

NIA

THE NATIONAL INSTITUTE OF AEROSPACE

2011 ANNUAL REPORT

Cutting-Edge Research,
Innovative Technology Development
and Extraordinary Education



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Dr. Fuh-Gwo Yuan

NIA Langley Professor
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Center for Smart Structures and Materials

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As we survey our many accomplishments in 2011, the National Institute of Aerospace can reflect with some satisfaction on a very successful year. As you peruse this Annual Report, you will note significant milestones in nearly every aspect of our operations.

You will read about exciting new research in fields as diverse as materials, sensors, energy harvesting, atmospheric science and aviation safety. You will meet Dr. Chuantong Wang, NIA's first R&D 100 Award recipient. You will encounter the latest award-winning invention by the prolific Dr. Tian-Bing Xu. You will be introduced to Professors Edmonson, Fuller and Yuan who have assumed new leadership roles in both research and education at NIA.

You will learn that our Graduate Education program, established just eight years ago, has now produced more than 100 masters and doctoral degrees, and that our students continue to receive awards for the outstanding quality and significance of their research. You will find an expanding network of collaborations with visiting scholars and students from the U.S., Canada and four other continents.

The opening of the NIA Research and Innovation Laboratories in 2012 will give us new capabilities in both research and education.

important support from NASA Headquarters, the Federal Aviation Administration, the Army Research Laboratory and several commercial customers.

Our Board of Directors was further strengthened this year through the creation of three at-large positions to complement the eight positions allocated to NIA's full member institutions. Retired astronaut and ATK vice president Kenneth Reightler, Johns Hopkins University Applied Physics Laboratory director emeritus Dr. Richard Roca, and Bethesda Financial Group co-founder Jeffrey Pirone were elected Directors At-Large in 2011.

Looking forward to 2012, we stand ready to build on the exciting momentum of the year just completed. We remain committed to our Vision, Mission and Values, and we are finding new ways to achieve them. The opening of the NIA Research and Innovation Laboratories in 2012 will give us new capabilities in both research and education. We look forward to partnering with both the City of Hampton and the Commonwealth of Virginia to leverage our research and education programs to support the economic development of the region. And as always, we will pursue all of this in collaboration with our principal stakeholders – NASA Langley Research Center and our member universities.

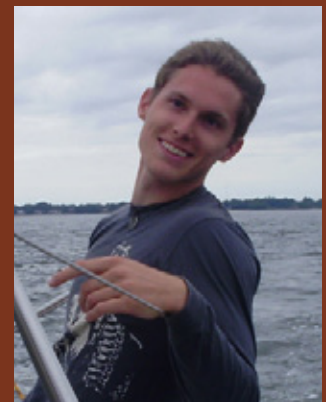
I cannot complete my reflections on 2011 without also noting that tragedy struck NIA this year. In May we lost two of our own – both young men with extraordinary promise. Tyler Lorenzi and Alex Brown lost their lives in a boating accident on the James River. An Associate Research Engineer with NIA, Tyler worked in NASA's Advanced Materials Processing Branch. His friends remember him as endlessly curious. Alex, a University of Maryland Ph.D. candidate in Prof. Hubbard's Morpheus Laboratory, had been selected to receive NIA's Martin Drews Scholarship for 2011. His friends valued his leadership. An NIA Foundation scholarship fund has been established in their memory and in honor of their eight friends who survived the same accident. Alex and Tyler's friends are also planning a memorial to them located next to our new NIA Laboratories.



Dr. Robert E. Lindberg, Jr.

Exploring further, you will discover our numerous Educational Outreach programs that together provide a comprehensive approach to improving the technological literacy of our future workforce. You will also come upon our expanding efforts in Public Outreach, working with partners new and old to successfully engage the public in the excitement of engineering and science. You will see that the NIA Foundation partnered with NASA to co-host national events throughout the year and around the country.

