

# Space News Roundup

Vol 25 No 24

December 19, 1986

National Aeronautics and Space Administration

## Season's Greetings

Dear Colleagues,

With the holidays come reflection, and it is natural that we reflect on the difficult year now coming to a close and on the goals which lie ahead. A sense of sadness will stay with us from 1986, but it is important to remember that we pulled together as a family during our time of trouble, and we retained our professionalism and our determination to continue the quest for knowledge. It is important to remember that the desire for exploration, for pioneering the unknown, has always motivated the people of JSC. The vitality of that desire has not diminished; we can find some comfort in the hope that it has instead been strengthened by adversity. JSC represents, for the western world, the pinnacle of expertise in the field of manned space flight. Nothing has changed that. We owe it to ourselves, our Center and our lost friends to profit by reflection, to renew our determination and continue the quest for excellence. Remember that the dream is still alive; keeping it alive is what we do best. And we must keep that in mind as we continue in the goals of returning safely to flight, of developing the Space Station and preparing JSC for its role in future programs. The coming year holds new promise, and I look forward to sharing that with you as we move on and move ahead. My best wishes to you and your families for a most happy holiday season.



*Aaron Cohen*  
Aaron Cohen

## Poll finds strong public support for space program

The American public strongly supports the U.S. space program and wants it to move ahead.

That was one of the findings in a survey of American attitudes towards the space program conducted by the Market Opinion Research Corporation, a leading public opinion survey organization. The firm did a nationwide telephone poll of 1,200 adults late last summer.

The survey found that the U.S. public views the Space Shuttle as a key element in achieving payoffs from the space program.

The survey showed that an overwhelming majority of Americans favor both resumption of manned flights and the building of a replacement for the Space Shuttle *Challenger*.

In addition, the study revealed that the American public favors the Space Station as a long term U.S. space goal; that support for NASA's new Space Station program has increased since January; and that Americans support increased funding for NASA's civilian space program.

Survey results showed that 70 percent of Americans approve of the space program, 76 percent believe it should be continued and 57 percent say it should be expanded.

Other results disclosed that 89 percent want to resume manned flights, 85 percent believe there should be a replacement shuttle and 76 percent think astronauts and certain key civilians should

travel on the shuttle.

In addition, 79 percent agree that obtaining benefits for medicine, industry and science requires a

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replacement shuttle for the *Challenger*, and 73 percent believe that a replacement is needed to avoid abandoning the benefits that

are attainable from the investment in the space program to date.

Sixty-three percent think that without the replacement shuttle, U.S. space capabilities would be crippled, and 58 percent believe that without a replacement, America will fall further behind the Soviet Union.

According to the survey, the American public supports a number of long term goals for the space program. Fifty-six percent say a U.S. mission to Mars should be a goal for the civilian space program, and 58 percent approve of a future joint U.S.-Soviet Union manned mission to Mars.

An even stronger majority, 78 percent, support a manned earth orbiting space station and un-

manned exploration of planets as goals for America's space program.

Americans favor NASA's new Space Station program by a margin of 69 percent to 15 percent, the recent survey found. Fifty-eight percent favored and 25 percent opposed the Space Station in a survey conducted before the *Challenger* accident.

The survey results also showed that 52 percent of Americans disagreed with the statement that expenditures for the nation's civilian space program should be cut back. Sixty percent believed that the U.S. government should spend "whatever is necessary to maintain U.S. leadership in space."

The survey was commissioned by Rockwell International.

## Space News Briefs

### Brown is new AA for Management

Administrator James Fletcher has appointed June Gibbs Brown to become the new Associate Administrator for Management at NASA Headquarters. Brown succeeds C. Robert Nysmith, who has been reassigned to the position of Director of NASA Productivity Programs. Brown most recently served as Vice President and Chief Financial Officer of System Development Corp., now a part of UNISYS, the company formed from the merger of SDC, Sperry and Burroughs. From 1981 to 1985, Brown served as the NASA Inspector General. She holds a B.A. in business administration, summa cum laude, and a M.B.A. from Cleveland State University. She received a J.D. degree from the University of Denver School of Law and is a graduate of the Harvard Advanced Management Program.

