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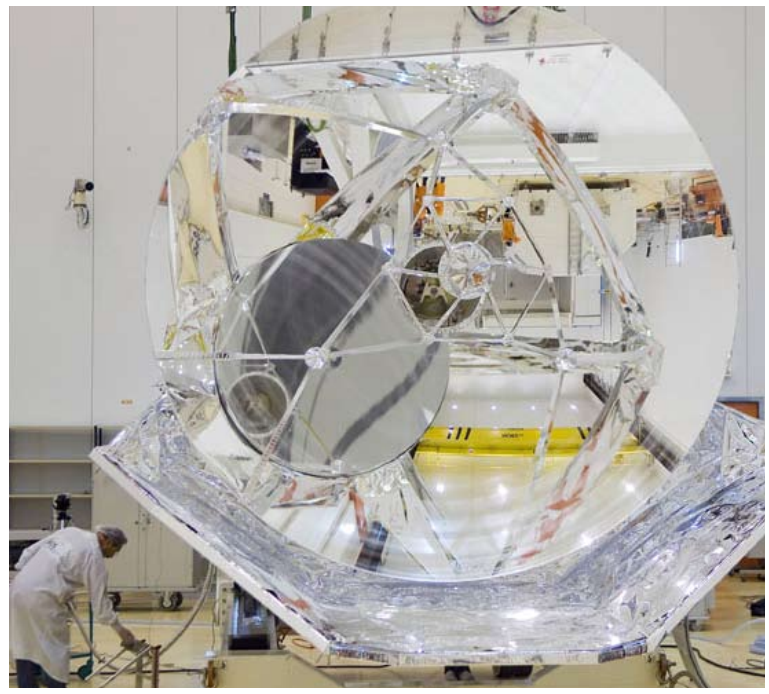
Herschel, Planck to look deep into cosmos

Thanks in large part to the contributions of instruments and technologies developed by JPL, long-range views of the universe are about to become much clearer.

By Mark Whalen



European Space Agency

In a cleanroom at Centre Spatial Guyanais, Kourou, French Guyana, the Herschel spacecraft is raised from its transport container to begin launch preparations.

When the European Space Agency's Herschel and Planck missions take to the sky together, onboard will be JPL's legacy in cosmology studies.

The pair are scheduled for launch together aboard an Ariane 5 rocket from Kourou, French Guyana on April 29. Once in orbit, Herschel and Planck will be sent on separate trajectories to the second Lagrange point (L2), outside the orbit of the moon, to maintain an approximately constant distance of 1.5 million kilometers (900,000 miles) from Earth, in the opposite direction than the sun from Earth.

The Herschel observatory will study the evolution of stars and galaxies with a mirror measuring 3.5 meters (about 11½ feet) wide, the largest astronomical telescope ever launched. Herschel will observe "cold" objects such as star-forming clouds and comets, using the far infrared and submillimeter portions of the spectrum. JPL has contributed key technology to the Heterodyne Instrument for the Far Infrared (Hifi), a Dutch instrument, and the Spectral and Photometric Imaging Receiver (Spire), a United Kingdom instrument.

Planck will improve our knowledge of the origin and evolution of the universe by measuring the cosmic microwave background radiation—the most important source of information scientists have about the geometry and contents of the universe—over the whole sky, with unprecedented sensitivity and angular resolution. JPL is providing the bolometers in the High-Frequency Instrument, technology for the low-noise amplifiers in the Low-Frequency Instrument, and a 20-Kelvin cooler that is critical for both instruments.

Herschel can be considered a successor to JPL's Spitzer Space Telescope in that it's looking at longer wavelengths, continuing to move further into the far infrared. There's overlap with Spitzer, but Herschel extends the range: Spitzer's wavelength range is 3.5 to 160 microns; Herschel will go from 65 to 672 microns. Herschel's mirror is much bigger than Spitzer's and its angular resolution at the same wavelength will be substantially better.

