16 and hit the shuttle's stubby left wing.

Mr. Dittemore, the program manager, said the hit from the broken-off insulation was not discovered until a day after the Columbia's ascent, when engineers reviewed liftoff tapes.

He said that there had been a "thorough discussion" of the event and that NASA experts had concluded that the incident was "inconsequential." He said that even if it had caused damage to the shuttle's heat-shielding tiles there was nothing that could have been done to repair it in space, and the trajectory of re-entry would not have changed. He said that the path of re-entry was designed to minimize heat formation on the underside of the vehicle and that there was no way to reduce it further.

After repeated questioning today, Mr. Dittemore acknowledged that NASA experts had found "significant problems" on the left side of the craft and that the insulation accident could have started the chain of events that led to the shuttle's demise. But he said he was far from ready to accept that explanation.

Mr. Dittemore added additional details to the chronology of the shuttle's final minutes of flight. He said that at 8:53 a.m. Eastern time, as the craft neared

the California–Nevada border, temperature readings from hydraulic lines on the left side of the craft stopped being transmitted. Sensors on other controls, including brake lines and actuators, rose 25 to 30 degrees in five minutes. He called that the "first significant thermal event" reported from the shuttle's instruments.

At 8:54 a.m., he said, temperature sensors in the border between the shuttle's thermal tiles and its metal skin along the left fuselage recorded the 60-degree heat spike, while temperatures inside the cargo bay and on the right side of the craft remained within normal limits.

At 8:58, as the shuttle crossed New Mexico, its controls began to indicate an increase in drag on the left side. The drag continued to increase as the shuttle crossed West Texas.

"The flight control system was commanding surfaces to get the vehicle back to where it believed it should be, more to the roll to the right," he said. "Soon after, we had a loss of signal."

Mr. Dittmore said the astronauts aboard the Columbia gave no sign that they were aware of the heat-related problems and expressed no concern about the unusual behavior of the ship on re-entry. He said that as trained pilots they were almost certainly monitoring the computer-driven instructions that were correcting for the unexpected drag.

"We know they are monitoring flight control systems," he said. "We know that they're monitoring attitude. We train them to do that. As pilots, that is what they're going to do."

However, he added, "We have no data, no communication, no evidence that the crew was alarmed."

Speaking of the increased drag on the shuttle, Mr. Dittmore said it was "well within the ability of the flight control system to respond to and to react." But he went on to say, "It's out of family in the sense that we've never seen it to this degree."

In answer to a question, Mr. Dittmore said that after the insulation accident, officials had considered trying to photograph the shuttle — through satellites or large telescopes — to look for signs of damage. That approach was discarded, he said, because photos could not discern the severity of any tile problem, and because the astronauts were incapable of repairing tile in space.

He added: "The best experts at our disposal concluded that it was a minor problem, not a significant problem. And when you added it all up, there was no need to take pictures to document any evidence because we believed it to be superficial."

The agency had long ago decided that a complex space walk to repair tiles could end up doing even more damage to the space shuttle, Mr. Dittmore said, so the idea of training for that contingency was abandoned.

On the ground, the search for body parts and remnants of the wrecked spaceship continued, with new pieces being found across the debris field throughout the day.

No injuries were reported from falling debris, although 70 people in Nacogdoches County, Tex., went to local hospitals because they had touched bits of wreckage and feared for their health. Officials continued to warn people away from the debris because the shuttle operates on a toxic brew of chemicals and propellants.

A piece of wreckage that witnesses said was as big as a compact car was reported to have fallen into the Toledo Bend reservoir along the Texas–Louisiana border, leading to fears that the water source for a large region was polluted. Gov. Rick Perry of Texas said he had dispatched state environmental officers to check the lake, but he reassured residents that "any debris in that large a body of water should not be a problem at all."

The nation and the world today mourned the astronauts: Col. Rick D. Husband of the Air Force, the shuttle's commander; the mission pilot, Cmdr. William C. McCool of the Navy; Lt. Col. Michael P. Anderson of the Air Force, the payload commander in charge of the science equipment; Dr. Kalpana Chawla, an aerospace engineer; two Navy doctors, Capt. David M. Brown and Cmdr. Laurel Salton Clark; and Israel's first space traveler, Col. Ilan Ramon.

Pope John Paul II prayed for the seven victims during a Mass in Rome, saying "the new pain of the tragic explosion" had "provoked strong emotions in all of us."

President Vladimir Putin of Russia sent messages of condolence to President Bush and Prime Minister Ariel Sharon of Israel. Mr. Putin told Mr. Bush that Russia was "all the more sensitive to this tragedy" because of the close cooperation in space exploration between the United States and Russia.

In Titusville, Fla., where many Kennedy Space Center workers live, the Rev. David Waller memorialized the astronauts at a morning service. He called the trail of smoke from the burning shuttle "a glistening tear across the face of the heavens."