### Hermes preparatory work now underway

The preparatory program for the European Space Agency's Hermes space shuttle began officially Nov. 27 when funding by member nations reached a specified level. Under an agreement adopted by the ESA Council in October, the research and development program was tentatively approved providing that 70% of the \$35 million necessary for its completion was pledged by member nations prior to program startup. The program is intended to refine the design of the Hermes orbiter and its systems. Nations now committed to the program are Austria, Belgium, Denmark, France, Ireland, Italy, Spain, Sweden, Switzerland and West Germany. Great Britain, Holland and Canada are also expected to take part. The Hermes, intended for first flight in the 1990s, was originally conceived by CNES, the French space agency, and was adopted by ESA as a formal program in October.

### NASA and 3M sign joint agreement

NASA and the 3M Company signed a joint agreement Dec. 8 under which the St. Paul, Minn. firm will conduct 62 materials processing experiments aboard the Space Shuttle over an extended period. Signed by NASA's Assistant Administrator for Commercial Programs, Isaac T. Gillam, and Dr. Lester C. Krogh, 3M's Vice President for Research and Development, the joint endeavor agreement will provide 62 flight opportunities for the purpose of conducting materials processing in space experiments in organic and polymer science, areas in which 3M specializes and has major interests. NASA will schedule the 3M experiment flights on a space available basis. The assignment of specific flights will be contingent upon negotiation of individual task agreements which contemplate a particular 3M research project in a specific scientific area over a specified number of Shuttle flights. Under the agreement, NASA will have use of 3M's experiment apparatus for its own scientific investigations, subject to certain limitations. Although a major payload manifest has been established for the resumption of Shuttle flights, no flight dates as yet have been determined for secondary payloads — the category of the 3M experiments.

## Bulletin Board

### New Year's Eve dance scheduled

The Employee Activities Association will sponsor a New Year's Eve dance beginning at 7 p.m. at the Gilruth Recreation Center. Music will be by the Nick Navarro Combo and Sunshine Festival. The evening will begin with a social hour at 7 p.m., a cold cut buffet at 8 p.m., dancing from 9 p.m. to 1 a.m. and breakfast from 12:30 to 1:30 a.m. Tickets are \$12 per person and will go on sale at 8 a.m. Dec. 9 in the Bldg. 11 Exchange Store. The tickets will be on sale until 2 p.m. Dec. 23.

### Space radiation/VLSI conference planned

Natural space radiation and VLSI technology will be the subjects of a conference to be held Jan. 20 and 21 at the Gilruth Center. The conference will provide a forum for the exchange of information between the physics and avionics communities, organizers hope, with an eye toward future spacecraft designs to cope with the ionizing radiation environment of low Earth orbit. The conference general chairman is JSC Director Dr. Aaron Cohen. The conference committee will clear JSC employees for attendance per JSC Form 1167. Registration is required by close of business Jan. 9. The conference is being sponsored by Prairie View A&M University, JSC, the American Institute of Aeronautics and Astronautics and the Institute of Electrical and Electronic Engineers. For more information, call Dr. R. P. Bennett at McDonnell Douglas, 280-1500, x3112.

### Class planned for junior high students

Several JSC employees are planning to hold educational sessions on the Space Station for local junior high school students. The classes would begin after the first of the year, and an organizational meeting will be held at noon Jan. 15 in Room 135, Bldg. 2. Persons interested in providing ideas or expertise should call Andy Petro, x36622, Peggy Lathlaen, x38632, or Jim Poindexter, x38624, for more information.

