SCIENCE AND TECHNOLOGY CORPORATION

NEWSLETTER

... An Innovative Advanced Technology Company

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STC Fabrication, Design, and Engineering (FDE)

STC has spent the past seven years as the fabrication prime contractor at NASA Langley Research Center (LaRC), and, in that time, STC has developed a technical capability that is world class. During our original fabrication contract (EFS), STC

helped NASA grow their capabilities in support of the Constellation Program. After winning the follow-on fabrication contract (EMCHFSS) at NASA, STC made a concerted effort to grow this unique capability. We wanted to leverage the follow-on contract to develop and expand STC's fabrication capabilities. In that vein, STC has begun to repurpose space at the 15 Research Drive location in Hampton, VA. Taking advantage of available space, STC now has a welding shop in an area that was previously the loading dock, and a composites shop in what was previously a conference room.

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STC Student Internship Program (STIEP) at NASA Langley Research Center

Since 1993, Science and Technology International Education Program (STIEP) has been actively promoting, through a network of academic institutions, research and education, a wide range of Aerospace and other related projects. It includes such diverse topics as: Air Traffic Control/Air Traffic Management, Wake Vortex Hazard-Runway Capacity & Separation Standards, Cockpit Display Design (Human Factors), Digital Data Link, Aviation Environment (Integrated Noise Model/Aviation Environment Design Tool), NextGen/Single European Sky ATM Research, Global Positionion System-Global Navigation Satellite System comparison, Space Debris & Satellite Slot Allocation, Space Shuttle Main Engine Performance Analysis, Aviation Biofuels, and Aerospace Sensor Design & Data Analysis, Spatial & Spectral Analysis. Sponsored by STC, in cooperation with Taksha University, the STIEP Program provides university

From left to right: Scott Hill, Dr. Shih-Yung Lin, Dr. Amar Choudry, Donato Girolamo, and Steve Jurzyck, Deputy Director, Langley Research Center.

students, under the leadership of STC Mentor, Dr. Amar Choudry, an opportunity to do research as interns with co-mentors at various U.S. government and industrial organizations, on technical and business topics related to aerospace, space, aviation, and transportation. The tenure of their internship lasts 4–6 months at the end of

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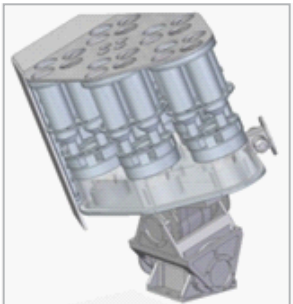
Geostationary Remote Infrared Pollution Sounder (GRIPS)

Climate change and air quality are the most pressing environmental issues of the 21st century – for America and for the world as a whole. Despite decades of research, the sources and sinks of key greenhouse gases remain highly uncertain [IPCC, 2007] making atmospheric composition predictions difficult. STC, along with University of Maryland, GATS and Space Dynamics Laboratory, has proposed a revolutionary instrument for measurement of key climate gases (CO_2, CH_4) and pollutant (CO) from geostationary orbit. Our instrument is called GRIPS, an acronym for Geostationary Remote Infrared Pollution Sounder. GRIPS was proposed for NASA's Earth Venture Instrument initiative, (EVI). Although GRIPS was not selected in this round (there were 25 or so proposals) STC will be resubmitting the proposal this spring for the next EVI call.



GRIPS Instrument consists of quad-telescope clusters, mounted on a pointing gimbal. Each quad telescope provides 3 data points for the trace gas profile: boundary layer, mid-troposphere, column. Each cluster makes a different trace gas measurement.

How does GRIPS work? GRIPS is a gas filter correlation radiometer (GFCR). A GFCR uses the target gas (CO_2, CH_4 or CO) as a filter. Solar radiation reflected from the earth is split inside the instrument and passes along two paths, one containing a sample of the target gas and one without. Since we know how much light will be absorbed by the gas filter, we can work out how much light was absorbed by the atmosphere.

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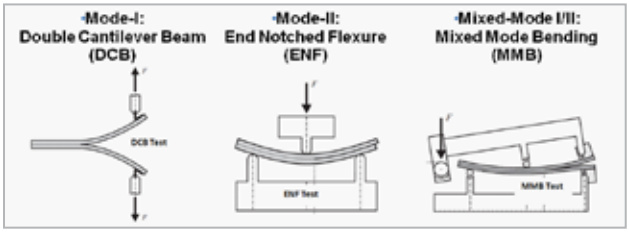
STIEP (*Continued from page 1*)

which they deliver reports, software, and papers.