"Herschel is really critical for studying important processes like how stars are formed," said Paul Goldsmith, NASA Herschel project scientist and chief technologist for JPL's Astronomy and Physics Directorate. "At the start of the process in which a star is formed, you see hardly any infrared radiation (that, say, Spitzer could observe) and no visible radiation to speak of. You do get radiation at longer, far-infrared wavelengths, but that part of the spectrum is almost totally blocked by Earth's atmosphere. Herschel will be the first long-duration, extremely sensitive observatory to be able to give us complete access to this region of the spectrum."

Herschel will transform the field of galaxy evolution, added Jamie Bock of JPL's Astronomical Instrumentation Group, principal investigator for the spider web–like bolometer arrays on the Spire instrument, which will conduct large surveys of far-infrared galaxies in the sub-millimeter band. "We know that approximately half the energy of stars in the universe comes out in the far-infrared and half of it comes out in the optical," he said. "For the optical, we have things like the Hubble Space Telescope and ground-based telescopes to view galaxies in the billions, and millions more with spectroscopy. In comparison, in the far infrared we have maybe a few hundred pictures of galaxies that emit primarily in the far-infrared, but we know they are important in a cosmological sense, and just the tip of the iceberg. With Herschel, we will see hundreds of thousands of galaxies, detected right at the peak of the wavelengths they emit."

Photos: Carol Lachata, JPL Photolab

Jamie Bock, left, and Charles Lawrence.

A large fraction of the time with Herschel will be spent studying regions of star formation in the Milky Way. "As the star-forming regions get denser and colder, the gas tends to turn into molecules, rather than atoms," noted Goldsmith. "Then the question becomes one of chemistry and what molecules actually exist in these interstellar, star-forming clouds." A major part of JPL's involvement in Herschel's mission will be addressed at NASA's Herschel Science Center, directed by George Helou and operated by Caltech's Infrared Processing and Analysis Center. Professor Tom Phillips is the U.S. principal investigator for the Hifi instrument, which will make the first spectral scan of these star-forming regions.

Paul Goldsmith, left, and Ulf Israelsson.

Ulf Israelsson, manager of JPL's Herschel/Planck Projects Office, added that the NASA Herschel Science Center will operate the American component of the solicitation process and will develop software to support observations by the U.S. science community.

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Gavin noted leader of leaders

By Mark Whalen

Carol Lachata, JPL Photolab

From left: Tom Gavin today; in 1970; in 1994 with then–JPL Director Ed Stone, Cassini Project Manager Dick Spehalski and California Sen. Barbara Boxer; with Chris Jones, celebrating Cassini's successful orbit insertion in 2004.

Now in his 47th year at JPL, Tom Gavin has seen it all. He has learned hands-on from some of the greatest leaders in the Lab's history, and through an accomplished and award-filled career he has made it his call to help prepare many of JPL's new leaders of today as well as others yet to come.

A year after earning a chemistry degree from Villanova University in Pennsylvania in 1961, Gavin joined the Lab to work on the Mariner Project, the series of missions that would begin JPL's accomplishments in planetary flybys as well as other pioneering efforts. He moved up the ranks to become mission assurance manager for the Voyager and Galileo projects, and in 1990 was appointed spacecraft system manager for Cassini, where he served until that spacecraft's launch in 1997. He then was deputy director of Space and Earth Science Programs, and director for Space Science Flight Projects. In recent years he held the position of Associate Director, Flight Projects and Mission Success.

Gavin announced in February his intention to step down from the Executive Council position. Here he provides a retrospective look at his career.

Why the decision to step down now? Is it a retirement?

No, it's clearly not a retirement. At some point in your life you have to decide if you have the requisite energy for the job, and I had my 69th birthday in December. So in my 70th year, I can feel myself slowing down and it's not really fair to me—or to JPL—for me to stay on full time. I still think I have a lot to offer, if it's focused on a few things, and in this particular case that is Mars Science Laboratory, which is pretty important to JPL.

