

Goat View

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September 2012

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THE WEEKLY



2012 Robert H. Goddard Honor Awards

Nominations for the 2012 Robert H. Goddard Honor Awards may be submitted from September 1-October 15. Specific information and details are included in the [2012 July-December Awards Call book](#). Contact Khrista White at x6-9059 or MJ Jackson at x6-4574 for questions or assistance.

Service for Armstrong at National Cathedral

NASA Administrator Charles Bolden and other dignitaries will attend a public memorial service at the National Cathedral to honor Neil Armstrong on September 13. The ceremony will be broadcast live on [NASA Television](#) and streamed online by NASA. For more information, click on the picture of Neil Armstrong.



SDO Enters Semiannual Eclipse Season

Twice a year, SDO moves into its eclipse season, a time when Earth blocks its view of the sun for a period of time each day. Spacecraft observing the sun from an orbit around Earth has to contend with such eclipses, but SDO's orbit is designed to minimize them as much as possible. To watch the video of Earth moving across the sun, click on the image of the sun.



Mission to Study Magnetic Explosions Passes Major Review

NASA's Magnetospheric Multiscale (MMS) mission passed a Systems Integration Review, which deems a mission ready to integrate instruments onto the spacecraft. MMS will observe magnetic reconnection, which creates explosive bursts of energy and which powers a variety of space phenomena from the aurora to solar flares. For more about MMS, click on the picture.



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Cover caption: University of Washington Applied Physics Laboratory Senior Principal Oceanographer Jason Gobat work one of their instruments onboard the Woods Hole Oceanographic Institution's research vessel Knorr in Woods Hole, Mass.

Photo Credit: (NASA/Bill Ingalls)

GoddardView Info

Goddard View is an official publication of NASA's Goddard Space Flight Center. *Goddard View* showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. *Goddard View* is published weekly by the Office of Communications.

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News items for publication in *Goddard View* must be received by noon Wednesday of each week. You may submit contributions to the editor via e-mail at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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SEPTEMBER 11 DAMAGE VISIBLE FROM SPACE

Visible from space, a smoke plume rises from the Manhattan area after two planes crashed into the towers of the World Trade Center. The above photo was taken of metropolitan New York City (and other parts of New York as well as New Jersey) the morning of September 11, 2001. "Our prayers and thoughts go out to all the people there, and everywhere else," said Station Commander Frank Culbertson of Expedition 3, after the terrorists' attacks.

The following day, he posted a public letter that captured his initial thoughts of the events as they unfolded. "The world changed today. What I say or do is very minor compared to the significance of what happened to our country today when it was attacked."

Upon further reflection, Culbertson said, "It's horrible to see smoke pouring from wounds in your own country from such a fantastic vantage point. The dichotomy of being on a spacecraft dedicated to improving life on the earth and watching life being destroyed by such willful, terrible acts is jolting to the psyche, no matter who you are."

Here are more excerpts from Culbertson's letter. Read Culbertson's [letter](#) in its entirety.

"I had just finished a number of tasks this morning, the most time-consuming being the physical exams of all crew members. In a private conversation following that, the flight surgeon told me they were having a very bad day on the ground. I had no idea...

He described the situation to me as best he knew it at ~0900 CDT. I was flabbergasted, then horrified. My first thought was that this wasn't a real conversation that I was still listening to one of my Tom Clancy tapes. It just didn't seem possible on this scale in our country. I couldn't even imagine the particulars, even before the news of further destruction began coming in.

I glanced at the World Map on the computer to see where over the world we were and noticed that we were coming southeast out of Canada and would be passing over New England in a few minutes. I zipped around the station until I found a window that would give me a view of NYC and grabbed the nearest camera. It happened to be a video camera, and I was looking south from the window of Michael's cabin.

The smoke seemed to have an odd bloom to it at the base of the column that was streaming south of the city. After reading one of the news articles we just received, I believe we were looking at NY around the time of, or shortly after, the collapse of the second tower. How horrible..."