Through STIEP, STC was privileged to sponsor an Italian student from Delft University of Technology (TU Delft) in the Netherlands, Donato Girolamo. Donato spent nearly nine months with STC supporting research at NASA LaRC in Hampton, VA. Donato was sponsored through the Electronic, Mechanical, and Composite Hardware Fabrication Support (EMCHFS) contract under Project Manager Mr. Jeff Manning with the support of the NASA LaRC Engineering Director, Mr. Steve Sanford, and his Deputy Director for Technical Services, Mr. Stewart Harris. In pursuit of his Master's thesis, Donato worked with the Mechanical Systems Branch, directed by Mr. Scott Hill, and worked directly with Dr. Carlos Da´vila and Dr. Shih-Yung Lin. Donato, who is working towards his Master's degree in Mechanical Engineering, was presented with several exciting research opportunities. After reviewing the various opportunities and discussing them with mentors and advisors, Donato chose to perform research on "Damage Progression in the Adhesive Layers of Bonded Composite Joints." Donato spent a lot of time reading and researching prior to getting hands on experience in the lab and working with the test specimens and equipment. Donato's efforts were in collaboration with The Boeing Company in Seattle, WA, under a Space Act Agreement (SAA) with NASA LaRC. The work was related to an effort to design the biggest composite aerospace structure yet built. One of the big hurdles encountered was the fact that there is no autoclave large enough to cure the entire structure. Designing such a large structure required dividing the composite barrel into sections that could then be bonded together Out of Autoclave (OaA). The joints where these sections would be bonded together would be critical parts of the structure. Donato's efforts would be focused on developing a methodology to study the failure of an adhesive layer in two concepts of bonded joints, Conventional Splice Joints (CSJ) and Durable Redundant Joints (DRJ), in which NASA LaRC has a patent pending. The methodology was applied to the characterization of an FM300M mat-reinforced structural adhesive bonding IM7-977-2 composite laminates and would provide essential information for the Progressive Damage Analysis (PDA) of the joints. To get experimental data, Donato pursued de-lamination failure modes. There are three "classic" de-lamination modes, Mode-I (crack opening), Mode-II (In plane shear), and Mode-III (Tearing). Usually, Mode-II and Mode-III can be assumed to have the same mechanical properties. Three test setups were performed, to include Mode-I, Mode-II, and Mixed-Mode I/II. The tests can be categorized as Double Cantilever Beam (DCB) for Mode-I, End Notched Flexure (ENF) for Mode-II, and Mixed Mode Bending (MMB) for Mixed-Mode I/II. The following figure shows the various tests.



The technical significance of Donato's work included the development of methodology to measure the Cohesive Laws, the identification of two new failure mechanisms during the tests, which were also addressed by the PDA:

- Double De-lamination
- Core Crush

and improvement of the PDA for composite bonded structures.

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HONORS and AWARDS

STC Ames Employees Receive NASA Team Awards

Dr. Robert E. Childs received a NASA Team Award for his support of the Constellation Program's Flight Dynamics Team. The NASA Award citation reads: "In recognition of your extraordinary efforts in the areas of Aerodynamic, Guidance, Navigation, and Control contributing to the successful Orion Pad Abort 1 Test Flight." It is signed by L. Dale Thomas, the NASA Constellation Program Manager. The STC AEMMS contract supports the breadth of NASA's Launch Abort Systems for both design and mission scenario systems analysis.

Dr. Hamed S. Nejad received a NASA Team Award for his support of the Constellation Program's Engineering Risk Assessment Team. The NASA Award cites Dr. Nejad for his contributions to the Constellation/Orion comprehensive Risk Analyses.□

STC – Deseret Chemical Depot Operation Receives Awards

Steve Freudenberger (STC)

For the third straight year, STC – Deseret Chemical Depot Operation has been awarded by the Utah Safety Council, the "Award of Merit" for our outstanding safety performance and a "Perfect Record Award" for not having a recordable injury for over 60 months.