### Armand Bayou star party planned

Star gazers will explore the winter night sky during a star party Jan. 10 at the Armand Bayou Nature Center. Telescopes will be available for viewing and a free program will be held in the Nature Center auditorium. Interested persons are advised to wear warm clothing and bring a pair of binoculars. The star party will be held from 7:30 to 10 p.m. at the Nature Center, located at 8600 Bay Area Blvd. For more information, call 474-2551, or Bill Williams at 333-1367.

### JSCAS to meet Jan. 9

The next meeting of the JSC Astronomical Society will be held at 7:30 p.m. Jan. 9 at the Lunar and Planetary Institute. An invitation to attend the meeting and join the society is extended to anyone with an interest in astronomy. For more information, call Bill Williams at 333-1367.

### BAPCO's next meeting is Jan. 20

BAPCO, the Bay Area PC Organization, will hold its next monthly meeting at 7:30 p.m. Tuesday, Jan. 20, at the Holiday Inn on NASA Road 1. The group has recently organized a special interest group for beginners, and will cover DOS, word processing, spreadsheets and databases. The local IBM PC users group is open to all persons with an interest in microcomputers and meets regularly the third Tuesday of each month. For more information, call Earl Rubenstein, x3501 or Jack Calvin, x2983.

### Next issue will be Jan. 9, 1987

The next issue of the Space News Roundup, Volume 26, Number 1, will carry the dateline of Friday, Jan. 9, 1987. The deadline for submissions to that issue is Wednesday, Dec. 31.

## MOD donates to Houston Food Bank

Employees of JSC's Mission Operations Directorate (MOD) donated \$925 to the Houston Food Bank Dec. 10.

The money was raised Nov. 1 during the second annual MOD Olympics, a family event sponsored to promote unity among MOD's six divisions and contractors.

Dr. Barbara Adams, Food Bank Accountant, and Russ Levinton, director of marketing, accepted the check from Michael Darnell, chairman of the MOD Olympics for 1986 committee.

"We're making this donation to the Houston Food Bank in hopes that the action will promote the giving spirit during this holiday season," Darnell said. "It is hoped that this donation will contribute to the benefit of the hard-core poverty stricken communities of Houston."

The Houston Food Bank is a private non-profit organization that acts as a clearinghouse where food companies and individuals can donate wholesome food. The food is distributed to 275 local charities that help the poor, hungry and victims of crisis.



Michael Darnell, representing the Mission Operations Directorate, hands a check for \$925 to Dr. Barbara Adams, Accountant for the Houston Food Bank. The money was raised during the MOD Olympics Nov. 1.

## Tracking operations extended

NASA's Goddard Space Flight Center has announced plans to extend operations at five of its ground tracking stations until at least September 1988.

The ground tracking stations planned for extended operational status are at Ascension Island in the southeast Atlantic Ocean; Santiago, Chile; Guam; Hawaii; and the Yarragadee Shuttle air-ground voice station located in western Australia.

The five stations are part of a network which relays commands to and receives data from near Earth-orbiting spacecraft, including the Space Shuttle.

Goddard's plan to eventually close those stations is conditional on the February 1988 launch by the Space Shuttle of the second Tracking and Data Relay Satellite (TDRS) and subsequent placement of TDRS into geosynchronous Earth orbit.

A third TDRS is scheduled for launch in September 1988 as a backup to either of the two operational satellites.

NASA changed its original network streamlining plans, calling for station closings to start on July 1, 1986, because of the loss of a TDRS in the 1986 Space Shuttle Challenger accident.

A sixth ground station at Dakar,

Senegal has been placed in caretaker status until resumption of Space Shuttle flights. Upon completion of the Tracking and Data Relay Satellite System constellation of three TDRS's planned for mid 1989, the Dakar station also will be closed.

The TDRSS, owned by the Spacecom of Contel and managed by the Goddard Space Flight Center, will be comprised of two operational and one spare TDRS on orbit, providing more than 85 percent coverage of a spacecraft's orbit, compared with 50 percent coverage now provided by existing ground stations and the first TDRS, launched in April 1983.