I had already made a commitment to Charles Elachi that I would stick around for the 2009 launch and I told Charles I was willing to work part time as required to help the Mars Lab project get over its problems.

Have you set a schedule?

I'm going to work full time until June, when the project is through with its re-planning, then I'm going to take a month vacation, then I'll come back and probably work three days a week, until we mutually decide my services are no longer required.

Will that be prior to the 2011 launch?

One can only hope. I don't want to be in the position of "Hey, I wish that guy would leave."

What in particular are you offering right now? Is it in engineering and technical areas, cost issues or a combination?

Mentoring, giving others ideas and helping the leadership of the project. It's bringing my own experiences for the benefit of those close to the project today. It's really a combination of spacecraft system development management and cost/schedule/technical issues.

You ended up working on great flagship missions, but what led you to this line of work in the first place?

This is something I've wanted to do since I was 8 or 9 years old. I was intrigued by the concept of space exploration. When I was offered in the summer of 1962 to come to JPL, my wife and I jumped at the chance.

How did you end up in executive management?

I was the mission assurance manager for Voyager and Galileo, both of which were fairly successful projects. When the leadership of the Comet Rendezvous Asteroid Flyby/Cassini project experienced some trouble, John Casani took over as project manager. I had previously worked for John on Galileo, so he asked me to take over the spacecraft office, a position probably equivalent today to the flight system manager.

The thing you might be best known for around here is the Design Principles and Flight Project Practices documents. I understand you're quite proud of that effort. How did they come about?

Following the 1999 losses of Mars Polar Lander and Mars Climate Orbiter, which were traumatic experiences for the Laboratory, there were comments that JPL had lost its way.

Throughout the 1990s this institution was in the "faster, better, cheaper" fever. And everybody was doing their own thing. As a consequence, it was hard to measure the acceptable institutional risk. So the value of these documents was to set a standard for what the institutional risk was.

But the history of this goes back to the 1960s, '70s and '80s, when a handful of people went from project to project. We never had more than three projects in development at one time. So in the post-Cassini timeframe, when we had a multitude of projects, we didn't have the necessary experience base that we had in the previous three decades.

To compensate for that, what we did, very frankly, was write down, in an organized way, all the lessons learned from the prior projects. Casani and Matt Landano also played a very special role in the development of the practices. They came from a very simple concept —how do we do work? We literally used the terms "this is the way we work."

A lot of people are still depending on these practices. Does that surprise you?

No, but it makes me feel good. JPL people don't exactly love rules, OK? But they value these documents because they set the standards. And frankly, they wrote them. We pulled together teams of people from the technical areas to develop them, rather than sit up in an ivory tower and say, "Here's what we're going to do." They're in their third or fourth revision, so they're living documents.

I think it was a constructive way to make sure that everyone doing project and design work at JPL knew what the acceptable criteria were. But this generated something that I had not anticipated. We could now go into reviews and convince the customer that we will stick to our own design principles and standards.

What else might be part of your legacy?

The Flight Projects Center, which will come online in August. Specifically, those using the facility will be project phases B through D—the development phases. It's an office building with an interior that's designed the way projects operate—lots of conference rooms.

The dollars were allocated for it six years ago. We had good support from NASA Headquarters for the new building, especially from the late Dr. Earle Huckins … he was the enabler.

Have your mentoring activities always worked out successfully?

Well, you'd have to ask the current crop of project managers, but most of the people at JPL who are or have been project managers have sat in that chair you're sitting in right now. I spent a lot of time in this office mentoring people, talking about their career options and what they could do to improve their chances of becoming a project manager. At JPL, you don't automatically get anointed; you go through a series of experiences over the years that will qualify you to be a project manager here.

We also have a class that we typically run twice a year that's a prerequisite to becoming a project manager at JPL. I will probably continue to teach several modules of that.

Was there ever a point in your career where you figured that you would end up where you are today?

It never crossed my mind. When I was a young engineer at this place, the 9th floor of 180 was the last place I wanted to go.