These two awards were presented to **Mr. Steve Freudenberger** at the annual Utah Safety Council Award banquet held in September 2012 in Salt Lake City, Utah. STC was recognized by the Utah Safety Council for commitment to safety and achieving its outstanding safety performance. As our operations run down at the depot, management and the employees have been committed to maintain its safety record and hopefully will be able to maintain its perfect record until our operations are complete.□

FDE (*Continued from page 1*)

The new welding space has been revamped with an upgraded electrical system, providing four 220 outlets for welding equipment, and a ventilation system to remove fumes from the working space. To properly outfit the space, the loading dock was framed, dry walled, and painted, providing a functional, conditioned area in which personnel can work comfortably and safely.

Composites Shop

In an effort to maximize the capability for the planned investment cost, STC leveraged the skill sets available within our fabrication team. One of the advantages of having fabricators is their knowledge of building things. For instance, a welding table was needed and rather than buy a welding table, material was bought and a custom table was built for the welding shop. This allowed STC to invest more in equipment which included a Metal Inert Gas (MIG) welding machine, a Tungsten Inert Gas (TIG) welding machine, a small Hobart welder, an acetylene torch kit, a plasma cutter and chop saws. After acquiring the welding wire, welding materials, welding shields, gloves, etc., STC has developed an efficient welding area in which to work.

Once the welding area was completed, welding certifications were needed. On the NASA EMCHFSS contract, STC was qualified to weld based on NASA's certifications. To perform non-NASA related work, or welding for other organizations, STC needed to develop a welding program and achieve our own certifications. This effort will be important for future proposals and contract opportunities. Developing a welding program was not a trivial effort, and was conducted with a Certified Welding Inspector (CWI) to help write the STC procedures and to perform the welder qualifications. The effort by the STC welding staff was outstanding. They were asked to take the most difficult qualification tests (6G), which gave STC the most capabilities, and none hesitated.

Through their dedicated efforts, STC achieved welding certifications for Stainless Steel and Mild Steel (heavy wall to thin wall). We are very close to achieving aluminum

Welding Space

certifications and pursuing Chrome-Moly certifications. These efforts have allowed us to pursue external work with the company's certifications. STC has quoted work for Jacobs Technology and Jefferson Lab, which has led to work from Jefferson Lab and with sub-contractors to Jacobs on the ROME contract. We are marketing with other companies and organizations to showcase the company's new capabilities, and anticipate new opportunities. STC has been fortunate to have personnel at Aberdeen and Edgewood who have made introductions and set up tours and visits for our Fabrication Team at Aberdeen Proving Ground and Edgewood Chemical and Biological Center. We believe the relationships that have been started will develop into productive opportunities, and the EMCHFSS Team would like to thank Mr. Jim Rice and Mr. Bob Lackey for their support in arranging those introductions.

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New Contracts

In April 2012, STC was on the winning team with AMA for the Technical, Engineering, and Aerospace Mission Support (TEAMS2) contract, which is a 5 year contract ending in March 2017.

STC has submitted multiple CBRNE task order proposals and has been awarded three (3) under the full and open contract and two task orders under the small business contract. We were also a subcontractor to SAIC on one other CBRNE task order.

STC has been awarded multiple delivery orders under our NOAA Ancillary and Engineering BPAs, both in NOAA Boulder and at NOAA NESDIS.

STC recently submitted several SciTech II task order proposals and were awarded two task orders.

STC is currently in subcontract negotiation with SAIC as a teammate for the PAIS V contract.

Recently, STC has been awarded new contracts and subcontracts valued at over $30M from our Government and Commercial/prime customers, with aggregate orders totaling over $8M under GSA IT and PES contracts.

AMS/STC SCHOLARSHIP AWARD

The American Meteorological Society (AMS) has named Amanda N. Lindquist as the recipient of the AMS/STC Freshman Undergraduate Scholarship for 2008 and Reena Joubert for 2009. They were presented their scholarships at the 2011 and 2012 AMS Annual Meeting in Seattle and New Orleans, respectively.

From left to right: Reena Joubert, Mike Farrar (STC), and Amanda N. Lindquist.

Amanda is completing her senior year at Florida State University in 2012 pursuing a major in meteorology. Reena is completing her junior year at Massachusetts Institute of Technology in 2012 pursuing a major in atmospheric science and physics.