Watch a 2010 [video](#) with Frank Culbertson as he reflects on the events of 9/11 ten years later. To download the above image, click on it. ■



“What if the drought in the U.S. Midwest became permanent?”

NASA VOYAGE TO EXPLORE SEA SALTINESS AND CLIMATE

By: Maria-José Viñas

A NASA-sponsored expedition is set to sail to the North Atlantic's saltiest spot to get a detailed, three dimensional picture of how salt content fluctuates in the ocean's upper layers and how these variations are related to shifts in rainfall patterns around the planet.

The research voyage is part of a multi-year mission dubbed the Salinity Processes in the Upper Ocean Regional Study (SPURS), which will deploy multiple instruments in different regions of the ocean. The new data also will help calibrate the salinity measurements NASA's [Aquarius](#) instrument has been collecting from space since August 2011.

SPURS scientists aboard the research vessel Knorr leave from the Woods Hole Oceanographic Institution in Woods Hole, Mass., and head toward a spot known as the Atlantic surface salinity maximum, located halfway between the Bahamas and the western coast of North Africa. The expedition also is supported by the National Oceanic and Atmospheric Administration and the National Science Foundation.

The researchers will spend about three weeks onsite deploying instruments and taking salinity, temperature and other measurements, before sailing to the Azores to complete the voyage on Oct. 9.

They will return with new data to aid in understanding one of the most worrisome effects of climate change—the acceleration of Earth's water cycle. As global temperatures go up, evaporation increases, altering the frequency, strength, and distribution of rainfall around the planet, with far-reaching implications for life on Earth.

“What if the drought in the U.S. Midwest became permanent? To understand whether that could happen, we must understand the water cycle and how it will change as the climate continues to warm,” said Raymond Schmitt, a physical oceanographer at Woods Hole and principal investigator for SPURS.

“With SPURS we hope to find out why these climate models do not track our observations of changing salinities,” said Eric Lindstrom, physical oceanography program scientist at NASA Headquarters. “We will investigate to what extent the observed salinity trends are a signature of a change in evaporation and precipitation over the ocean versus the ocean's own processes, such as the mixing of salty surface waters with deeper and fresher waters or the sideways transport of salt.”



To learn more about what drives salinity, the SPURS researchers will deploy an array of instruments and platforms, including autonomous gliders, sensor-laden buoys and unmanned underwater vehicles. Some will be collected before the research vessel heads to the Azores, but others will remain in place for a year or more, providing scientists with data on seasonal variations of salinity.

Some of the devices used during SPURS to explore the Atlantic's saltiest spot will focus on the outer edges of the study area, traveling for hundreds of miles and studying the broadest salinity features. Other instruments will explore smaller areas nested inside the research site, focusing on smaller fluxes of salt in the waters. The suite of ocean instruments will complement data from NASA's salinity-sensing instrument aboard the Aquarius/SAC-D (Satellite de Aplicaciones Cientificas-D) observatory, and be integrated into real-time computer models that will help guide researchers to the most interesting phenomena in the cruise area.

“We'll be able to look at lots of different scales of salinity variability in the ocean, some of which can be seen from space, from a sensor like Aquarius,” said David Fratantoni, a physical oceanographer with Woods Hole and a member of the SPURS expedition. “But we're also trying to see variations in the ocean that can't be resolved by current satellite technology.”

The 2012 SPURS measurements in the North Atlantic will help scientists understand the behavior of other high-salinity regions around the world. A second SPURS expedition in 2015 will investigate low-salinity regions where there is a high input of fresh water, such as the mouth of a large river or the rainy belts near the equator. ■

Above: Two NOAA Pacific Marine Environmental Laboratory (PMEL) buoys on the stern of the Woods Hole Oceanographic Institution's research vessel Knorr. Photo Credit: NASA/Bill Ingalls

Opposite: NASA Physical Oceanography Program Scientist Eric Lindstrom talks about the instruments onboard the Woods Hole Oceanographic Institution research vessel Knorr. Photo Credit: NASA/Bill Ingalls



GLOBAL HAWK MISSION BEGINS WITH HURRICANE LESLIE

By: Keith Koehler and Steve Cole

NASA has begun its latest hurricane science field campaign by flying an unmanned Global Hawk aircraft over Hurricane Leslie in the Atlantic Ocean during a day-long flight from California to Virginia. With the Hurricane and Severe Storm Sentinel (HS3) mission, NASA for the first time will be flying Global Hawks from the U.S. East Coast.

