



Southeastern Space Supporter

Newsletter of HAL5 - the Huntsville Alabama L5 Society chapter of the National Space Society

Volume 3, Number 6 - November-December 1994

FIRST WORD

Changes for HAL5 Newsletter

(by Ronnie Lajoie, New SSS Editor)

Change is inevitable, even for HAL5. Starting with this issue, the Southeastern Space Supporter newsletter will be produced entirely with volunteer labor, including your new editor, yours truly. The change is a cost-cutting measure to make better use of HAL5 membership funds.

I would like to commend Philomena Grodzka of HATS for putting together an excellent newsletter for the past two years. I hope we will be able to keep up the good work on our new reduced budget.

I also would like to apologize for the lack of graphics in this edition, as the newsletter is still going through a period of transition. Please enjoy instead the extra articles on some really interesting topics. I promise that some neat graphics (including cartoons by Larry Scarborough) will be included in future editions.

Next year promises to be busy for us members of HAL5, as we are now at the center of the new Reusable Launch Vehicle program. See page 3 for news articles related to this program.

As the newsletter cover indicated, we are having our last program of the year this Thursday, October 26, from 7-9pm at the Huntsville Public Library. So don't miss it! The featured guest will be Dr. David Hathaway of NASA who will speak on the results of this summer's comet impacts on Jupiter. For more info, see the following article:

Hubble Sheds New Light on Jupiter Collision

(by Donald Savage, Sep. 30, 1994)

Scientists are debating that question as they continue to pore over Hubble Space Telescope imaging and spectroscopic data gleaned in the wake of the spectacular July bombardment of Jupiter by comet P/Shoemaker-Levy 9.

Their initial findings, combined with results from other space-borne and ground-based telescopes, shed new light on Jupiter's atmospheric winds, its immense magnetic field, the mysterious dark debris from the impacts, and the composition of the doomed comet itself.

The Last Days of the Comet

Before the comet impact, there was a great deal of speculation and prediction about whether the 21 nuclei would survive before reaching Jupiter, or were so fragile that gravitational forces would pull them apart into thousands of smaller fragments. Hubble helped solve this question by watching the nuclei until about 10 hours before impact. HST's high resolution images show that the nuclei, the largest of which were probably a few kilometers across, did not break up catastrophically before plunging into Jupiter's atmosphere. This reinforces the notion that the atmospheric explosions were produced by solid, massive impacting bodies.

HST's resolution also showed that the nuclei were releasing dust all along the path toward Jupiter, as would be expected from a comet. This was evident in the persistence of spherical clouds of dust surrounding each nucleus throughout most of the comet's journey. About a week before impact, these dust clouds were stretched out

along the path of the comet's motion by Jupiter's increasingly strong gravity.

Was Comet Really an Asteroid?

At present, observations seem to slightly favor a cometary origin, though an asteroidal origin cannot yet be ruled out. The answer isn't easy because comets and asteroids have so much in common: they are small bodies; they are primordial, having formed 4.6 billion years ago along with the planets and their satellites; either type of object can be expected to be found in Jupiter's vicinity. The key difference is that comets are largely icy while the asteroids are virtually devoid of ice because they formed too close to the Sun. The attached table summarizes the observational results that shed light on this question.

What is That Dark Stuff Made Of?

The HST Faint Object Spectrograph (FOS) detected many gaseous absorptions associated with the impact sites and followed their evolution over the next month. Most surprising were the strong signatures from sulfur-bearing compounds like diatomic sulfur (S₂), carbon disulfide (CS₂), and hydrogen sulfide (H₂S). Ammonia (NH₃) absorption also was detected. The S₂ absorptions seemed to fade on timescales of a few days, while the NH₃ absorptions at first got stronger with time, and finally started fading after about one month. During observations near the limb of Jupiter, the FOS detected emissions from silicon, magnesium and iron that could only have originated from the impacting bodies, since Jupiter itself normally does not have detectable amounts of these elements.