## Sensor aids ocean studies

An airborne sensing device that could greatly enhance satellites' capability to monitor ocean weather patterns has been developed by researchers at NASA's Jet Propulsion Laboratory.

The new infrared radiometer, used to measure ocean surface temperatures, is 100 times more sensitive than typical radiometers. The new radiometer's ability to distinguish between the temperature of the ocean surface and that of the atmosphere immediately above is considered a major scientific advance. Earlier airborne sensors lacked this ability, making the task of assembling highly accurate

climate maps more problematic.

The radiometer was tested in flights over waters between Los Angeles and Southern California's Santa Catalina Island, aboard the Goodyear blimp *Columbia*. The radiometer is a passive instrument—as opposed to active instruments such as radar devices that emit signals to monitor weather patterns. The radiometer gauges sea temperatures by analyzing infrared light given off naturally by the ocean surface.

Researchers hope that temperature and wind maps generated by such instruments will help scientists develop better models of highly complex global weather interac-

tions—for example, how storm systems are generated in the tropics and spread to other latitudes.

Eventually, scientists believe oceanographic research may lead to a better understanding of such phenomena as El Niño, an unusual water warming in the eastern Pacific Ocean that previously has damaged fishing industries.

The scientific team which developed the infrared radiometer was led by oceanographer Denise Hagan and physicist Crofton Farmer of JPL's Atmospheric and Oceanographic Science Section. The research is funded by NASA's Office of Space Science and Applications.



Changes to the main entrance of Bldg. 1 began last week in an effort to maintain better climate control in the lobby. The new entrance, shown in this artist's concept, features an air barrier and automatic doors.

# Bioreactor has possibilities on Earth, too

By Kelly Humphries

In studying the effects of gravity on living cell processes, a team of JSC aerospace physicians, biologists and engineers has discovered that techniques useful in producing rare medicines in space may also be valuable on Earth.

Dr. David Wolf, project engineering manager, said the biosynthetic process has the potential to produce large quantities of living cells and proteins useful in fighting diseases such as cancer, in regenerating human cells, and in supporting life in space for long periods. Meanwhile, the team's attempts to simulate biosynthesis as it would occur in microgravity have produced new and better methods of maintaining cell cultures on Earth.

"The whole team is very excited, highly motivated and determined to successfully accomplish this project," said Wolf, who is both an aerospace physician and an electrical engineer. The team includes biologists, chemists, engineers, technicians and support from Technical Services Division.

"The key thing about this team is that the work requires the close knit interactions of a highly multidisciplinary team," he said. "I think this is an excellent example of the enhanced in-house productivity, motivation and team spirit NASA is trying to promote."

This particular biosynthetic process uses a device called a "bioreactor" to grow delicate living mammalian cells that naturally secrete proteins effective in fighting many diseases. Many such pharmaceutical products can be made right here on Earth, but gravity in many cases severely limits the process and results. Research on how well this type of bioreactor works in microgravity, will determine whether the products may be produced in large enough quantity and of sufficient quality to increase their availability and reduce their cost, Wolf said.

The basic process involves seeding the mammalian cells onto tiny beads (between 50 and 150 microns in diameter) that are coated with collagen, a structural protein. The cells, which attach themselves to the beads, then live and grow in a suspension solution containing oxygen and nutrients (including glucose and glutamine). As part of their life process, the cells secrete proteins that normally would be used by the body to fight diseases or would be used as hormones, but in this case are instead filtered out of the solution and purified for use as pharmaceuticals.

In standard 1-g reactor vessels,

the cells require agitation and mixing to distribute oxygen and nutrients, remove waste products and keep the beads suspended in the culture media. But mixing also can damage the cells, which reduces the quality, quantity and concentration of product. Using more beads to sustain more cells, which could in turn secrete more product, requires more mixing. But more mixing means more damage and less product in lower concentration. High concentration is important to the next processing step, purification.

