

MARSBUGS:

The Electronic Exobiology Newsletter

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AVIAN DEVELOPMENT STUDIED ON MIR SPACE STATION NASA release: 95-57

Scientists have taken the first steps toward understanding how microgravity affects the development of birds with the successful "fixing," or preservation, of fertilized quail eggs aboard the Russian space station Mir. The eggs are part of a group of eggs launched aboard a Russian Progress transport vehicle earlier this month and then transferred to Mir. Crewmembers will fix the remaining eggs at later stages of development before they hatch. The preserved eggs will be returned to Earth aboard Space Shuttle Atlantis as part of the STS-71 mission. This mission, tentatively scheduled for a June launch, will mark the first time a U.S. Space Shuttle docks with Mir. A second group of fertilized quail eggs is scheduled to be transported to Mir later this year.

The quail experiment, known as Incubator II, is one of the basic biology experiments being conducted as part of the Shuttle/Mir science program. Gary Jahns, Ph.D., is the Shuttle/Mir payload manager at NASA's Ames Research Center, Mountain View, CA.

"The primary objective of the 11 principal investigators is to answer key questions about the effects of microgravity on avian development," Jahns explained. "From the beginning

this was developed as a joint U.S./Russian experiment, with investigators from both countries sharing all samples."

Ames' Life Sciences Division developed special fixative containers and glove bags to provide three layers of containment for the potentially hazardous fixatives required by U.S. investigators. "This hardware allows the cosmonauts to work safely with much better fixatives than have been allowed on Mir in the past, enabling far more detailed analysis of returned samples," Jahns said.

Next year, plans for the experiment are more ambitious. "Current plans are to fly adult quail to Mir in March 1996," Jahns continued. "The first group will include three female and one male quail. During the initial stages of the research, astronauts will put the eggs that we anticipate will be fertilized in space into an on-board incubator. Scientists will study the eggs at various stages of development," Jahns said.

They will be returned to Earth either on the Space Shuttle or on a Soyuz vehicle. "The hardware concepts developed and tested as part of the joint Shuttle/Mir project will be of great benefit to the development of future hardware being designed for the international Space Station," Jahns said. "In addition, using facilities on Mir will give U.S. researchers the unique opportunity to explore many areas of growth and development that have, to date, been unavailable to the U.S. research community."

Jahns said that the international cooperation in the Shuttle/Mir program offers tremendous opportunities for both American and Russian scientific communities. "The integration of U.S. and Russian space resources offers the research communities a greater capability to perform critical research than would have been possible if the two programs had remained isolated," he said.

"This avian experiment continues 20 years of fruitful collaboration between NASA and the Russian Institute of Biomedical Problems, located in Moscow."

THE PERSPECTIVE FROM SPACE IS CRITICAL TO EARTH STUDIES

NASA release: 95-54

The following statement by NASA Administrator Daniel S. Goldin was released today to mark the 25th anniversary of Earth Day.

In the 25 years since the first Earth Day, we have changed the way we think about our planet. Apollo astronauts captured the Earth as a blue marble against a vast background of darkness-- beautiful, but fragile and finite. Our missions to other planets have revealed them to be fascinating and diverse, but also lacking any obvious signs of life. We know of no place like Earth. NASA has developed a program, called Mission to Planet Earth, that captures the spirit of exploration and focuses it back on our own planet. Only from space can we obtain the global perspective needed to better understand how all of the parts of the Earth's environment--air, water, land and life--interact and make life possible. Mission to Planet Earth, for which NASA has partners across the U.S. government and around the world, has helped reveal the Earth's secrets. To give just a few examples:

Working with other agencies and industry, NASA researchers helped establish that human industrial activities were threatening the ozone layer. NASA and the National Oceanic and Atmospheric Administration (NOAA) data now indicate that international treaties designed to protect ozone are beginning to work.

TOPEX/Poseidon, a satellite developed by NASA and the French space agency, is providing us with our first truly worldwide data on changes in global sea level, and is helping us better track El Nino, a physical change in the Pacific Ocean that dramatically alters weather patterns around the globe. NASA researchers were able to track and measure the cooling effect that the 1991 eruption of Mount Pinatubo had on the Earth's climate. Researchers around the world are still studying the volcano's effect on ozone levels in the tropics. NASA research is helping us to understand natural disasters: floods, earthquakes and severe storms. By better understanding them, we can better prepare for them and lessen their damage.