What changed?

Well, I guess as you get older and accomplish things, you become a lot more comfortable. This was the office of JPL legends like Bob Parks and Bud Schurmeier; it never occurred to me that I would have this opportunity. But I've loved it, and I really appreciate Charles' confidence in me.

Any regrets, about things that have happened or things you wanted to get done?

No, I have no regrets about my decision to come work here. I love this place … I'm in my 47th year here; I've been here longer than a lot of people here have been alive.

I love the people here; I love their ingenuity and their willingness to work. And to all those people who I ever offended unknowingly, I apologize.

I have no regrets; I'd sign up again.

Herschel/Planck *Continued from page 1*

Planck will be the third-generation space mission to study the cosmic microwave background, noted Charles Lawrence, Planck project scientist at JPL. The first was the Cosmic Background Explorer, a Goddard Space Flight Center–managed mission launched in 1989 to measure microwave and infrared light, which measured the spectrum of the cosmic microwave background and made the first measurements of tiny variations in the intensity of the cosmic microwave background in different directions on the sky. The second generation was NASA's Wilkinson Microwave Anisotropy Probe (W-Map), which launched in 2001 and is still observing.

With an unprecedented combination of sensitivity, angular resolution and frequency coverage, Planck promises yet more, Lawrence said. "Whereas W-Map has measured about 10 percent of the information content on the temperature range of the cosmic background, Planck should measure essentially all of it. Also, W-Map has measured 1 percent of the information on polarization properties of the cosmic background, and Planck should be able to measure about 10 percent."

Previous studies of the cosmic background showed that 80 percent of the matter in the universe is different than the kind of matter we and our world are made of. Called "dark matter," it has and is affected by gravity, but it has no electromagnetic interactions at all. "This stuff that the cosmic background says has to be there because of its gravitational effects can never be seen directly with any of our telescopes; it just doesn't emit any light at any wavelength," Lawrence said.

"What we'll be measuring with Planck is at the heart of our understanding of the universe—how it's constructed, what it's made of, how old it is, how big, how much energy it has in it. We should be able to measure the total mass energy in the universe to about half a percent, and we should be able to measure the distance to what looks like the surface where the cosmic background was emitted to about two-tenths of a percent—that's more accurate than I know how big my house is. Pretty remarkable."

Both Herschel and Planck are benefiting from JPL's long-standing research and technology development efforts. The connection to cosmic-background missions was made in the mid-'90s, when it became clear that cryogenic technology would be a very powerful addition to space missions to study the cosmic background, Lawrence said. Initial development of Planck's sorption cooler, a key element of the Planck active cooler system, was led by JPL's Larry Wade, who had been working on sorption coolers at JPL since 1991, building on pioneering work in sorption coolers by Jack Jones and others at JPL that goes back 30 years.

Goldsmith noted that the work on the Hifi-related detectors was also started many years ago, by a Caltech president's fund, then was picked up later through NASA's technology-development process. "Then all of that work got things to the point where JPL could propose these major contributions to the Hifi instrument and have credibility," he said.

Technology development is indeed an ongoing process and provides never-ending promise as well as challenges, Bock noted.

"Looking toward the future, both Herschel and Planck are going to be fantastic, but when missions fly, their technology is 10 years out of date, by definition. We already have improvements—just in the focal plane—such that you could imagine successor missions to Herschel and Planck that will have essentially similar cooling systems and similar-sized telescopes, but completely new science just by improvements that are coming this decade."

Kepler launches

Kennedy Space Center

The Kepler mission successfully launched into space from Cape Canaveral Air Force Station, Fla., Friday, March 6. Kepler is designed to find the first Earth-size planets orbiting stars at distances where water could pool on the planet's surface. Liquid water is believed to be essential for the formation of life.

"It was a stunning launch," said Kepler Project Manager James Fanson of JPL. "Our team is thrilled to be a part of something so meaningful to the human race—Kepler will help us understand if our Earth is unique or if others like it are out there."

