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NASA's Kepler discovers its smallest 'habitable zone' planets to date

BY MICHELE JOHNSON

NASA's Kepler Mission has recently discovered two new planetary systems that include three super-Earth-size planets in the "habitable zone," the range of distance from a star where the surface temperature of an orbiting planet might be suitable for liquid water.

The Kepler-62 system has five planets; 62b, 62c, 62d, 62e and 62f. The Kepler-69 system has two planets; 69b and 69c. Kepler-62e, 62f and 69c are the super-Earth-sized planets.

Two of the newly discovered planets orbit a star smaller and cooler than the sun. Kepler-62f is only 40 percent larger than Earth, making it the exoplanet closest to the size of our planet known in the habitable zone of another star. Kepler-62f is likely to have a rocky composition. Kepler-62e, orbits on the inner edge of the habitable zone and is roughly 60 percent larger than Earth.

The third planet, Kepler-69c, is 70 percent larger than the size of Earth, and orbits in the habitable zone of a star similar to our sun. Astronomers are uncertain about the composition of Kepler-69c, but its orbit of 242 days



Relative sizes of all of the habitable-zone planets discovered to date alongside Earth. Left to right: Kepler-22b, Kepler-69c, Kepler-62e, Kepler-62f and Earth (except for Earth, these are artists' renditions). Image credit: NASA Ames/JPL-Caltech.

around a sun-like star resembles that of our neighboring planet Venus.

Scientists do not know whether life could exist on the newfound planets, but their discovery signals we are another step closer to finding a world similar to Earth around a star like our sun.

"The Kepler spacecraft has certainly turned out to be a rock star of science," said John Grunsfeld, associ-

ate administrator of the Science Mission Directorate at NASA Headquarters in Washington. "The discovery of these rocky planets in the habitable zone brings us a bit closer to finding a place like home. It is only a matter of time before we know if the galaxy is home to a multitude of planets like Earth, or if we are a rarity."

The Kepler space telescope, which simultaneously and continuously

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NASA Administrator Charles Bolden visits Ames



NASA Administrator Charles Bolden (far left) visited Ames May 24, 2013, to view demonstrations of Ames' contributions to the PhoneSat nanosatellite mission and 3D printing activity and to meet with local news media. U.S. Congressman Mike Honda, 17th Congressional District, California, (third from left) and Ames Research Center Director S. Pete Worden (second from left) were at the site of PhoneSat and additive manufacturing demonstrations. Demonstrating the 3D printing technology was Sarah Hovsepian (far right) SpaceShop manager. Additive manufacturing, also known as 3D printing, is a critical part of President Obama's push for building a strong American manufacturing sector. The PhoneSat program recently launched three small satellites built from off-the-shelf cellular phone technology.

NASA photo by Dominic Hart

NASA imaging sensor prepares for Western wildfire season

by Ruth Dasso Marlaire

Airborne imaging technology NASA developed and transferred to the U.S. Department of Agriculture's Forest Service (USFS) in 2012 is being tested to prepare for this year's wildfire season in the western United States.

The Autonomous Modular Sensor (AMS) is a scanning spectrometer designed to help detect hot-spots, active fires and smoldering and post-fire conditions. Scientists at Ames and USFS engineers installed it on a Cessna Citation aircraft that belongs to the Forest Service. The USFS plans to use it in operational fire imaging and measurement.

The western United States is expected to have continued droughts this year resulting in increased potential for fire outbreaks, according to the National Interagency Fire Center (NIFC) in Boise, Idaho. To help mitigate fire danger, NASA researchers and USFS firefighters are collaborating to improve fire management capabilities.



NASA-developed wildfire imaging technology transferred to the U.S. Department of Agriculture's Forest Service (USFS) has begun test flights onboard a Forest Service aircraft in preparation for this year's wildfire season in the western United States.

Image credit: USFS

"NASA technologies in the fields of data communication, aircraft systems, advanced sensing systems and real-time information processing finally have coalesced into the operational use that supports national needs in wildfire management," said Vincent Ambrosia, principal investigator of the

Wildfire Research and Applications Partnership project and a senior research scientist at Ames and California State University, Monterey Bay.

Developed by NASA's Airborne Sciences Program, the Autonomous Modular Sensor acquires high-resolution imagery of the Earth's features

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Ames Contractor Council hosts 2013 Excellence Awards ceremony

BY PATRICIA ELSON

The Ames Contractor Council (ACC) recently held its annual Excellence Awards Ceremony in the Syverton Auditorium. This event celebrates and acknowledges the contributions that both individuals and teams have made to Ames activities. This year, Length of Service awards were added for contractor staff with 20 or more years of service at Ames.

The event was hosted by Master of Ceremonies Neill Callis, ACC President; presentations were made by Gregory Hite, ACC Vice President, and Lewis S. G. Braxton III, Deputy Center Director. A total of 18 individuals and 12 teams were recognized for their outstanding performance over the past year. A total of 210 contractors were recognized for their length of service.

The ACC also presented its Safety Excellence Award at the event, recognizing Stinger Ghaffarian Technologies, Inc., for their best-of-class safety performance at NASA Ames during 2012.



NASA photo by Dominic Hart

Ames Deputy Center Director Lewis Braxton (right) congratulates contractor staff in attendance with 40 or more years of service to NASA Ames: Back row, left to right: Doug Pearson (55), Fred Witteborn (54), Herbert Finger (42) and Rick Serrano (47). Front row, left to right: John Humbert (49), Vera Vizir (40) and Lynn Albaugh (40).

NASA successfully launches three smartphone satellites

by Ruth Dasso Marlaire

Transmissions from all three PhoneSats have been received at multiple ground stations on Earth, indicating they are operating normally. The PhoneSat team at Ames will continue to monitor the satellites. The satellites are expected to remain in orbit for as long as two weeks.

"It's always great to see a space technology mission make it to orbit -- the high frontier is the ultimate testing ground for new and innovative space technologies of the future," said Michael Gazarik, NASA's associate administrator for space technology in Washington. "Smartphones offer a wealth of potential capabilities for flying small, low-cost, powerful satellites for atmospheric or Earth science, communications, or other space-born applications. They also may open space to a whole new generation of commercial, academic and citizen-space users."