In the longer term, we will need to unravel other mysteries. Will the Earth get warmer? Will sea levels rise, threatening coastal communities? Will rainfall patterns shift? How would climate change affect weather, the frequency of severe storms and the way we live? These are the scientific challenges we will study in the next 25 years. NASA is also participating in the Administration's initiative "Technology for a Sustainable Future." This program cuts across the government to identify and promote technologies that simultaneously protect the environment and promote economic competitiveness. NASA's part of the initiative, called Insight 2000, is a joint effort with

NOAA and the Department of the Interior. This program aims to identify users of environmental data beyond the scientific community-- state and local governments, educators, industry, not-for-profit groups--and get useful data to them.

NASA's environmental research goes beyond Mission to Planet Earth. The Office of Aeronautics is working with industry to develop cleaner-burning engines for tomorrow's airplanes. These airplanes will use less fuel and cause less damage to the atmosphere. Within the agency, NASA has developed an extensive environmental management program in all its activities. We instill efficient management practices through pollution prevention and waste minimization. We embrace the principles of environmental justice and pursue "green" use of resources. We will redouble our commitment to achieve compliance with environmental laws and regulations.

In more than 35 years of space travel, we have looked out at the Universe and found that for the time being the Earth is the only place we can live. We have also looked back and seen that our planet is not a collection of separate environments, but a single global environment, protected by a fragile shell of air. On Earth Day 1995, we look forward to the next 25 years, as NASA continues to help humanity understand its environment and how it is changing.

MARS PATHFINDER UPDATE

Brian Muirhead, Mars Pathfinder Project Flight System Administrator
April 24, 1995

Flight System Status Report

The Mars Pathfinder Flight System Team of over 400 engineers and technicians all over the country is currently in the final stages of engineering model testing and flight hardware fabrication leading to the start of the spacecraft system-level Assembly, Test and Launch Operations (ATLO) phase on June 1st, 1995. This phase is coming 18 months after project start in Nov. 1994 and lasts until launch which is scheduled for December 2, 1996.

Currently, the Attitude and Information Management (AIM) subsystem has just completed its engineering model functional and vibration tests and delivered its first full-function set of flight software operating on the approximately 20-million-instruction-per-second flight computer. The Telecommunication Subsystem has started integration and test with the flight deep space transponder, diplexer and command decoder unit. The Mechanical Integration Subsystem has started assembly of the flight cruise stage structure which will then be delivered to the Propulsion Subsystem for integration with the propulsion hardware. The lander petals, cabling and various actuators are in flight fabrication and assembly. The Power and Pyro Switching subsystem is completing assembly and testing of its electronics and the solar arrays are starting assembly. The Entry, Descent and Landing subsystem has just completed key tests to demonstrate parachute stability, rocket assisted deceleration performance and aeroshell structural integrity and is preparing for a very important airbag drop test sequence at the Plumbrook Station in Cleveland, Ohio.

Overall progress is excellent, with the team feeling very excited about the progress to date, with the fruits of many hours of hard work paying off in top quality hardware/software that is coming together and starting to work as a system. The usual class of problems are occurring in this phase of a flight project such as electronic parts failures, noisy signals, test

problems and delays, etc. but the team is knocking the problems down as quickly as they come up and no schedule or budget busting problems have appeared (yet!!!!?).

Status

Design changes since Critical Design Review (CDR):

- Added auxiliary transmitter and TMU for create a redundant downlink.
- Added second area of EEPROM bringing total to 4 Mbyte. Bridle design significantly simplified.

Flight system is in final stages of detailed design (~91% by mass is detailed). Most electronic Engineering Models are complete and in test Fabrication of Development Test Model and Flight mechanical hardware has begun. Surface telecommunication performance has been reverified based on latest understanding of Viterbi decoder and Block V receiver: > 40 bps achievable based on actual mission geometry. Current open design :

- Entry, Descent & Landing (EDL) communications link.
- Airbag strength under horizontal impact with rocks.
- Auxiliary transmitter cable routing and performance.

People inside and outside the Project are reporting that Pathfinder is doing things right, is pioneering new ways of doing business and making a difference for the Project, JPL and NASA. People feel pressure but are enjoying their jobs: the team feels empowered.