Engineers have begun to check Kepler to ensure it is working properly, a process called "commissioning" that is expected to be completed in early May. In early April, commands will be relayed to Kepler to eject its dust cover and make its first measurements. After another month of calibrating Kepler's single instrument, a wide-field charge-couple device camera, the telescope will begin to search for planets.

Kepler is a NASA Discovery mission. NASA's Ames Research Center is the home organization of the science principal investigator and is responsible for the ground system development, mission operations and science data analysis. JPL manages Kepler mission development. Ball Aerospace & Technologies Corp. of Boulder, Colo., is responsible for developing the Kepler flight system and supporting mission operations. For more information, visit *http://www.nasa.gov/kepler.*

News Briefs

Yoseph Bar-Cohen

Bar-Cohen publishes book

Yoseph Bar-Cohen, supervisor of the Advanced Technologies Group (355N), is the coauthor of a new book, "The Coming Robot Revolution: Expectations and Fears About Emerging Intelligent, Humanlike Machines."

The book, Bar-Cohen's fifth, covers the state of the art, potential and challenges of the humanlike-robot technology that used to be science fiction and is increasingly becoming an engineering reality.

"Such robots can greatly benefit future NASA exploration missions in performing tasks that require human capability without the risk associated with the harsh ambient conditions," said Bar-Cohen.

A physicist and JPL senior research scientist, Bar-Cohen joined the Lab in 1991. That year, he established the Nondestructive Evaluation and Advance Actuators Lab (http://ndeaa.jpl.nasa.gov), which has been responsible for a series of innovative concepts and mechanisms for planetary exploration, medical, commercial and other applications.

Honors for former JPLers

Robert McEliece, a professor emeritus of electrical engineering at Caltech and a former JPL group supervisor, has won the 2009 Institute of Electrical and Electronics Engineers' Alexander Graham Bell Medal.

The award, to be bestowed in June at an honors ceremony, recognizes McEliece "For fundamental contributions to the theory and practice of error-correcting codes and to the design of deep-space telecommunication systems" and is one of the highest professional acclaims that one can receive from Institute of Electrical and Electronics Engineers peers.

McEliece joined JPL in 1963 and later supervised the Information Processing Group. He served as a Caltech professor starting in 1982.

Also to be honored is retired JPL researcher Antal Bejczy, who earned the Institute of Electrical and Electronics Engineers' Robotics and Automation Award, "For leadership and sustained contributions to a broad set of innovative robotic and automation techniques applicable to space research and on Earth."

Australian staffers receive thanks

Staff members at the Canberra Deep Space Communications Complex in Australia recently received NASA Honor Awards for their actions in assisting victims of a car accident in 2007.

During a visit to the complex in February, JPL Deputy Director Gene Tattini presented the Exceptional Bravery Medal to three people who located and revived a victim who had stopped breathing, and Public Service Group Achievement Award to six others who helped with traffic control and comforted the other victims.

JPL Deputy Director Gene Tattini, left, presents William Cowan with the Exceptional Bravery Medal.

The Canberra complex, part of the Deep Space Network, is administered by JPL.

The accident occurred in June 2007 when a dual cab pickup truck tried to negotiate the Point Hut Crossing on the southern route access to the Canberra Deep Space Communication Complex where the road curves on either side of a level crossing over the Murrumbidgee River. Inclement conditions and a treacherous road combined to make the 90-degree turn on the opposite side of the crossing impossible to negotiate and the driver swerved, pulling off the road. The vehicle then rolled a number of times before coming to rest on the side of the road away from the river.

The incident occurred just before the Canberra Deep Space Communication Complex carpools arrived at the area on their way home. Staff members rendered emergency assistance, located and stabilized all accident victims, contacted emergency help and secured the area to ensure that traffic was not impeded.