The Global Hawk took off from NASA's Dryden Flight Research Center on September 6 and landed at Wallops on September 7 after spending 10 hours collecting data on Hurricane Leslie. The month-long HS3 mission will help researchers and forecasters uncover information about how hurricanes and tropical storms form and intensify.

NASA will fly two Global Hawks from Wallops during the HS3 mission. The planes, which can stay in the air for as long as 28 hours and fly over hurricanes at altitudes greater than 60,000 feet, will be operated by pilots in ground control stations at Wallops and Dryden Flight Research Center at Edwards Air Force Base, Calif.

The mission targets the processes that underlie hurricane formation and intensity change. The aircraft help scientists decipher the relative roles of the large-scale environment and internal storm processes that shape these systems. Studying hurricanes is a challenge for a field campaign like HS3 because of the small sample of storms available for study and the great variety of scenarios under which they form and evolve. HS3 flights will continue into early October of this year and be repeated from Wallops during the 2013 and 2014 hurricane seasons.

The first Global Hawk arrived at Wallops carrying a payload of three instruments that will sample the environment around hurricanes. A second Global Hawk will look inside hurricanes and developing storms with a different set of instruments. The pair will measure winds, temperature, water vapor, precipitation and aerosols from the surface to the lower stratosphere.

"The primary objective of the environmental Global Hawk is to describe the interaction of tropical disturbances and cyclones with the hot, dry and dusty air that moves westward off the Saharan desert and appears to affect the ability of storms to form and intensify," said Scott Braun, HS3 mission principal investigator and research meteorologist at Goddard.

This Global Hawk will carry a laser system called the Cloud Physics Lidar (CPL), the Scanning High-resolution Interferometer Sounder (S-HIS), and the Advanced Vertical Atmospheric Profiling System (AVAPS).

The CPL will measure cloud structure and aerosols such as dust, sea salt and smoke particles. The S-HIS can remotely sense the temperature and water vapor vertical profile along with the sea surface temperature and cloud properties. The AVAPS dropsonde system will eject small sensors tied to parachutes that drift down through the storm, measuring winds, temperature and humidity.

"Instruments on the 'over-storm' Global Hawk will examine the role of deep thunderstorm systems in hurricane intensity change, particularly to detect changes in low-level wind fields in the vicinity of these thunderstorms," said Braun.

These instruments will measure eyewall and rainband winds and precipitation using a Doppler radar and other microwave sensors called the High-altitude Imaging Wind and Rain Airborne Profiler (HIWRAP), High-Altitude MMIC Sounding Radiometer (HAMSR) and Hurricane Imaging Radiometer (HIRAD).

"The mission targets the processes that underlie hurricane formation and intensity change."

HIWRAP measures cloud structure and winds, providing a three-dimensional view of these conditions. HAMSR uses microwave wavelengths to measure temperature, water vapor, and precipitation from the top of the storm to the surface. HIRAD measures surface wind speeds and rain rates.