Satellites consisting mainly of the smartphones will send information about their health via radio back to Earth in an effort to demonstrate they can work as satellites in space. The

found at: <http://www.phonesat.org>

NASA's off-the-shelf PhoneSats already have many of the systems needed for a satellite, including fast processors, versatile operating systems, multiple miniature sensors, high-resolution cameras, GPS receivers and several radios. NASA engineers kept the total cost of the components for the three prototype satellites in the PhoneSat project

between \$3,500 and \$7,000 by using primarily commercial hardware and keeping the design and mission objectives to a minimum. The hardware for this mission is the Google-HTC Nexus



The PhoneSats are approximately the size of a coffee cup.

One smartphone running the Android operating system.

NASA added items a satellite needs that the smartphones do not have -- a larger, external lithium-ion battery bank and a more powerful radio for messages it sends from space. The smartphone's ability to send and receive calls and text messages has been disabled. Each smartphone is housed in a standard

cubesat structure, measuring about four inches square. The smartphone acts as the satellite's onboard computer. Its sensors are used for attitude determination and its camera for Earth observation.

The PhoneSat project is a technology demonstration mission conceived of at Ames and funded by NASA's Space Technology Mission Direc-

torate at NASA Headquarters. The directorate is innovating, developing, testing and flying hardware for use in future science and exploration missions. NASA's technology investments provide cutting-edge solutions for our nation's future.

The PhoneSat family of systems is part of an overall Ames effort to assess commercial grade technologies for use in small- and nano-spacecraft systems to save development costs and leverage industry investments in high-quality, mass-produced components. Ames has successfully completed and delivered eight nanosatellites for launch since 2006.

"Smartphones' ability to tolerate vigorous use makes them able to withstand the launch and space environment; and their compact, modern electronics components make them work in the vacuum of space more easily. After we realized this, we set out to explore whether smartphones can be used as the core components of a satellite," said Jim Cockrell, PhoneSat project manager at Ames.

For more about information about NASA's Small Spacecraft Technology Program and the PhoneSat mission, visit: <http://www.nasa.gov/smallsats>

For more information about NASA's Space Technology Mission Directorate, visit: <http://www.nasa.gov/spacetech>.



NASA photos by Ben Howard

PhoneSat 1.0 hanging from a high-altitude balloon. PhoneSat 1.0 during high-altitude balloon test.

spacecraft also will attempt to take pictures of Earth using their cameras. Amateur radio operators around the world can participate in the mission by monitoring transmissions and retrieving image data from the three satellites. Large images will be transmitted in small chunks and will be reconstructed through a distributed ground station network. More information can

Ames wins NASA's 2012 Government Invention of the Year award

BY JESSICA CULLER

NASA's Ames has won the 2012 NASA Government Invention of the Year for a tiny sensor that can detect chemicals in the air.

"High Sensitive, Low Power and Compact Nano Sensors for Trace

more unknown parts of a gas using carbon nanotubes. The electronic sensors developed from these carbon nanotubes are inexpensive, light-weight and consume very little power. A typical sensor device based on this concept includes a set of

Station. Other federal agencies are using sensors based on this technology to detect trace gases in various environments. Specific applications for which the innovative sensors have been tested and used include trace chemical detection in planetary exploration, air monitoring, leak detection and hazardous agent detection using cell phones. Potential future applications may include environmental monitoring, industrial process monitoring and control and biomedical diagnosis.

"We're very pleased to have Ames inventiveness recognized with this award for the third consecutive year," said S. Pete Worden, NASA Ames center director. "With this invention, our people have basically created the insides of a tricorder, and based on the uses we've already demonstrated, I can't wait to see the fantastic applications that NASA and industry are going to devise for it."

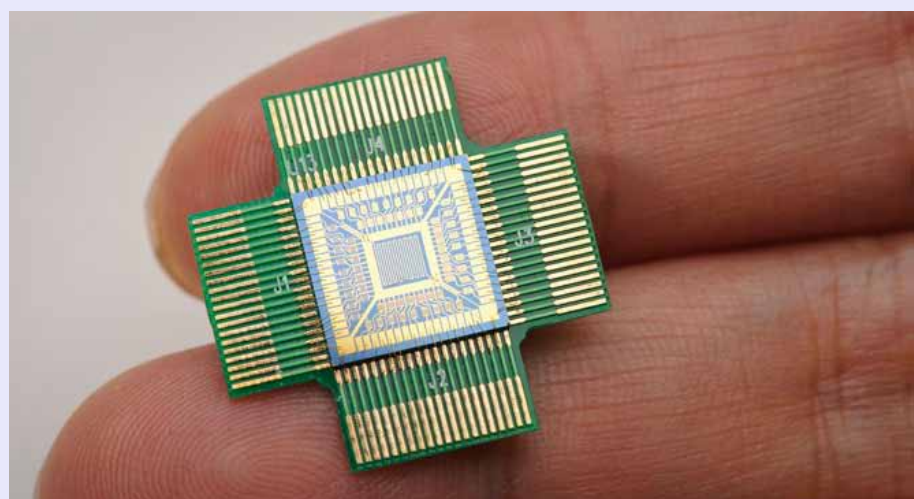
Each NASA field center submits nominations for the awards, which are evaluated by NASA's Inventions and Contributions Board. The board determines which nominations qualify for each category, ranks the nominees, and makes recommendations to the NASA Office of the General Counsel for review and approval.

This year Ames also won a Commercial Invention of the Year runner-up recognition for its Rehydration Beverage, a patented water-electrolyte beverage that results in significantly greater body hydration levels than similar beverages available on the market. Invented by Ames' John Greenleaf, it has been used by astronauts before, during and after spaceflight, including missions to the International Space Station, and by athletes who require rapid rehydration after strenuous exercise.

Ames previously earned the NASA Government Invention of the Year award in the following years:

- 2007, for low-density, light-weight heat shield materials
- 2008, for a high-speed 3-D laser scanner with real time processing
- 2010, for software that creates simulations for managing air traffic scenarios
- 2011, for a low-cost, light-weight, two-piece, thermal protection system for use on space vehicles during atmospheric re-entry at hypersonic speed

Ames also won NASA Commercial Invention of the Year in 2010 for the Powder Handling Device for Analytical Instruments.



NASA photo by Dominic Hart

A multiple-channel silicon-based sensing chip, consisting of 64 nanosensors and is less than one square centimeter, is the winner of the 2012 NASA Government Invention of the Year.

Chemical Detection" was invented by Jing Li and Meyya Meyyappan of NASA Ames, and Yijiang Lu of the University of California, Santa Cruz.

The invention includes methods and systems for estimating one or

comb-shaped metal microelectrodes fabricated by photolithography on an electrically insulating substrate.