General system description

Delta II launched and spin injected to Mars Earth to Mars

- Spin stabilized, hydrazine propulsion
- Solar powered, low/medium gain antenna communication

Entry, Descent and Landing (EDL)

- Ballistic entry using ablative heat shield, SLA 561
- Temperature sensors in heatshield and backshell (Aeroshell Instrumentation Package)
- Parachute deploy and descend to ~55-65 m/s vertical
- Rocket assisted deceleration to 0 +/-20 m/s vertical, 20 m/s horizontal
- Airbag triggered just prior to landing (<50 g load), deflate and retract
- Lander petals (3) open, expose solar array, high gain antenna, camera and rover

X-band downlink at 40 bps minimum over Low Gain Antenna (LGA) to 70 meter Deep Space Network ground station

At least 1200 bps to 70 meter Deep Space Network ground station w/ 3.5 degree tracking accuracy on High-Gain Antenna (HGA)

Solar arrays with secondary battery provide at least 30 days nominal lifetime

Payload

- Rover, Alpha Proton X-ray Instrument (APX)
- Atmospheric Structure and Meteorology (ASI/MET)
- Lander mounted stereo camera
- Aeroshell instrumentation (thermocouples)

General subsystem descriptions

Attitude and Information Management (AIM) Hardware

- IBM R-6000, 32 bit architecture, single board computer
- 32-bit parallel VME bus, hard backplane
- 128 Mbyte mass memory
- 4Mbyte EEPROM
- Cassini inherited Hardware Command Decoder/Critical Relay Controller
- (HCD/CRC), Reed-Solomon Downlink (RSDL), Remote Engineering Unit (REU) designs and ASIC's (Ground Data System [GDS] provides adjustments to command formats to allow use of HCD w/ Mars Observer GDS)
- Attitude control sun sensor (Adcole) and star scanner (Ball Aerospace)

Attitude and Information Management (AIM) Software

- Attitude control, command and control software written in C
- Integration of all flight software, including EDL, camera, ASI/MET, accelerometer

Mechanical Integration Hardware

- Cruise/lander structure (new designs, aluminum)
- Deploy devices (MISR and SIR-C heritage), standard pyro devices (NSI squibs)
- Active fluid loop heat rejection system (HRS)
- Standard cabling approach (use Teflon-Kapton-Teflon insulated wire)

Entry, Descent and Landing

- Aeroshell (Heatshield and Backshell) (Viking design and materials)
- Parachute (Viking design with some new materials, low altitude testing)
- Rocket assisted deceleration (RAD) (based on aircraft ejection seat rockets & space qualified propellant)
- Airbags (new designs with proof of concept testing)

Power and Pyro Switching

- 5.5 mil GaAs (gallium arsenide) cruise and lander solar arrays (existing technology)
- Lander 40 A-hr (amp-hour) Ag-Zn (gold-zinc) batteries (modified existing design, early testing)
- Shunt regulator and radiator (Cassini design)
- Power distribution, pyro switching (MSTI design)

Telecommunications

- X-band transponder, CDU from Cassini, procure new diplexer and switches
- Solid state amplifier (XSSPA) new development with Avantek power modules
- TMU, full custom ASIC (new design)
- High (comm. design), medium and low (modified Cassini designs) gain antennas

Propulsion

- Hydrazine mono-propellant, 4 Ti tanks w/PMD
- 8 1 lbf thrusters (Olin/Rocket Research)

This Mars Pathfiner status report is available on the Mars Pathfinder home page: <http://mpfwww.jpl.nasa.gov/>

THE NATIONAL SPACE SOCIETY'S 14TH ANNUAL
INTERNATIONAL SPACE DEVELOPMENT CONFERENCE

Cleveland, OH May 18-21, 1995
HOLIDAY INN, INDEPENDENCE
Held one week earlier than Memorial weekend.

PROPOSED SPEAKERS
WORKSHOPS

Dr. Guion Bluford
Astronomy

Dr. R. Lynn Bondurant
Rocketry

Michael Ciancone
Space Frontier Foundation

Charles Walker
Space Materials

Dr. Michael Fulda

Mae Jemison (invited by Ohio
Aerospace Institute

Dr. Robert Zubrin

SPECIAL EVENTS

Gordon Woodcock
NASA Tours

Dr. David Webb
Music of the Heavens Concert

Cleveland Metroparks Zoo
Rainforest Exhibit Tours

FEATURED TOPICS

Student Robotic Lunar Rover
Contest

Apollo/Soyuz (Then & Now)

NASA's Space Art Program

Teachers Seminar

Lunar & Mars Settlements

High School Student Day

Space Law

Star Gazing Party

Nano Technology

Art Exhibit & Auction

Astronaut Training

ISDC '95 Registration

Simulated Trip to the Moon

Environment

Space Medicine

Out of the Foundry into the Frontier

Privitization of Space Program

Many Roads to Space Session

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ISDC '95

Join the excitement of the NATIONAL SPACE SOCIETY'S
14th Annual International Space Development
Conference(ISDC '95) to be held in Cleveland, Ohio on May
18, 19, 20 & 21, 1995 (One weekend before the Memorial Day
weekend.)