The AMS Freshman Undergraduate Scholarship is awarded on merit and is designed to encourage outstanding undergraduates to pursue careers in the fields covered by the award. Additionally, the students awards are announced from AMS in their Freshman year but are not presented at the AMS meeting until their Junior year. STC has sponsored the scholarship since 1992.□

FDE (*Continued from page 3*)

Efforts at the 15 Research Drive location did not stop with the welding capabilities. One of the common themes that has been heard through our meetings and visits is the need for composite fabrication. STC, through the NASA EMCHFSS contract, has developed an exceptional modeling and composites skill set. To better leverage that skill set, it was decided to convert the conference room at 15 Research Drive into a small composites shop. Once again, the STC fabrication staff used their skills to help with the remodeling of the conference room. The carpeting was pulled up, the floors cleaned, and the room refit. A layup table with a finished aluminum surface was built, a flammable locker was installed, a compressed air line was put in, a ventilation fan was installed, and a cutting table and fabric rack were built. Additionally, materials and equipment have been purchased, which include fiberglass, carbon fiber, tubing, a freezer, and a vacuum pump. These materials and equipment allow us to perform composite layup and vacuum assisted resin infusion. The new space and equipment, along with STC's personnel and skill set, provides a new capability that we believe has a tremendous growth potential. We believe that the composites and model making space, in conjunction with the existing machine shop, and the electronics and instrumentation capabilities, provides STC with an extremely functional capability and a facility that should prove useful in moving into what we believe is a growth area.

We are excited about the new capabilities and the modifications to our facility. The welding certifications can be used for any opportunity within the company, and STC has qualified welders that are available to support any welding or fabrication need.

If there is any way in which STC's fabrication can add value, please feel free to contact Mr. Jeff Manning (manning@stcnet.com). We believe these fabrication capabilities within STC can be leveraged with our engineering and technical capabilities to potentially respond to opportunities not previously thought about and provide end-to-end support to our customers.□

GRIPS (*Continued from page 1*)

Of course there are other complicating factors such as scattering by clouds and aerosols. The GFCR technique is fairly insensitive to these processes, but GRIPS is designed to make additional measurements of O_2 and N_2O to help correct for aerosol and cloud scattering.

We proposed GRIPS to ride on a Korean geostationary satellite and this would give us prime observing space over Asia where industrial growth and pollution is observed to be very high. The Korean satellite already includes an instrument measuring other pollutants such as ozone, NO_2, aerosols and formaldehyde. GRIPS would compliment these measurements nicely. In the development of GRIPS, STC scientists made two trips to Korea and have developed a number of contacts for future work.□

Security Corner

Geotagging

Most smart phones have GPS capabilities unless they are disabled. If you take a picture using a smart phone and post that picture to a social networking site, anyone can access the altitude, latitude and longitude of where the picture was taken. To prevent this, you can turn off the GPS capability on your smart phone camera application. By disabling this feature, the picture is not tagged with location information, but you can still use other GPS capabilities (such as driving directions).

Quality Corner

Regarding vendor evaluations for vendors on the Approved Supplier List, please remember that evaluations for approved vendors are due annually. Evaluations for vendors conditionally approved are due after 6 months from being conditionally approved. Please submit evaluations to Carol Lightner or AnnaMaria Clack in the STC Corporate office.

STIEP (*Continued from page 2*)

Historically, fasteners and rivets have been preferred to bonded joints; however, bonded joints may have advantages such as:

- Weight saving
- Improved fatigue, damage tolerance, and durability properties
- Uniform distribution of stresses over large areas
- Excellent resistance against corrosion
- High vibration damping
- Attenuation of shock propagations
- Sealing properties
- Special structural design concepts – sandwiches, assembly, laminates

Following the completion of his research, Donato was required to give a number of presentations leading up to the defense of his Master's Thesis. Donato gave a well received presentation at STC's new headquarters office in September 2012, in which over 20 people attended, including the Deputy Director of Langley Research Center, Mr. Steve Jurzyck, his mentor, Dr. Amar Choudry, and other NASA LaRC personnel with whom he worked with. Donato left at the end of September 2012 to make a long awaited visit back home to Italy, before jumping on another plane to fly back to TU Delft to defend his Thesis. All feedback received about Donato, his efforts, and his work were extremely positive, and his research presented new questions. Those questions just might lead to another research opportunity.□