The sensors have been deployed by NASA to detect trace gases in the crew cabin on the International Space

California Governor meets scientists at Ames



NASA photo by Dominic Hart

California Governor Edmund G. Brown Jr. joined more than 500 world-renowned researchers and scientists May 23, 2013, to release a groundbreaking call to action on climate change. The event was held in the NASA Research Park and marked Sustainable Silicon Valley's fourth annual Water, Energy and Smart Technology (WEST) Summit and Showcase of Solutions for Planetary Sustainability at NASA's Ames Research Center. From left to right, California Governor Jerry Brown, Daniel Rasky, Waleed Abdalati, James Hansen, Anthony Barnosky and Banny Bannerjee.

NASA's Kepler discovers its smallest 'habitable zone' planets to date

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measures the brightness of more than 150,000 stars, is NASA's first mission capable of detecting Earth-size planets around stars like our sun. Orbiting its star every 122 days, Kepler-62e was the first of these habitable zone planets identified. Kepler-62f, with an orbital period of 267 days, was later found by Eric Agol, associate professor of astronomy at the University of Washington and co-author of a paper about the discoveries published in the journal *Science*.

The size of Kepler-62f is now measured, but its mass and composition are not. However, based on previous studies of rocky exoplanets similar in size, scientists are able to estimate its mass by association.

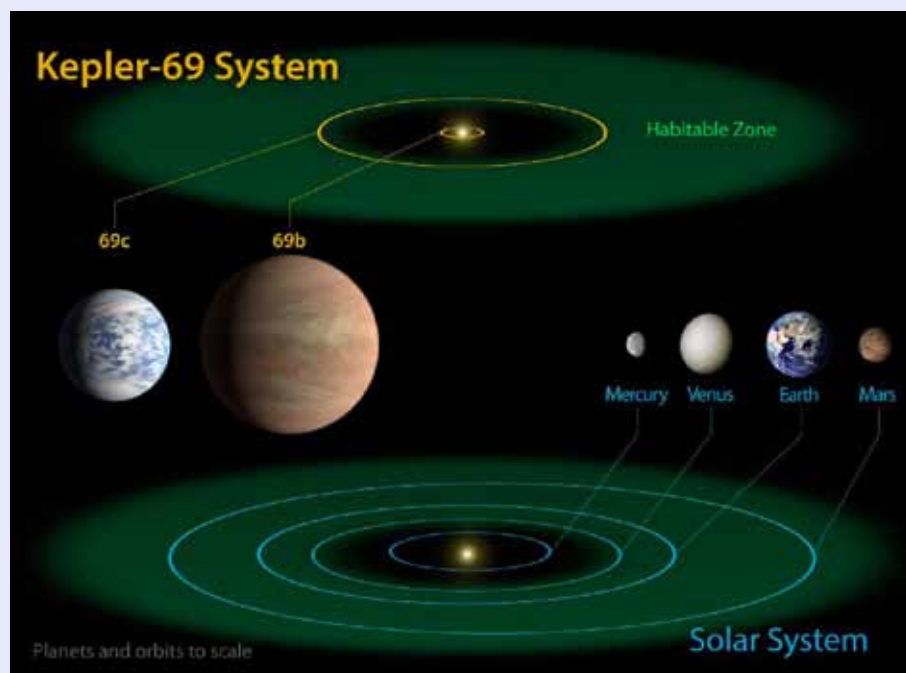
"The detection and confirmation of planets is an enormously collaborative effort of talent and resources, and requires expertise from across the scientific community to produce these tremendous results," said William Borucki, Kepler science principal investigator at Ames and lead author of the Kepler-62 system paper in *Science*. "Kepler has brought a resurgence of astronomical discoveries and we are making excellent progress toward determining if planets like ours are the exception or the rule."

The two habitable zone worlds orbiting Kepler-62 have three companions in orbits closer to their star, two larger than the size of Earth and one about the size of Mars. Kepler-62b, Kepler-62c and Kepler-62d, orbit every five, 12, and 18 days, respectively, making them very hot and inhospitable for life as we know it.

The five planets of the Kepler-62 system orbit a star classified as a K2 dwarf, measuring just two-thirds the size of the sun and only one-fifth as bright. At seven billion years old, the star is somewhat older than the sun. It is about 1,200 light-years from Earth in the constellation Lyra.

A companion to Kepler-69c, known as Kepler-69b, is more than twice the size of Earth and whizzes around its star every 13 days. The Kepler-69 planets' host star belongs to the same class as our sun, called G-type. It is 93 percent the size of the sun and 80 percent as luminous and is located approximately 2,700 light-years from Earth in the constellation Cygnus.

"We only know of one star that hosts a planet with life, the sun. Finding a planet in the habitable zone around a star like our sun is a significant milestone toward finding truly



Kepler-69 and the Solar System - The diagram compares the planets of the inner solar system to Kepler-69, a two-planet system about 2,700 light-years from Earth in the constellation Cygnus. The two planets of Kepler-69 orbit a star that belongs to the same class as our sun, called G-type. Kepler-69c, is 70 percent larger than the size of Earth, and is the smallest yet found to orbit in the habitable zone of a sun-like star. Astronomers are uncertain about the composition of Kepler-69c, but its orbit of 242 days around a sun-like star resembles that of our neighboring planet Venus. The companion planet, Kepler-69b, is just over twice the size of Earth and whizzes around its star once every 13 days. The artistic concepts of the Kepler-69 planets are the result of scientists and artists collaborating to help imagine the appearance of these distant worlds. The Kepler space telescope, which simultaneously and continuously measures the brightness of more than 150,000 stars, is NASA's first mission capable of detecting Earth-size planets around stars like our sun. Image credit: NASA Ames/JPL-Caltech

Earth-like planets," said Thomas Barclay, Kepler scientist at the Bay Area Environmental Research Institute in Sonoma, Calif., and lead author of the Kepler-69 system discovery published in the *Astrophysical Journal*.

When a planet candidate transits, or passes in front of the star from the spacecraft's vantage point, a percentage of light from the star is blocked. The resulting dip in the brightness of the starlight reveals the transiting planet's size relative to its star. Using the transit method, Kepler has detected 2,740 candidates. Using various analysis techniques, ground telescopes and other space assets, 122 planets have been confirmed.

Early in the mission, the Kepler telescope primarily found large, gaseous giants in very close orbits of their stars. Known as "hot Jupiters," these are easier to detect, due to their size and very short orbital periods. Earth would take three years to accomplish the three transits required to be accepted as a planet candidate. As Kepler continues to observe, transit

signals of habitable zone planets the size of Earth orbiting stars like the sun will begin to emerge.