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Friday Dinner \$19.00

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Saturday Banquet \$35.00

Sunday Lunch \$12.00

ALL MEALS \$118.00

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THE THERMAL EMISSION SPECTROMETER NEWS

By Ken Edgett

TES NEWS is the quarterly publication of the Arizona Mars K-12 Education Program. Initiated in 1992 to share news about the Mars Observer Thermal Emission Spectrometer (TES) experiment with educators and the interested public in Arizona, TES NEWS has evolved so that it now covers Arizona connections to the Mars Global Surveyor and Mars Pathfinder Missions. These connections include the TES for Mars Global Surveyor and the Imager and Wind Sock experiments for Mars Pathfinder. Other information about Mars missions, Mars science, etc. are covered, as well as topics relevant to the K-12 education outreach program.

TES NEWS offers the reader a glimpse inside the workings of a real spacecraft instrument team (the TES team working at Arizona State University) and also provides this wider range of information. Each issue also includes updated reading lists of recent books and articles (including fiction) related to Mars that may be found in local newstands and libraries (i.e., scientific journals are usually not mentioned unless there is a really vital review article).

K-12 educators interested in receiving a hardcopy of TES NEWS and other announcements about Mars educational opportunities in Arizona may send on school letterhead a note that includes name, address, phone, fax, email, school, grades, and specialties to:

K. Edgett, Arizona Mars K-12 Education Program, Department of Geology, Arizona State University, Box 871404, Tempe, AZ 85287- 1404, USA. Others, particularly interested parties not involved with K-12 education, are urged to help us save paper and money by reading TES NEWS over the Internet. TES NEWS can be found on the WWW at URL:

http://esther.la.asu.edu/asu_tes/tesnews_info.html our general URL with other educational material is:

http://esther.la.asu.edu/asu_tes/

SPACE FRONTIERCON IV: SPACE - FICTION OR FRONTIER?

The Space Frontier Foundation, Space Studies Institute, and the California Space Development Council announce the Space Frontier Foundation's fourth annual conference: SPACE FRONTIERCON IV: SPACE - FICTION OR FRONTIER? October 6 - 8, 1995 Los Angeles, CA.

Last year we discussed how we, Apollo's Children, must take back the dream of space settlement and commercial

utilization. This year, we continue this theme, reporting on why there is new excitement in the space community, excitement that can be shared by all of us. Learn about bold new commercial initiatives, increased support within Congress for extending American enterprise into space.

Planned topics and activities include:

Return to the Moon...for a profit...and to stay. Cheap Access to Space...for a profit...and to stay. Cities in the Sky Space Tourism...if you could spend two nights at an LEO hotel for \$10,000, would you?

Sex in Space

Interstellar Migration and Human Frontiers

Mars Direct

Media Coverage of Space...why can't they get it right and how we can help.

Space Art Gallery and Auction

What is Washington's role?

How you can participate...Foundation activities that need you

Plus a special event: the Saturday evening banquet where the Foundation bestows three awards: Vision-to-Reality (presented to the Delta Clipper team last year), Visions of the Future (presented to J. Michael Straczynski, creator and producer of Babylon 5), and the Foundation Service Award (presented to Tim Kyger, space development advocate).

Much, much more...with six months to go, we're still working on additional topics!

CONFERENCE TICKETS:

until June 1st \$50

June 2nd - Sept. 15 \$60

after Sept. 15 \$70

BANQUET TICKET: \$50

This is just the first notice for this conference, and more will follow as we finalize hotel and meal prices, and additional activities. It's just that we feel this conference is too important to delay its announcement until all administrative details are completed. WE WANT YOU THERE...YOU'LL WANT TO BE THERE, RATHER THAN HEAR ABOUT WHAT YOU MISSED! To register, please send a check payable to the Space Frontier Foundation, 16 First Avenue, Nyack, NY 10960. So we may keep you informed of breaking news, please provide: Name, mailing address, day and evening phones, fax, and e-mail address. Remember, if you are unsatisfied with the pace of space development, if you think that shuttles circling the Earth 300 miles up is not much advancement after traveling 240,000 miles to the Moon over 25 years ago...YOU WILL ENJOY THIS CONFERENCE.

End *Marsbugs* Vol. 2, No. 5