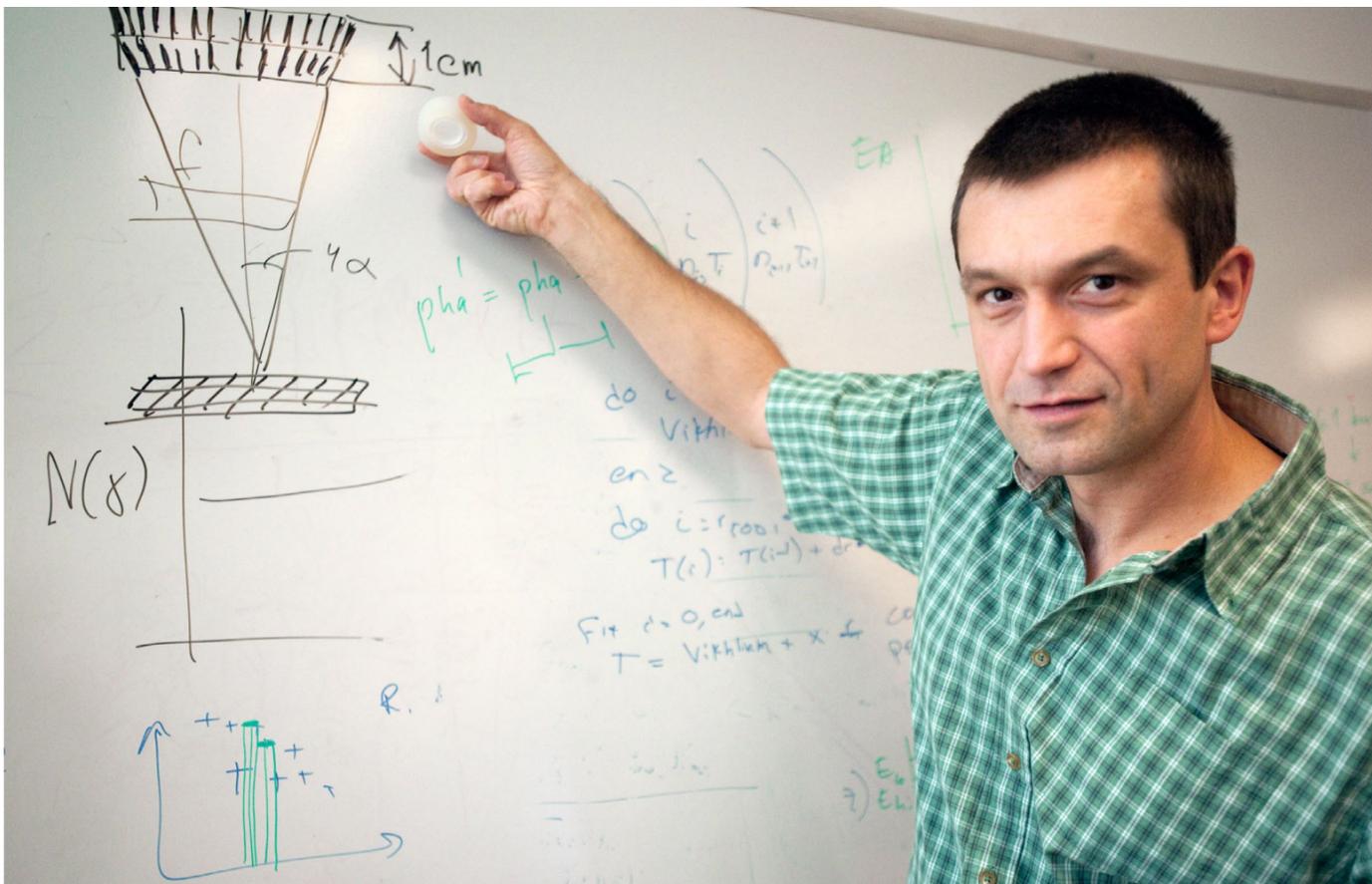
The HS3 mission is supported by several NASA centers including Wallops; Goddard; Dryden; Ames Research Center, Moffett Field, Calif.; Marshall Space Flight Center, Huntsville, Ala.; and the Jet Propulsion Laboratory, Pasadena, Calif. HS3 also has collaborations with partners from government agencies and academia.