Ames is responsible for Kepler's ground system development, mission operations, and science data analysis. NASA's Jet Propulsion Laboratory in Pasadena, Calif., managed Kepler mission development.

Ball Aerospace & Technologies Corp. in Boulder, Colo., developed the Kepler flight system and supports mission operations with the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.

The Space Telescope Science Institute in Baltimore archives, hosts and distributes Kepler science data. Kepler is NASA's 10th Discovery Mission and was funded by the agency's Science Mission Directorate.

For more information about the Kepler mission and to view the digital press kit, visit: <http://www.nasa.gov/kepler>

NASA Ames Sustainability Base wins again!



NASA photo by Jon-Pierre Wiens

Acterra, a Silicon Valley-based environmental non-profit, just announced the prestigious 2013 Acterra Business Environmental Awards. NASA Ames' Sustainability Base was selected a winner in the category of Sustainable Built Environment. Sustainability Base (<http://www.nasa.gov/sustainability-base>) advances dual goals of providing a healthy, productive work environment, while pushing the envelope of high-performing buildings by incorporating technologies from NASA's aeronautics and space exploration missions into its built environment. Acterra (www.acterra.org) is a non-profit organization with a 43-year history of environmental stewardship in and around Silicon Valley.



NASA photo by Eric James

Shin showcases aeronautics

Jaiwon Shin, NASA's Associate Administrator for Aeronautics Research, recently visited Ames and spoke to Ames employees during an All Hands. He discussed the proposed budget for the Aeronautics Research Mission Directorate (ARMD) portfolio and the ARMD Strategic Implementation Plan. He also presented ARMD Associate Administrator Awards to Ames recipients.

Ames honors support staff on Administrative Professionals Day



All civil servant and support service contractors, who in the performance of their tasks complete secretarial, administrative or clerical duties, were invited to attend Administrative Professionals Day, April 25, 2013. Those who attended are shown at left. This was an interactive workshop geared toward the recognition and appreciation of the secretarial, administrative support professionals and clerical support community during Administrative Professionals Week at Ames. This year, secretaries and administrative support staff were recognized for their integral role at Ames with the workshop theme of "Taking a Stand." This theme highlighted and recognized all the administrative support professionals at Ames and their work supporting the NASA mission. Administrative support professionals were shown some self-defense tactics and learned how to react to a hostile situation (lower right photo).



NASA photos by Dominic Hart

NASA imaging sensor prepares for Western wildfire season

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from its vantage point aboard research aircraft. The sensor transmits nearly real-time data to ground disaster management investigators for analysis.

The sensor has been modified to fly on various crewed and uncrewed platforms, including NASA's Ikhana remotely piloted aircraft, a Predator-B modified to conduct airborne research. Between 2007 and 2010 the AMS flew on the Ikhana and NASA's B-200 King Air to demonstrate sensor capabilities, support national and state emergency requests for wildfire data, and ensure its operational readiness.

Data gathered during those flights was used to develop and test algo-

rithms for scientific programs that monitor changes in environmental conditions, assess global change and respond to natural disasters.

The Autonomous Modular Sensor will be operated daily over wildfires throughout the United States, providing an unprecedented amount of data to the fire research and applications communities. USFS also will use the sensor to support other agency objectives, such as vegetation inventory analysis, and water and river mapping.

"I see tremendous opportunity for my agency and other land management agencies to benefit from the application of NASA-developed technology," said Everett Hinkley, national

remote sensing program manager with USFS in Monterey, Calif. "The AMS expands our current capabilities and offers efficiencies in a number of remote-sensing applications, including fire, post-fire and forest health applications."

NASA will continue to support the Forest Service's use of the Autonomous Modular Sensor. Researchers with NASA and other agencies will have access to the data and can request mission use through partnerships.

For more information about Autonomous Modular Sensor, visit: <http://airbornescience.nasa.gov/instrument/AMS>.

SOFIA observations reveal a surprise in massive star formation

BY NICK VERONICO

Researchers using the airborne Stratospheric Observatory for Infrared Astronomy (SOFIA) have captured the

simple, like the cocoons of protostars with the sun's mass."

The observations of G35 were made in 2011 with a special camera aboard SOFIA, a modified Boeing 747SP aircraft that can carry a telescope with an effective diameter of 100 inches (2.5 meters) to altitudes as high as 45,000 feet (13,700 meters).

G35 was an ideal target for investigations because it is in an early stage of development. But infrared light coming from G35 is so strong it prevented infrared space telescopes from making detailed images. Also, the protostar is embedded so deeply in its natal cloud that it cannot be detected by optical telescopes observing from the ground at visible wavelengths.

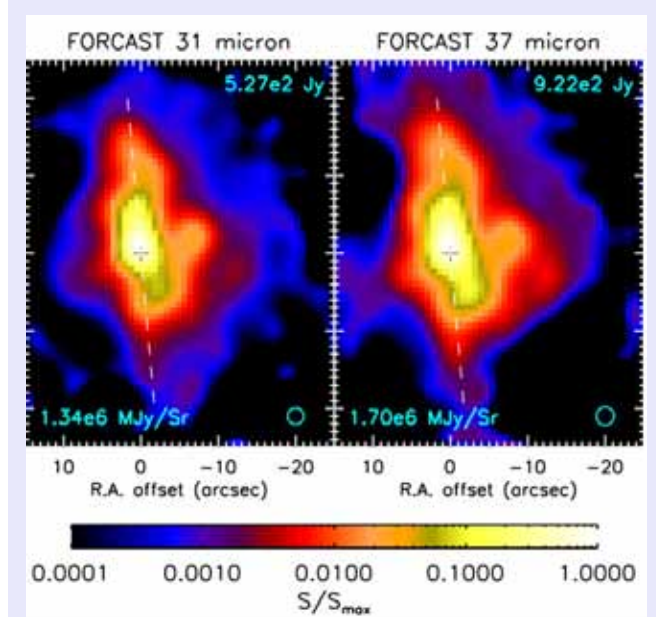
Flying high above the light-blocking water vapor in Earth's atmosphere, the airplane-mounted Faint Object Infrared Camera for the SOFIA Telescope (FORCAST) enabled astronomers to see G35

they foster the formation of smaller stars like our sun, and because at the ends of their lives they create and distribute chemical elements that are the basic building blocks of Earth-like planets," said co-author James De Buizer, a SOFIA staff scientist with the Universities Space Research Association (USRA) at NASA's Ames Research Center.