Dr. Dennis Morrison developed early concepts for growing cells in microgravity where agitation is needed only to distribute nutrients, not to induce suspension, Wolf said. With less agitation, there is less cell damage and more production of pharmaceuticals. The first experiment in a microgravity environment, on STS-7, confirmed that cells would adhere to the beads in a weightless environment.

The JSC team is working with embryonic human and baby hamster kidney cells to determine exactly how much mixing is required just to distribute nutrients to the delicate cells in microgravity and improve their survival rate. These particular cells, when properly nourished and handled, secrete products that are useful in treating heart attacks by dissolving blood clots. More important, the proteins secreted by the cells work specifically on the blood clots as they form, rather than impairing the body's overall clotting ability. The fact that these particular cells have been used for biosynthesis on Earth will provide a basis for comparison with microgravity performance.

In order to analyze fundamental bioreactor performance and separate the many variables involved, the JSC team has built a bioreactor that uses clinostatic technology to approximate zero-g. The system already is docketed for three U.S. Patent Office examinations, and the technique of using simulated zero-g in the process has become a spinoff technology for finding better ways to culture living cells on Earth.

Most equipment for the system was developed and integrated in-house in the Bldg. 37 Biomedical Laboratories Branch. Technology Inc. employees instrumental in developing the system were C.D. "Andy" Anderson, Jay H. Cross, Ray Schwarz, Laura Pearson, Bill Bowie, Bill Hall, Tinh Trinh, Marian Lewis, Kevin Damron, Helen Huls, Kay Elton, Jean Turner and Paul Swank.

"I like to refer to the system as a combination of an artificial kidney,



Project Engineering Manager David Wolf inspects the bioreactor system with colleagues Tinh Trinh, Bill Bowie and Bill Hall of Technology Inc. The drawer contains the bioreactor chamber, where mammalian cells are cultured. Above the drawer are the status display panel and the system's computer control unit. The entire system will be designed to fit into two Shuttle mid-deck lockers or Spacelab.

an artificial heart, an artificial brainstem and an artificial lung," Wolf said.

The major components include an oxygenator that serves as a lung, maintaining oxygen and carbon dioxide at the proper levels; a pump that serves as a heart, circulating the culture media; a product extraction loop that acts as a kidney, filtering the secreted product from the media by its molecular weight; and a computer, process controller, sensors and effectors that serve as a brainstem and nervous system, automatically sensing the state of the system and making corrections to maintain a constantly ideal environment for