HS3 is an Earth Venture mission funded by NASA's Science Mission Directorate in Washington. Earth Venture missions are managed by NASA's Earth System Science Pathfinder Program at the agency's Langley Research Center in Hampton, Va. The HS3 mission is managed by the Earth Science Project Office at NASA's Ames Research Center. ■

Above: The Global Hawk unmanned aircraft coming in for a landing at NASA's Wallops Flight Facility in Wallops Island, Va on Sept. 7, 2012. Credit: NASA/Wallops

Below: This visible image of Hurricane Leslie was captured by the MODIS instrument aboard NASA's Aqua satellite on Sept. 5 as the storm was approaching Bermuda. Leslie was just becoming a hurricane and its eye became visible. Credit: NASA Goddard/MODIS Rapid Response Team





American author Robert Collier once noted that every tool, utensil, and instrument created by humans evolved from simple beginnings. Goddard scientist Maxim Markevitch would agree. After all, the inspiration behind his quest to build an X-ray mirror using a never-before-tried technique came from a roll of Scotch® tape.

Markevitch, who has assembled a team of Goddard's preeminent experts in the field of X-ray optics, has begun investigating the feasibility of fashioning a low-cost mirror from plastic tape and tightly rolling it like the sticky adhesive commonly found in most homes and offices. "I remember looking at a roll of Scotch tape and thinking, 'was it possible to use the same design for capturing hard X-rays,'" Markevitch recalled.

With funding from NASA's Center Innovation Fund, the team now is pursuing Markevitch's "early-stage" idea and has already begun testing candidate materials that could be fashioned into a rolled mirror capable of collecting X-rays. To capture these ever-elusive photons, the mirrors must be curved and nested inside a cylindrical optical assembly.

Motivating Markevitch is the fact that these highly specialized mirrors are time-consuming and expensive to build and assemble, despite efforts to dramatically reduce production costs ([CuttingEdge, Winter 2012](#)). Making matters more demanding is the fact that X-ray observatories in the future likely will require much larger collecting areas. "It's a lot of work fabricating these rigid shells and making sure they're properly aligned," he said.

The science Markevitch would like to pursue would require a larger mirror. Over the past few decades, NASA has launched several X-ray observatories sensitive to lower-energy "soft X-rays." They discovered and imaged the faint, diffuse X-ray signal from a variety

of astrophysical sources dominated by thermal emission, such as galaxies and clusters of galaxies. Other missions were sensitive to higher-energy gamma rays, but they lacked imaging capabilities. "There remains a large and totally unexplored discovery space of faint, diffuse nonthermal astrophysical objects emitting at high X-ray energies," Markevitch said.

Markevitch, Takashi Okajima, Will Zhang, and Peter Serlemitsos are acquiring and testing candidate tape that would be coated on one side with a multilayer of reflective material and then wound into a roll, forming a large number of densely packed nested shells that are spaced by the varying thickness of the tape. "The collecting surface is automatic, it's rolled, selfsupporting, and already aligned," Markevitch said.

"Maxim's Scotch tape idea is in an early stage," Zhang said. "In the next year, we will know whether it has a chance of working."

If it does, it could prove "game-changing for hard X-ray astronomy," Markevitch said. "It could significantly reduce the cost of building large mirrors, bringing within reach the possibility of building a mirror with 10 to 30 times greater effective area than current X-ray telescopes." ■

Above: Principal Investigator Maxim Markevitch with his inspiration. The whiteboard drawing shows the shape of the X-ray mirror roll. Photo credit: Debora McCallum

INSPIRATION FROM A ROLL OF TAPE

By: Lori Keesey



NEXT MARS MISSION ENTERS FINAL PHASE BEFORE LAUNCH

By: Nancy Neal Jones

NASA's Mars Atmosphere And Volatile Evolution (MAVEN) mission has passed a critical milestone, Key Decision Point-D (KDP-D). The project is officially authorized to transition into the next phase of the mission, which is system delivery, integration and test, and launch.