Images of G35 may be viewed on NASA's SOFIA site: <http://www.nasa.gov/sofia>

Figures 1a and 1b show FORCAST images of G35 at wavelengths of 31 and 37 microns. Figures 2a and 2b respectively present G35 images obtained by NASA's Spitzer Space Telescope and the Gemini-North telescope at Mauna Kea, Hawaii, also used in this study. Figure 3 shows computer model images intended to match characteristics of the central regions of the images in figures 1a and 1b.

The model images show greatly simplified versions of what is revealed especially in the SOFIA images: a luminous protostar heating a dense interstellar cloud from the inside while simultaneously expelling cone-shaped jets of gas toward the tops and bottoms of the frames. The top outflow cone appears brighter because it is directed toward us and there is less obscuring material along the line of sight.



Figures 1a and 1b show the G35 protostar at wavelengths of 31 and 37 microns taken by the FORCAST instrument on the SOFIA observatory's infrared telescope in 2011. (Zhang et al. 2013, *Astrophysical Journal*)

most detailed mid-infrared images yet of a massive star condensing within a dense cocoon of dust and gas.

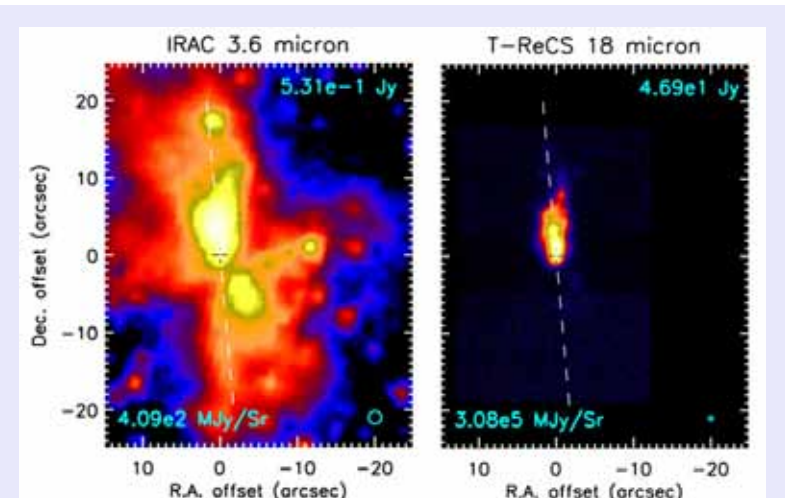
The star is G35.20-0.74, commonly known as G35. It is one of the most massive known protostars and is located relatively close to Earth at a distance of 8,000 light-years.

Until now, scientists expected the formation process of massive stars would be complicated by the turbulent, chaotic environments in the centers of new star clusters where they form. But observations of G35 suggest this giant star, more than 20 times the mass of our sun, is forming by the same orderly process as do stars with the same mass as the sun. Stars most like the sun are understood to form by simple, symmetric collapse of interstellar clouds.

"The focus of our study has been to determine how massive stars actually form," said Yichen Zhang of the University of Florida. Zhang is lead author of a paper about the discovery published April 10, 2013 in the *Astrophysical Journal*. "We thought the G35 protostar's structure would be quite complicated, but instead we found it is

where it hides -- inside a dark, dense, interstellar dust cloud -- by collecting infrared light escaping the cloud. Uniquely suited for this work, FORCAST detected faint details next to bright structures at wavelengths inaccessible to any other telescope on the ground or in space.

"Massive stars, although rare, are important because there is evidence



Figures 2a (left) and 2b (right) present G35 protostar images obtained by NASA's Spitzer Space Telescope and the Gemini-North telescope at Mauna Kea, Hawaii. (Zhang et al. 2013, *Astrophysical Journal*)

The high resolution of the images showcases the capability of modern

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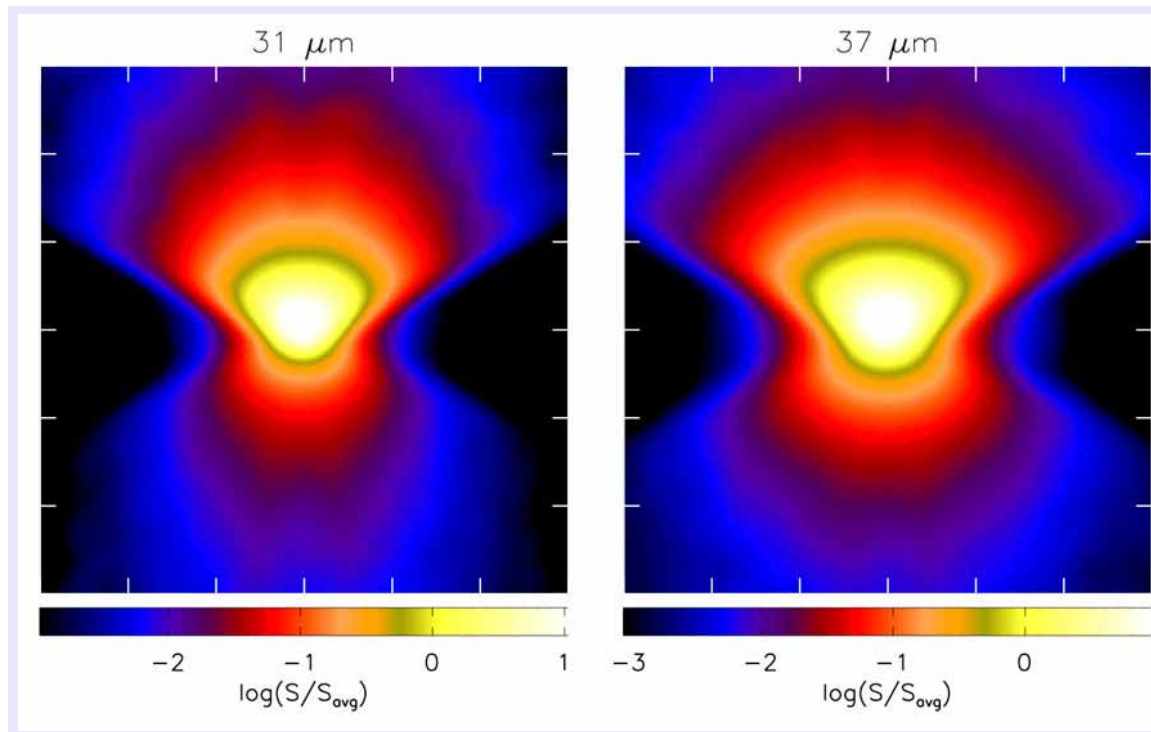