Swept Across Jupiter

Observations made with HST's Wide Field Planetary Camera-2, a week and a month after impact, have been used to make global maps of Jupiter for tracking changes in the dark debris caught up in the high-speed winds at Jupiter's cloudtops. This debris is a natural tracer of wind patterns and allows astronomers a better understanding of the physics of the Jovian atmosphere. The high speed easterly and westerly jets have turned the dark "blobs" originally at the impact sites into striking "curly-cue" features. Although individual impact sites were still visible a month later despite the shearing, the fading of Jupiter's scars has been substantial and it now appears that Jupiter will not suffer any permanent changes from the explosions.

Hubble's ultraviolet observations show the motion of very fine impact debris particles now suspended high in Jupiter's atmosphere. The debris eventually will diffuse down to lower altitudes. This provides the first information ever obtained about Jupiter's high altitude wind patterns. Hubble gives astronomers a "three dimensional" perspective showing the wind patterns at high altitudes and how they differ from those at the visible cloudtop level. At lower altitudes, the impact debris follows east-west winds driven by sunlight and Jupiter's own internal heat. By contrast, winds in the high Jovian stratosphere move primarily from the poles toward the equator because they are driven mainly by auroral heating from high energy particles.

Piercing Jupiter's Magnetic Field

About four days before impact, at a distance of 2.3 million miles from Jupiter, nucleus "G" of comet P/Shoemaker-Levy 9 apparently penetrated Jupiter's powerful magnetic field, the magnetosphere. (Jupiter's magnetosphere is so vast, if visible from Earth, it would be about the size of the full Moon.)

Hubble's Faint Object Spectrograph (FOS) recorded dramatic changes at the magnetosphere crossing that provided

a rare opportunity to gather more clues on the comet's true composition. During a two minute period on July 14, HST detected strong emissions from ionized magnesium (Mg II), an important component of both comet dust and asteroids. However, if the nuclei were ice-laden -- as expected of a comet nucleus -- astronomers expected to detect the hydroxyl radical (OH). Hubble did not see OH, casting some doubt on the cometary nature of comet P/Shoemaker-Levy 9. Eighteen minutes after comet P/ Shoemaker- Levy 9 displayed the flare-up in Mg II emissions, there was also a dramatic change in the light reflected from the dust particles in the comet.

New Auroral Activity

HST detected unusual auroral activity in Jupiter's northern hemisphere just after the impact of the comet's "K" fragment. This impact completely disrupted the radiation belts which have been stable over the last 20 years of radio observations.

Aurorae, glowing gases that create the northern and southern lights, are common on Jupiter because energetic charged particles needed to excite the gases are always trapped in Jupiter's magnetosphere. However, this new feature seen by Hubble was unusual because it was temporarily as bright or brighter than the normal aurora, short-lived, and outside the area where Jovian aurorae are normally found. Astronomers believe the K impact created an electromagnetic disturbance that traveled along magnetic field lines into the radiation belts. This scattered charged particles, which normally exist in the radiation belts, into Jupiter's upper atmosphere.

X-ray images taken with the ROSAT satellite further bolster the link to the K impact. They reveal unexpectedly bright X-ray emissions that were brightest near the time of the K impact, and then faded.

Magellan Spacecraft Ends Mission to Venus

(excerpt, Oct 14 article by Douglas Isbell)

The successful five-and-a-half year mission of NASA's Magellan spacecraft to map the surface and measure the gravity of Venus ended October 14 when ground controllers lost contact with the spacecraft. Magellan burnt up in the planet's upper atmosphere on October 16.

Magellan gathered scientific data on the planet's upper atmosphere, including aerodynamic interactions with it during the spacecraft's final descent, by orienting its wing-like solar panels in opposite directions, like a windmill.

Launched by Space Shuttle Atlantis in May 1989, Magellan entered Venus orbit in August 1990 and gathered data for over four years. The mission exceeded all of the objectives defined for its exploration of Venus.

It used radar to map 98 percent of the planet's cloud-covered surface to an average resolution of better than 300 meters and compiled a high-resolution, comprehensive gravity field map for 95 percent of the planet. The gravity data will allow scientists to see "underneath the planet's skin" and compare that knowledge of the interior to the wealth of surface features revealed by Magellan's radar imaging, said Project Manager Doug Griffith at NASA's JPL.

Magellan also performed a first-of-a-kind "aerobraking" maneuver by dipping into the atmosphere to reshape its orbit. This technique is now being used in the design of the Mars Global Surveyor mission to enable the spacecraft to enter orbit around the planet Mars in 1997 using less fuel, resulting in significant savings of weight and cost.