NIA reached new financial heights in 2011 as well. Total revenue, research revenue and donated revenue (cost sharing) all reached record figures. Furthermore, our sources of revenue were more diverse than ever, with



Alex Brown



Tyler Lorenzi

Introduction to Research

NIA's research portfolio continued to expand and diversify during 2011. NIA's research group recorded the highest level of revenues in the history of the Institute. Supporting the work of our strategic partner, NASA Langley Research Center (LaRC), remained a major focus of our efforts. However, our non-NASA research portfolio grew significantly through continued efforts and new awards from the Federal Aviation Administration (FAA), Airbus North America, the National Science Foundation, and the Air Force Office of Scientific Research. Research performed for the Federal Aviation Administration to better understand and model the effects of large aircraft wake vortices and human factors associated with flight deck workload expanded to record levels. Research for Airbus continued in the field of smart airframes and expanded into uncertainty quantification and management in the aircraft design cycle. Construction of our new NIA Research and Innovation Laboratories continued on schedule for completion in February of 2012. Laboratories for laser, acoustics, materials, rapid prototyping, and unmanned aerial vehicle research will be included -- as well as a new business incubator. NIA researchers continued to generate valuable intellectual property and to garner major research awards. Seventeen invention disclosures were generated in 2011, with three patents filed and two new patents received.



Dr. Douglas O. Stanley

The sections below are not meant to provide a comprehensive summary of our 2011 research efforts, but rather to highlight a few key areas and individuals.



Dr. Chuantong Wang

R&D 100 Award

Dr. Chuantong Wang, NIA Research Scientist, has been named as a winner of a 2011 R&D 100 Award for work done in collaboration with researchers at NASA Langley Research Center (LaRC) in developing the "SansEC Temperature Sensor."

Dr. Wang was honored at the R&D 100 Awards Banquet on October 13, 2011, in Orlando, FL along with

co-inventor Bryant D. Taylor, ATK Space Systems, and Principal Investigator, the late Dr. Stanley E. Woodard, Senior Scientist at NASA Langley Research Center.

The R&D 100 Awards, widely recognized as the "Oscars of Innovation" salute the 100 most technologically significant products from around the world introduced into the marketplace over the past year. Winners of the R&D 100 Awards are selected by an independent judging panel and the editors of R&D Magazine.

SansEC (Sans Electric Connection) sensing technology is a new fundamental technical framework of developing inexpensive wireless passive sensors. SansEC sensor, composed of an open-circuit conductive pattern having no electrical connection, is

a general sensing platform that can be applied to applications in many fields. The unique feature of being able to work after damage distinguished the sensor from any previously developed electrical device and makes it suitable for extreme and harsh environments where other sensors would fail. SansEC sensor has demonstrated the capability of many measurements including damage detection, distance measurement, high speed motion measurement (e.g. tire rotation), posture angle, temperature, chemical component detection, liquid level, material properties (conductivity and dielectric), touch/existence, deformation, and strain.

SansEC was originally developed as a method of having thermal insulation serve as a damage detection system for inflatable space structures. The researchers discovered its additional unique qualities as a new foundational technical framework of developing sensors. The simple design with only a few components makes the device easy and inexpensive to produce.

The sensor presents the next generation technology for vehicle tire safety monitoring which has a potentially large global market. By monitoring temperature, damage and rotation, the sensor can significantly improve vehicle tire safety, thereby significantly advancing vehicle safety by improving the detection of tire damage compared to conventional tire pressure monitoring systems.

Energy Harvesting Award

As a result of key research efforts led by Dr. Tian Bing Xu, NIA Senior Research Scientist, NIA was awarded top honors for making the most significant technical achievement in energy harvesting over the past 18 months. The recognition was announced during a special awards ceremony on November 15, at the Energy Harvesting & Storage USA 2011 conference in Boston, Massachusetts. Other project team members include Mia Siochi and Ji Su of the NASA Langley Research Center; Professor Xiaoning Jiang at North Carolina State University; Professor Lei Zuo and his student, Wanlu Zhou, at Stony Brook University; and Drs. Paul Rehrig and Wes Hackenberger at TRS Technologies.

Progress by the research team on a device called the HYPEHT, which stands for "hybrid piezoelectric energy harvesting transducer," was cited as the basis for the award of "Best Technical Development of an Energy Harvesting Device" to NIA during the ceremony.