Figure 3 shows computer model images intended to match characteristics of the central regions of the images of the G35 protostar in figures 1a and 1b. The model images show greatly simplified versions of what is revealed in the images taken by the FORCAST instrument on the SOFIA observatory's infrared telescope: a luminous protostar heating a dense interstellar cloud from the inside while simultaneously expelling cone-shaped jets of gas toward the tops and bottoms of the frames. The top outflow cone appears brighter because it is directed toward us and there is less obscuring material along the line of sight. (Zhang et al. 2013, *Astrophysical Journal*)

infrared detector arrays when used on an airborne platform and gives scientists hope that data gathered in this way substantially will advance their understanding of the Milky Way galaxy.

FORCAST was built by a team led by Terry Herter of Cornell University in Ithica, N.Y. Co-authors of the *Astrophysics Journal* paper include scientists from the University of Florida in Gainesville; University of Wisconsin in Madison; University of California at Berkeley; Louisiana State University in Baton Rouge; the Arcetri Observatory in Florence, Italy; and the USRA SOFIA science staff at Ames.

SOFIA is a joint project of NASA and the German Aerospace Center. SOFIA is based and managed at NASA's Dryden Aircraft Operations Facility in Palmdale, Calif. NASA's Ames Research Center in Moffett Field, Calif., manages the SOFIA science and mission operations in cooperation with the USRA headquartered in Columbia, Md., and the German SOFIA Institute at the University of Stuttgart.

For links to USRA and the German SOFIA Institute, visit NASA's SOFIA site and click on "SOFIA Science Center."

NASA's SOFIA marks 100th flight



NASA photo by Tom Tschida

The staff of NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) gathered April 11, 2013 on the ramp outside the Dryden Aircraft Operations Facility in Palmdale, Calif., to mark a milestone—the flying observatory's 100th flight. The airborne observatory departed from the facility that evening on an engineering flight for the German Receiver for Astronomy at Terahertz Frequencies (GREAT) spectroscopic receiver. GREAT works like a very high frequency radio receiver that detects light waves rather than light particles. The GREAT instrument was developed by a consortium of German research institutes led by the Max Planck Institute for Radio Astronomy in Bonn, Germany.

Bob Rubin, astrophysicist and student mentor, passes away

Bob Rubin's, 1941 - 2013, hometown was Philadelphia, Pa. He completed undergraduate and graduate studies at Case Western Reserve



Robert H. Rubin

University in Cleveland, Ohio. His advisor, Robert Hjellming, was interested in the physics of H II regions – interstellar clouds of gas ionized by nearby hot stars. He ignited in Bob an interest in such objects that endured the rest of his life.

Bob's thesis included a detailed model for the photoionization and thermal structure of an H II region. This was the first such model to accurately incorporate radiative transfer of the ionizing photons, and, consequently, Bob's continually updated NEBULA code has been used extensively ever since. After receiving his PhD in 1967, Bob took postdoctoral positions at the National Radio Astronomy Observatory and then at

the University of Illinois, after which he taught for several years at Cal State Fullerton.

In 1980, Bob moved to NASA Ames where he began modeling H II regions to interpret measurements of far infrared emission made from the Kuiper Airborne Observatory (KAO) by Ed Erickson's group. For example, combined with the group's data, the models established gradients as a function of distance from the Galactic Center in the abundances of nitrogen, oxygen, neon, and sulfur relative to hydrogen, and provided evidence for the previously unsuspected presence of hot stars in the vicinity of the Galactic Center.

To further our understanding of the structure and composition of ionized nebulae, Bob conceived observing programs to measure spectral lines from galactic and extra-galactic sources to compare with his models.

Recently, he had been working to deduce the unobservable extreme ultra-violet spectral energy distributions of hot stars that are critical to the relevant physics in these nebulae. Via successful proposals, he obtained data on both H II regions and planetary nebulae with various radio telescopes, the KAO, the Hubble Space Telescope, the Infrared Space Observatory, the Spitzer Space Telescope, the Herschel Space Observatory, and most recently, SOFIA.

Bob consistently supported his research at Ames with such proposals, funded by NASA through his personal venture - named for his favorite, signa-

ture nebula - Orion Enterprises:

<http://spacescience.arc.nasa.gov/staff/robert-rubin> and <http://spacescience.arc.nasa.gov/~rubin/>.

One of the most significant aspects of Bob's legacy is the many students that he mentored over the years. He always involved students in his research activities, attracting them both from local high schools and through various Ames programs that support college students for a semester or a summer. Often Bob included them as co-authors on his papers, deservedly for their efforts and in gratitude for their help. Many of his high school students have gone on to study at top-rated American universities.

In his younger days, Bob enjoyed piloting planes, running and hiking. He was an avid fan of competitive sports, especially track and field, and was enthusiastic about any team from Philadelphia. Bob's "Door" collection of some 200 non-astronomy Orion references was a favorite hobby: <http://www-space.arc.nasa.gov/~rubin/door8.html>.

He valued and spoke often of his collaborators and friends, both from Ames and elsewhere. The latter included Reggie Dufour (Rice U.), Bob O'Dell (Vanderbilt U.), Ben Zuckerman (UCLA), Pat Palmer (U. Chicago), and others all over the world. It is a credit to NASA Ames that it accommodates dedicated, accomplished and productive scientists like Bob Rubin.

Bob passed away on March 3, 2013. He will be missed and well-remembered by his many colleagues.

Edie Watson, former secretary to Hans Mark and Harvey Allen, dies

Edie Watson began her career at Ames in 1945, when it was part of NACA, working in the Electrical Section. Her husband, William "Sput" Watson, was stationed as a U.S. naval officer at Moffett Field. In 1946, they moved back to their hometown of Shellman, Ga. Soon after, Sput was offered the job of Industrial Relations officer at Moffett and they returned to the Bay Area. As she was lunching with old friends at Ames, she ran into Deputy Director Jack Parsons, who asked her to return to work at Ames.