"The Magellan mission to Venus has been successful beyond all expectations," said JPL Director Dr. Edward C. Stone. "It has demonstrated innovative technologies for future missions."

Ozone Hole Levels Drop to Record Lows Again

(excerpt, Oct 11 article by Allen Kenitzer)

A NASA instrument aboard a Russian satellite has detected a hole in the ozone layer over Antarctica with a surface area equal to the size of the North American continent. The Antarctic ozone hole levels for 1994 are nearly as large and as deep as the record lows from October 1993, according to preliminary data obtained by scientists at NASA's Goddard Space Flight Center.

The size of the ozone hole region has nearly leveled off in 1992, 1993 and 1994, at about nine million square miles (24 million square kilometers). During these years, the ozone depletion area has nearly filled the polar-vortex wind region that places an upper bound on the possible size of the ozone hole.

The largest hole ever observed was on September 27, 1992, when the hole had an extent of 9.4 million square-miles (24.4 million square-kilometers). Since the mid-1980s, scientists have observed the region covered by low total ozone beginning to grow in early August. This region has typically reached its maximum extent in late September and its greatest depth in early October.

Ulysses Mission Status

(excerpt, JPL Press Release, Oct 1, 1994)

The Ulysses spacecraft, the first probe to fly over the sun's south pole, is providing scientists with valuable new data about the forces at work in this region of space after a 2-billion-kilometer (1.2-billion-mile) journey.

The spacecraft reached its most extreme latitude of 80.2 degrees south of the sun's equator in mid- September, and is now looping back around the sun toward the equator. Ulysses will cross the sun's equator in February 1995 and begin its pass over the north pole of the sun in June 1995.

Ulysses has discovered that the solar wind emanating from the southern pole flows at nearly double the rate -- 800 kilometers per second, or about 2 million miles per hour -- that it does at lower latitudes in the equatorial region. The composition of the solar wind also appears to differ in the polar regions, and the sun's magnetic field seems to be surprisingly uniform. Continued measurements will yield more information about other solar phenomena as well, such as the mysterious 11-year cycles of solar activity which produce sunspots that are visible from Earth and indicate very hot regions in the sun's corona, or outer atmosphere.

New Shattered Comet Found to Cross Earth's Path

(excerpt, Space News article, Sep 26, 1994)

Astronomers are keeping a watchful eye on Machholtz-2, a comet discovered to be racing toward the Sun by an American scientist last month. Shortly after the comet was discovered, observers reported the comet had broken up in a manner similar to comet Shoemaker-Levy-9 before its impact with Jupiter in July, and there is some concern the fragments of comet Machholtz-2 could impact the Earth in the future. Five fragments have been spotted so far, and all are heading for Earth's orbit. However, astronomers warn it is extremely difficult to predict the long-term behavior of the comet fragments and advise the comet will be monitored closely.

SSTO / RLV NEWS

NASA Kicks-off New X-33 Reusable Launcher Program

(compiled by Ronnie Lajoie, Editor)

NASA managers briefed industry on October 19 on its plans to develop and build the X-33 advanced technology demonstrator that will pave the way for

a new reusable space launch vehicle in the next century.

The briefing was held at the Marshall Space Flight Center, site of the program office for the experimental vehicle that NASA will develop under the Clinton Administration's new space launch policy. At the briefing NASA released its Cooperative Agreement Notice outlining how it plans to develop the vehicle in conjunction with industry, which will be expected to contribute to the cost of development.

"Initial proposals will be solicited for a planned 13-month X-33 Preliminary Design Phase (PDP) with multiple Cooperative Agreements anticipated," NASA said in its CBD notice. "At the end of the PDP, proposals are planned to be solicited for the follow-on flight Demonstration Phase, and competitive selection(s) made."

Key technologies to be incorporated into the X-33 vehicle include reusable cryogenic tanks; graphite composite primary structure; durable thermal protection systems; reusable propulsion systems; autonomous flight control, and operable systems, according to the CBD notice.