"The spacecraft and instruments are all coming together at this point," said Bruce Jakosky from University of Colorado, the MAVEN principal investigator. "Although we're focused on getting everything ready for launch right now, we aren't losing sight of our ultimate objective—getting to Mars and making the science measurements."

MAVEN will be the first mission devoted to understanding the Martian upper atmosphere. The goal of MAVEN is to determine the role that loss of atmospheric gas to space played in changing the Martian climate through time.

The key decision meeting was held at NASA Headquarters in Washington on Sept. 10 and chaired by NASA's Science Mission Directorate.

"I'm incredibly proud of how this team continues to meet every major milestone on schedule on its journey to Mars," said David Mitchell, MAVEN project manager at Goddard. "Being ready for the start of system level integration and test is critically important to ultimately being ready for launch on November 18, 2013."

KDP-D occurs after the project has completed a series of independent reviews which cover not only technical health of the project but also programmatic health (schedule and cost). KDP-D represents the official transition from Phase C (development stage) to

Phase D in the mission life cycle. During Phase D, the spacecraft bus is completed, the science instruments are integrated into the spacecraft, spacecraft testing occurs, everything ships to Kennedy Space Center for integration into the Atlas-V rocket, and the MAVEN mission launches.

The next major review for the MAVEN team is the Mission Operations Review in November 2012. This review assesses the project's operational readiness and its progress towards launch. The project will continue to work with its partners to deliver all instruments in the next four months.

The MAVEN spacecraft will carry three instrument suites. The Particles and Fields Package, built by the University of California at Berkeley with some instrument elements from CU/LASP and Goddard, contains six instruments that will characterize the solar wind and the ionosphere of the planet. The Remote Sensing Package, built by CU/LASP, will determine global characteristics of the upper atmosphere and ionosphere. The Neutral Gas and Ion Mass Spectrometer, provided by Goddard, will measure the composition and isotopes of neutrals and ions.

MAVEN will launch during a 20-day period from November to December, 2013. It will go into orbit around Mars in September 2014, and, after a one-month check-out period, will make measurements from orbit for one Earth year. Goddard manages the project and is building two of the science instruments for the mission. ■

Above: Artist's concept of MAVEN Mars orbiter. Image credit: NASA/Goddard

SUMMER STUDENTS CHERISH GODDARD EXPERIENCE

By: Grace Montalvo



After an exciting and productive summer, interns must say goodbye. But this is not the end of an awesome experience; it is in fact the beginning of an amazing path for these students who contributed to Goddard with their work. For about ten weeks, interns from all over invaded Goddard and filled it with their curiosity, hunger for learning and unmistakable energy.

These young professionals had the opportunity to collaborate on NASA's mission through hands-on experience and exposure to space science, guided by mentors. Finding alternative materials to titanium to reduce human risk during atmospheric re-entry, science writing about the Lunar Reconnaissance Orbiter, communications projects, and mapping and planning travels for future scientific work in the moon are just some of the exciting things interns have been working on.

"I've had a pretty fantastic time here at Goddard, running around to different labs and facilities to meet with scientists and engineers from all over the disciplines. As a graduate student, this kind of productive experience is especially valuable; I have something to show for my time and effort," said Becky Strauss, who participated in a joint internship with the Office of Communications and the Lunar Reconnaissance Orbiter.

Besides their daily work, interns had a vast agenda full of interesting activities including tours, talks, conferences, and the Transit of Venus and the MSL Landing. The work atmosphere provided them with the right tools and opportunities to make the most out of this experience.

"The internship at NASA Goddard has been a real work environment experience. I had the chance to meet new people with whom I share my enthusiasm for science. I also had the opportunity to apply what I have already learned during my academic and research career and continue the learning process," said Lorraine Torres Castro who worked in the Power System branch.

Interns are not the only ones learning and growing. Students provide useful contributions that improve current work in many areas.