From 1946 to 1954, she worked for Harvey Allen in the High Speed Research Division, answering the telephone and directing correspondence for such aerospace luminaries as Walter Vincenti, Dean Chapman and Charlie Hall. In 1954, Ralph Huntsberger, head of the new design group for the national Unitary Plan Wind Tunnels lured Watson away to support his division, where she worked for a decade. When Harvey Allen became director in October 1965, he asked

Watson to manage the director's suite. When Hans Mark arrived as director in February 1969, Watson stayed on and introduced him to how things got done at NASA. As the top professional secretary at Ames, she set both policy and an open and efficient tone for the Center's administrative staff. Her direct staff of three handled the director's calendar, all international travel, and all correspondence for the research projects. She was, then, the unofficial historian of the Center, and collected an important set of documents.

"Edie was the friendly face of Ames, always caring," remembers Jack Boyd, who also came to rely upon her. "She was the soul of professionalism and honored to be part of the NACA and NASA mission. She was a devoted friend and always willing to help the Ames family as well as the newcomers on Center."

Following 30 years of government service, Watson retired in June 1975. The Ames Golf Club perpetually



Edie Watson

awarded her as the Most Congenial Golfer and, in retirement, she worked on her golf game and volunteered with the Navy League. She survived three loving husbands. Sput died in 1976, Harvey Kuhr in 1996, and William Blackman in 2005. Born just three days after NACA, she died April 21, at the age of 98.

Ames Ongoing Monthly Events Calendar

African American Advisory Group (AAAG) Mtg., last Tuesday of each month, 12 - 1 p.m., Bldg. N255 Rm 101C. POC: Rose King, ext. 4-3442.

Moffett Aikido Club, Monday and Wednesday evenings, 6:30 p.m., Bldg. 944. Aikido is a non-competitive, defensive martial art known as the "Way of Harmony." POC: Diane Pereda (650) 575-9070 or Robert Dean (650) 787-1007, email: mfaikido@aol.com

Ames Amateur Radio Club, third Thurs., of each month, 12 noon, N-T28 (across from N-255). POC: George Tucker, at ext. 4-2200.

Ames Bluegrass Club, every Tuesday from 11:30 a.m. to 1 p.m. in Bldg. 944. Players of all instruments and all levels are welcome, but we are particularly interested in experienced players willing to help improve the group's musical skills. POC: Bob Haberle at ext: 4-5494 or email: robert.m.haberle@nasa.gov

Ames Bocce Ball Club, Ames' newest Exchange-sponsored club is seeking members. POC: Mike Lindsay email: michael.c.lindsay@nasa.gov

Ames Bowling League, Homestead Lanes Thursdays at 6 p.m. Need substitute bowlers. Sign up questions: Steve Howard at ext. 4-4884.

Ames Contractor Council Mtg., first Weds. of each month, 11 a.m., Bldg. N-200, Committee Room. POC: Herb Finger at ext. 4-6598.

Ames Federal Employees Union (AFEU) Mtg., third Wednesday of each month, noon. Bldg. N-204, Rm. 101. Guests welcome. Check for occasional schedule changes at: <http://www.afeu.org>. POC: Paul K. Davis, ext. 4-5916.

Ames Golf Club, Members have the opportunity to play approximately 13 tournaments per year at a variety of 18-hole golf courses in the Bay and Monterey Area. POC: Barry Sullivan: Barry.T.Sullivan@nasa.gov.

Ames Green Team (formerly the Green Ames Working Group) meetings are held the first Tuesday of each month in N237, Room 101, from 10-11 a.m. For information, call Roger Ashbaugh, Ames Environmental Management Division, ext. 4-5660. <http://environmentalmanagement.arc.nasa.gov/reports/eo-13514.html>

The Hispanic Advisory Committee for Excellence (HACE) Mtg., first Thursday of each month, 11:30 a.m. - 12:30 p.m., Bldg. N-255, Rm. 101C. POC: Jeanette Zamora, jeanette.zamora-ortega-1@nasa.gov.

Ames Jazz Band Club, Bldg. 944, 5:30 p.m. - 7 p.m., POC: Ralph Bach, email: ralph.e.bach@nasa.gov

Jetstream Toastmasters, Mondays, 12 p.m. - 1 p.m., Bldg. N-269/Rm.179. POC: Tim Steiger, ext. 4-0195, tim.steiger@nasa.gov. Web: <http://jetstream.freetoasthost.com>

Ames Nimble Knitters Club, every Tuesday at 11:30 a.m., Bldg. N210/Rm 141. POC: Rosalyn Jung, knifan2@yahoo.com or Diane Alexander at ext. 4-3140. URL: <http://knit.arc.nasa.gov>

Ames Roller Hockey Club, meets daily from noon to 1 p.m. at rink on north end of the 80-foot-by-120-foot wind tunnel. Players should have experience skating and must wear protective equipment.

Ames Safety Committee, third Thursday of each month, 10 a.m. - 11 a.m., Bldg. N-237, Rm. 200. POC: John Livacich, jlivacich@mail.arc.nasa.gov, ext. 4-3243.

Women's Influence Network (WIN), first Wednesday of each month, Bldg. 241 room 237, 11:30 - 12:30 p.m., POC: Elena Serna, elena.serna@nasa.gov

Orphanage Without Borders Mtg., Mondays, Buiding 211, Room 205, 11:30 a.m.-12:30 p.m. The mission of Orphanage Without Borders (OWB) is to improve the lives of children living in orphanages and abandoned children. Our goal is to create a network of organizations that work together to provide children worldwide with the acceptable standards of life such as education, health, hygiene, discipline, affection, responsibility, hope of future, shelter, nutrition, clean water, joy and safety. We aim to apply these standards universally, meaning that they will be independent of the nationality, religion, culture, race, political opinion or social class of the children or orphanage location. For additional information contact Miguel at mvcharcos@orphanagewithoutborders.org or mcharcos@sofia.usra.edu.

Physical Inventory Underway

Ames' annual 100 percent wall-to-wall physical inventory for NASA tagged, bar-coded property is proceeding as scheduled. As a reminder, all controlled equipment documented on a NASA Form 892 "Employee Property Pass/Loan Agreement and Removal Permit" must have their NF 892 up to date. Employees are encouraged to bring in that property for scanning. Property passes are assigned to those people authorized to carry government equipment on and off Ames Research Center. If you have questions, contact Nelson Japlit at ext. 4-3428.

Exchange Information

Information about products, services and opportunities provided to the employee and contractor community by the Ames Exchange Council. Visit our web site at: <http://exchange.arc.nasa.gov>

Beyond Galileo Gift Shop N-235 in the cafeteria, 8 a.m. to 2 p.m., ext. 4-6873

Visitor Center Gift Shop (Exploration Center), Tues-Fri, 10 a.m. to 4 p.m., Sat. - Sun, 12 - 4 p.m., ext. 4-5412

Remember to purchase your baby shower, birthday and holiday gifts at Ames' two gift shops!