Administration Puts Out New Space Launch Policy

(excerpt from AIP article, Sep 23, 1994)

America's space launch fleet is aging, and the nation needs a policy to ensure the future of space transportation. At a September 20 hearing of the House space subcommittee, Presidential Science Advisor Jack Gibbons testified on the Clinton Administration's plans for future launch systems. The policy, due out in final form in early November, was roundly praised by Democrats and Republicans alike for its measured approach in difficult budgetary times, its delineation of responsibilities among the principle agencies, and its intent to involve the commercial space sector. According to Gibbons, a national space transportation capability is critical to

SOUTHEASTERN SPACE SUPPORTER

many of the Administration's science and technology goals. The policy separates the issue into two parts, with NASA and DOD each assigned a lead role for one part. DOD would be designated the lead agency for the modernization and evolution of the current expendable launch vehicle (ELV) fleet. NASA would develop and demonstrate the technology for a next generation of reusable launch systems. Gibbons said the plan faces fiscal realities by setting milestones for the next-generation effort, and decisions to continue forward will be made only as costs and risks are assessed. In recognition that a new space transportation system must be responsive to commercial users, the Departments of Commerce and Transportation would be tasked with stimulating private-sector interest and encouraging government-industry partnerships.

BMDO Balks at Payton Transfer to NASA's Code X

(The Aerospace Daily, October 11, 1994)

The new space access office, to be known in NASA-speak as Code X, has run into a snag as it tries to merge the old offices of Advanced Concepts and Technology and of Space Systems Development (Codes C and D) and the launch vehicle operation of the Office of Space Science (Code S). John E. Mansfield, the new head of Code X, has tapped Air Force Col. Gary E. Payton to head up development of an "X-33" flight vehicle to test reusable launcher technology. But the Pentagon's Ballistic Missile Defense Organization,

where Payton is advanced technology director, has balked at the transfer even though Payton already has spent some time working at NASA headquarters. "We're still negotiating with BMDO over Payton and still hopeful he'll come and join us," said a spokesman for the civilian agency.

NASA To Put Out 'Medium-Light' Launcher RFP

(The Aerospace Daily, October 11, 1994)

NASA plans to issue a request for proposals on about Oct. 24 for a new space launcher that it may use for a planned series of low-cost Mars probes through the turn of the century. Goddard Space Flight Center said in an Oct. 11 Commerce Business Daily notice that the RFP "will include five firm missions, and priced options for up to nine additional missions to be exercised within eight years of contract award." Known as the "medium-light" launcher, the new vehicle would carry about half the payload of a Delta II at about half the cost, boosting Mars Surveyor spacecraft weighing about 1,000 pounds to the Red Planet.

Alaska to Build Commercial Spaceport

(excerpt, Aerospace Daily, Sep 23, 1994)

The State of Alaska plans to break ground for a "better-faster- cheaper" commercial spaceport on Kodiak Island next spring, with initial capability to launch orbital vehicles based on

Thiokol's large Castor 120 motor due a year later, Alaskan officials told potential spaceport customers in Washington Tuesday.

The proposed Kodiak Launch Complex was conceived as a place where launch providers "can control their own destiny," according to Pat Ladner, executive director of the Alaska Aerospace Development Corp. Ladner, who was the original DOD program manager for the DC-X subscale single-stage-to-orbit prototype, said the facility will be built with state funds as a way to diversify Alaska's economy as oil revenues decline. The state is also developing a commercial satellite ground station at Fairbanks.

He told representatives of launch companies and government agencies that the state's philosophy is to capture anticipated small launcher business with a low-cost "pay for what you use" approach to polar launches. Documentation costs will be kept to a minimum, as will the standing workforce supporting the site, and customers will purchase services as the need them from private transportation and other contractors.

Although construction is set to begin next spring, Ladner would not reveal the cost of the planned facility. Site designers said they will incorporate input from potential users before completing their construction drawings, with flexibility a primary goal. In general the facility has been sized and designed to handle rockets in the Lockheed LLV 3 and Taurus 2 class.

<p><u>Special Announcement</u> HAL5 Program Night on THIS Thursday, October 26 "Comet Impact on Jupiter" See Inside Flyer for Details</p>	<p>Huntsville Alabama L5 Society 1019-A Old Monrovia Rd, Suite 168 Huntsville, AL 35805</p> <p>Place First Class Stamp Here</p>
--	---