"I think internships are very valuable. It provides a level of education you can't get in school," said Benjamin Emory, mentor of Andrew Tsoi, an aerospace engineering intern in the Mechanical Systems Analysis & Simulation Branch. "I like learning with and from my interns. I usually assign them a project I'd like to do myself but don't have the time to do fully."

Now, summer internships are over and many interns are already starting fall classes. Some of them are going back to school looking forward to successfully complete another semester, while some other are going back to graduate and begin a whole new chapter in their life. ■

Photo credit: NASA/Goddard/Becky Strauss

OUTSIDE GODDARD

By: Elizabeth M. Jarrell

A DIFFERENT KIND OF MISSION

Bob Savage, an electrical engineer and Assistant Director of Safety and Mission Assurance at Wallops Flight Facility, is a man on a different kind of mission. In 2006, Savage led a team from his church, including his family, on their first mission trip to Honduras.

"In 2006, I was at the Oakridge Community Church in Clarksville, Md., and noticed a table for mission trips to Honduras," says Savage. "I saw a need for help. In 1998, Hurricane Mitch came through Honduras and dropped about 75 inches of rain in certain parts of the country. The results were devastating. About 11,000 were killed and another 11,000 left homeless." His church has a sister church in Honduras that sponsors annual, one-week mission trips.

"Since I was leading the team, I had to ensure that everyone going was prepared for the unfamiliar journey. I made sure that everyone was up to date on their shots and had malaria pills. I also took our medical kit in case of an emergency," says Savage. The group also brought 13 duffel bags full of donated clothes to give away.

The team flew into San Pedro Sula, Honduras, was met by translators provided by their sister church, and then bussed 2½ hours to the remote town of Camalote. The group stayed in a three-bedroom house with one inside bathroom for the women and an outhouse for the men. There was no hot water for showers. They slept on thin foam mattresses on the concrete floor. The group traveled by pickup truck in town and to neighboring villages to distribute clothes. "Rush hour in Camalote consists of a herd of Brahman cattle being lead through town," notes Savage.

From Camalote, they hiked 2½ hours up a mountain to another remote village called La Virtud. They carried their mattresses, water, and clothes, but used donkeys to haul the donated clothes. "There was little to no trail and it was uphill all the way," says Savage. "We hiked above the clouds." They stayed in a two-room school house during their overnight visit. The next day, they distributed the clothes to the children.

"We distributed clothes to one village each day over the week. As the kids lined up, we tried to find one outfit for each. The word got out that we were coming with clothes so the kids met us at the local schools every morning," says Savage.

Every week-long mission trip has at least one major project. The men's project the first year was replacing the school's roof in Camalote. "We raised building funds at our home church and purchased the materials in Honduras. We could have just sent the money, but it means much more to the locals for us to personally go there and work side by side with them," says Savage. They knocked their shoes before putting them on and looked around very carefully while moving debris during construction to avoid scorpions. The women's project was painting an exterior church wall with a religious scene designed by Savage's oldest daughter.

The team also put on pantomime skits and puppet shows with religious themes for the children. They prepared craft projects and worked with the kids on the crafts during their village visits. "The friendship bracelets we made were probably the only jewelry these kids ever had," notes Savage. They also played games although they separated the boys from the girls when knocking the piñatas. At night, they got together and discussed the day's activities, planned for the next day and sang songs using instruments they had brought.

In 2007, 2008, and 2009, Savage led more church missions back to Honduras. Each trip had a different project, the most ambitious of which was building an entire two-room school for a remote village. He plans to lead another mission trip in 2012.

"You develop a bond with the people after a week and become friends. So you want to return to help them. It really opens your eyes. You see how lucky we are in the U.S. and how poor other people are in third world countries. Until you go on one of these types of trips, you never realize how blessed we are here in the U.S.," he concludes. ■

Below: Savage and team members distributing school supplies to children in a small school house in a remote village. Below left: The mission team that went to Camalote, Honduras standing in front of a mural that they painted on the side of a local elementary school.



Above: Team members distributing clothes to children in a small village near Camalote. All photos provided by Bob Savage