Mega Bites Cafeteria N-235, 6 a.m. to 2 p.m., ext. 4-5969/Catering ext. 4-2161

Barcelona Café Bldg. 3, 6:30 a.m. to 2 p.m., ext. 4-4948/Catering ext. 4-4948

See daily menus at: <http://exchange.arc.nasa.gov/cafe/menu.html>

Moffett Field Golf Club with 'Tee minus One' Grill and Sports Bar. Catering available. Call (650) 603-8026. Extended Happy Hour Thursdays, \$5 and \$6 pitchers of beer starting at 4 p.m. to 8:30 p.m.

RV Lots available. Call to reserve a space at (650) 254-1808.

Civilian/Contractors, \$50/mo; military \$25/mo

NASA Lodge (N-19) (650) 603-7100

Where to stay when you're too tired to drive home? What about the lodge?! Two types of rooms: Bldg. 19 (43 rooms), rate: \$65/night (\$5 ea add'l adult); Bldg. 583 A&B (150 rooms), rate: \$55/night (\$5 ea. add'l adult); B547 rate \$60/night (for large groups)

Ames Swim Center (N-109) (650) 603-8025

The swimming pool is now open. Hours of operation are as follows:
Lap swim only:
MWF 10 a.m. - 1 p.m.
MWF 3 p.m. - 6 p.m.
TTH 10 a.m. - 1 p.m.
TTH 4 p.m. - 7 p.m. The pool is heated year round. The pool normally is available for lap swim, pool parties and special events. POC: Ryan Storms, Pool Manager (650) 603-8025. Memberships: single memberships: \$60/yr. Family memberships: \$80/yr. After purchasing a membership, there is an entrance fee: daily entrance fee - \$3/day or lap pass fee - \$50 for 20 uses. Platinum membership - \$380/yr. (no daily fee). Special events: include military training, swim team events, kayak role practice, etc. The cost for special events is \$75/hr, or \$50/hr for military.

Exchange Basketball Gym is now open, Bldg. 2 (650) 603-9717

Hours of operation:
M-F 11 a.m. - 1:30 p.m.
M-F 4 p.m. - 7 p.m.

Chase Park reservations, call ext. 4-4948
NACA Park reservations, call ext. 4-4948

Ames Cat Network

The Ames Cat Network needs help finding homes for cats trapped at Moffett. They range from feral to abandoned/lost pets. They are tested, altered and inoculated. Call Iris at ext. 4-5824 if you or someone you know are interested in fostering or adopting a cat.

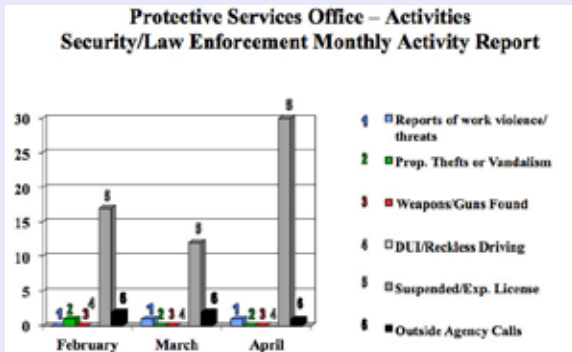
Ames emergency announcements

To hear the centerwide status recording, call (650) 604-9999 for information announcements and emergency instructions for Ames employees. You also may listen to 1700 KHz AM radio for the same information.

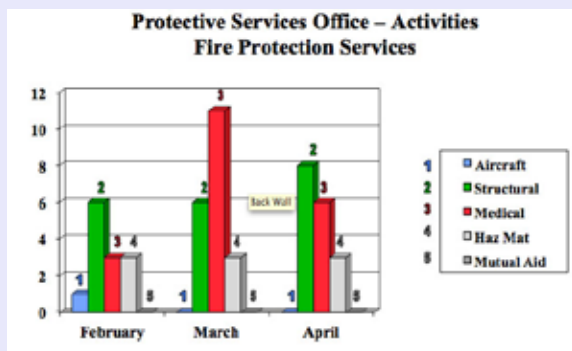
Protective Services monthly activity

A statistical summary of activities of the Protective Service Division's Security/Law Enforcement and Fire Protection Services units for the three-month period ending April 2013 is shown below.

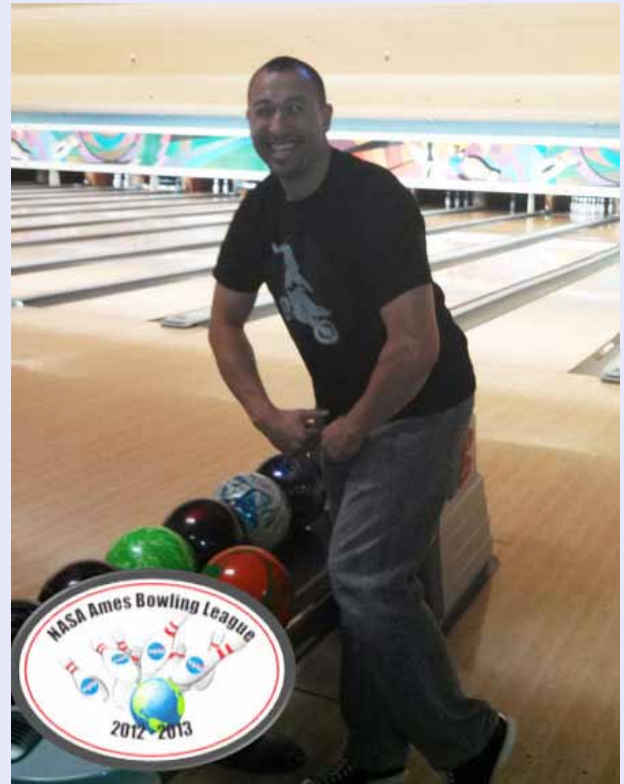
Security/Law Enforcement Activity



Fire Protection Activity



Simpson bowls 300



NASA photo

Recently, Chris Simpson (Code I) shown above, bowled a perfect 300 game in the All Ames Bowling league. The Ames Bowling League plays at the Homestead Lanes Thursdays at 6 p.m. For sign up questions, contact Steve Howard at ext. 4-4884.



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