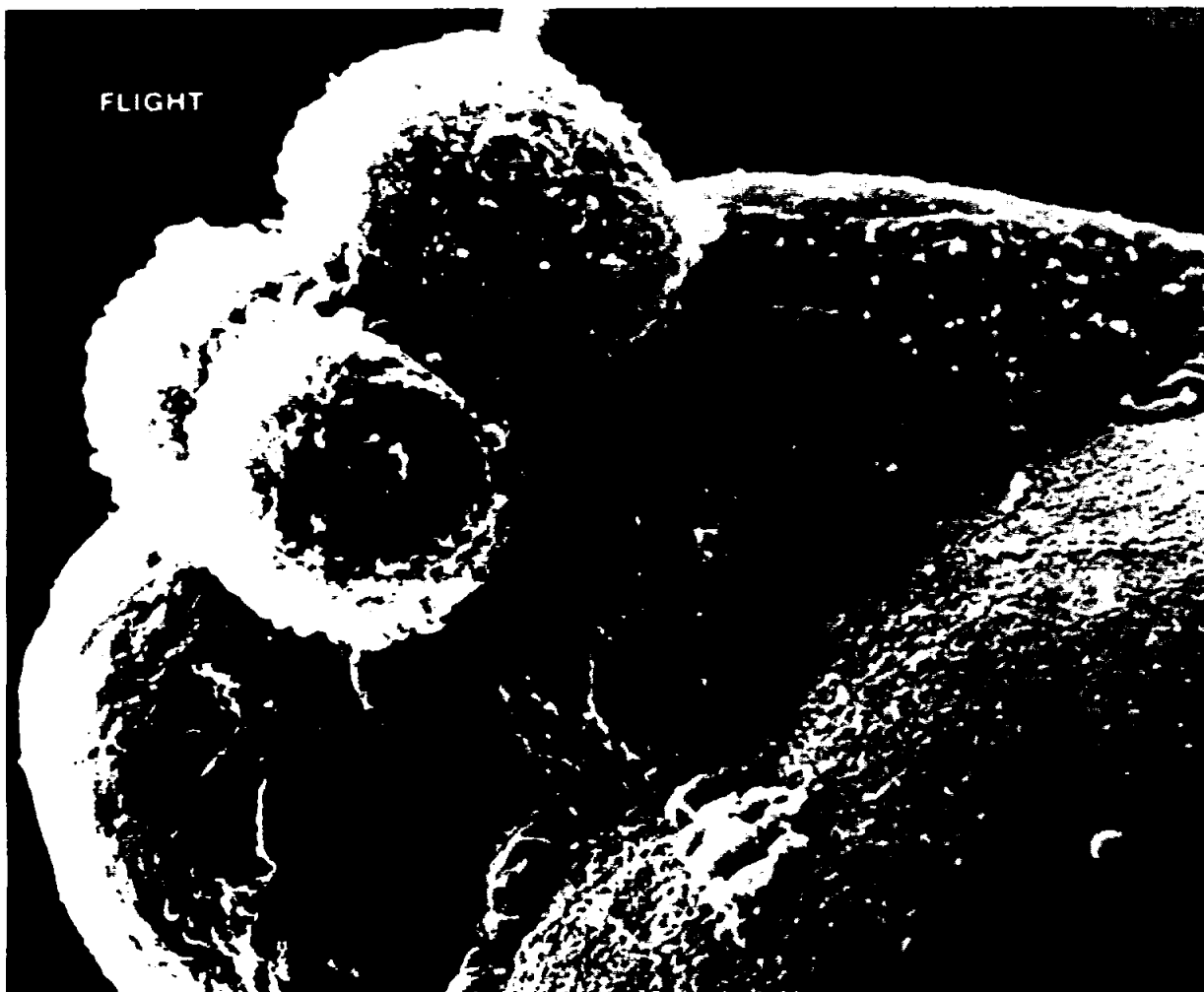
the cells.

Eventually, the bioreactor system may be teamed with the Continuous Flow Electrophoresis System (CFES) being developed by McDonnell Douglas, Wolf said. There is theoretical and experimental evidence that purification processes perform far better in space. The bioreactor would provide the feed stream that would be refined by CFES or other purification technologies, forming the basis of a space factory for pharmaceuticals.

Such a factory could sustain cell lines more difficult to culture and maintain than those now being tested. Examples include cells that

secrete erythropoietin, which modulate red blood cell formation in bone marrow and currently costs \$100,000 per milligram; interferon, an anti-viral treatment that is being tested for use against some cancers; lymphokines, which stimulate the immune system and may also be used in treating diseases.

The new processes also have the potential to regenerate human bone marrow and liver cells, which could be reimplanted in patients with associated diseases. Additional applications may include the culture of tumor infiltrating lymphocytes, which act as "killer" cells against cancer, space food production, and air and water regeneration.



These microscopic photos of the cell cultures prepared aboard STS-8 show human kidney cells attached to collagen-coated beads. Growing the cells in microgravity instead of Earth gravity reduces the amount of damage inflicted on the cells. In space, agitation is not needed to keep the cells suspended in their medium. At left, a cell is attached to one of the beads 2.5 hours after cells and beads were mixed. At center, numerous cells are anchored to one bead 24.5 hours after initial mixing. At right, several beads are shown suspended 24.5 hours after mixing.