Receiving the Exceptional Bravery Medal were Chris Grallelis, Dave True and William Cowan. The Public Service Group Achievement Award recipients were Paul Bradford, Nick Daskalakis, Ewen Hopkins, David Lorimer, Bas Ormeno and Andrew Paddison.

Passings

Laura Campanelli

Laura Campanelli, a long-time member of the Radio Metric Data Conditioning team, died Feb. 2.

A data analyst, she worked with nearly every JPL navigation team for more than 20 years and supported many launch and critical event operations during her career.

Services were held at Rose Hills in Whittier. The family requests that donations in her honor be considered for the Avon Breast Cancer Awareness walk in Long Beach.

Retiree **Preston Willson,** 90, died Dec. 8. Willson joined JPL in 1962 and retired in 2001.

David Griffith, 69, a retired inspector in the Construction of Facilities Program Office, died Feb. 18.

Griffith worked at JPL from 1962 to 2005. He is survived by his wife, Jane, and daughters Donna and Susan. Services were held at Oakdale Memorial Park in Glendora.

Letters

To my JPL friends and colleagues: Thank you so much for your support and many kind thoughts during my mom's long illness and upon her passing in November. It is wonderful to work in such a caring environment and to know those around you can fill in during trying times. I'd especially like to thank JPL for the beautiful plant sent in my mom's memory and my section (312), group (312I) and members of the outer planet flagship studies for their support, beautiful cards, plants and words of encouragement.

Tracy Van Houten

My family and I would like to thank all my friends and colleagues at JPL, Division 25, iBMS, and JPL softball for your support and kindness during the recent passing of my father, George Creason. Your lovely plants will be well cared for and your generous donations in his name are greatly appreciated. My father loved JPL and was a huge fan of the work we do here. I rarely saw him not wearing his NASA hat that I bought him on the day I joined the Lab over two years ago. This truly is a wonderful place full of caring people and I can't thank you all enough.

Tonia Hunt and the Creason family

I would like to extend my sincerest thanks to all across the Laboratory and at campus for their expressions of concern, kindness and sympathy during the time leading up to and after the recent passing of my father, Joseph Davis. In particular I would like to thank my friends and colleagues in Division 35 for their heartfelt condolences and lovely card, and also thank the JPL ERC for the beautiful anthurium plant which we will nurture as a living reminder of Dad. With warmest regards,

Greg Davis

From my wife Stephanie and me, thanks to JPL for the lovely flowers sent for the birth of our son Clement and to our friends for the various baby gifts, which have since blended together into the gray, lumpy mush that used to be our bedroom. Our great trip begins, made even greater with friends such as you all.

Richard Chen

I want to express my sincere appreciation to JPL, and friends and coworkers in both the Mars Exploration Directorate and the Interplanetary Network Directorate, for your kindness and generosity on the passing of my mom. I truly appreciate all of the cards and gifts and flowers you gave. Your kindnesses will always be remembered.

Joyce Pulliam

Heartfelt thanks to my friends and colleagues following the recent illness and passing of my dear and lovely mother. Your cards and kind words of encouragement were of great comfort to me and my family. Thanks also to JPL and the 25 Division for the beautiful plant. My mom loved plants and we take it as a living tribute to her memory.

Carlos Brinoccoli and family

I would like to thank my JPL colleagues for the sympathy card and lovely plant on the recent passing of my mother. Your support during this difficult time was much appreciated.

Robert Bonitz

My family and I would like to thank all our friends at JPL for their cards and kind words of support on the passing of my father. Thanks also to the ERC for the lovely plant.

Don Kurtz

I wish to thank all my colleagues on the Spitzer Operations Team for their kind support during this time of my wife's serious illness. I am especially grateful for the dinners sent to my house so that my kids would have good, hot meals during the nights when I was in the hospital. Your kindness will always be remembered.

David Bliss

Retirees

The following JPL employees retired in March:

James Lumsden, 40 years, Section 5310; **Allan Sacks,** 32 years, Section 981; **Lynn Barath,** 17 years, Section 3120.

JPL RETIREES:
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