Dr. Tian Bing Xu

HYPEHT was developed with support from NASA Langley Research Center's "Designer Extreme Materials Revolutionary Technical Challenge." The device uses a unique approach to couple more mechanical energy, produce more electrical charge, and yield greatly enhanced energy conversion efficiency compared to other methods. For instance, the HYPEHT yields 19 times more electrical energy output than an equivalent "31"-mode flexensional transducer and 100 to 1000 times more than an analogous bimorph or sandwich piezoelectric beam. The HYPEHT also achieves 26% mechanical to electrical energy conversion efficiency - five times greater than that of the state-of-the-art piezoelectric transducers.

In addition, this team has also invented other types of advanced piezoelectric energy harvesters, which can harvest electrical power on the order of watts with overall weight less than 50 grams. Simultaneously, they have addressed several critical theoretical and practical issues, such as generating electrical energy in piezoelectric structures, optimized energy delivery ratio from piezoelectric structures to electrical loads, and energy transportation and storage from piezoelectric structures to a super-capacitor for energy harvesting.

Advanced Materials Research

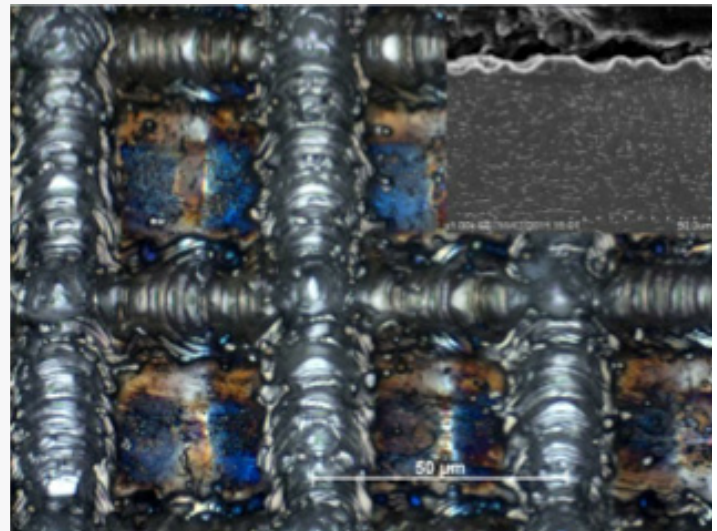
Biomedical Materials/Magnetic Nanoparticles for Diagnostic Imaging, Targeted Drug Delivery, and Cancer Therapy

Dr. Sang Hyon Chu, NIA Senior Research Scientist is conducting research to develop multifunctional magnetic nanoparticles for biomedical applications including enhanced MRI imaging, targeted drug delivery, and hyperthermia to kill cancer cells. A new nano-coating technology developed at NASA Langley Research Center enables polymeric coating of the magnetic core. The polyimide-based nanocoat provides biocompatibility, protection, and structural/ chemical/mechanical stability.

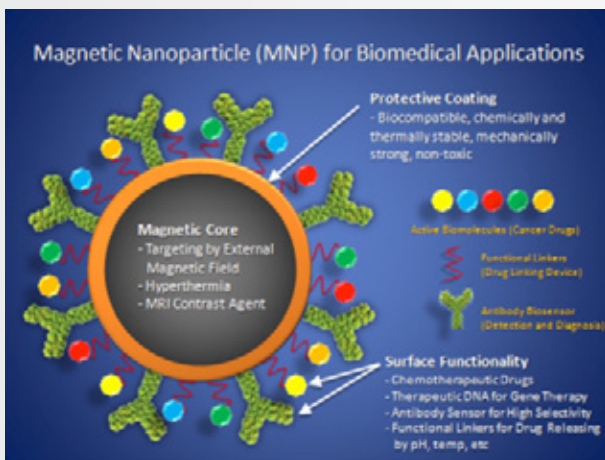
The new multifunctional magnetic nanoparticles hold the potential for a breakthrough in non-invasive nanomedicine area and benefit NASA's

long-duration space missions by serving remote diagnostics and delivery of appropriate therapy to astronauts under health risks caused by space radiations and microgravity environment.

Surface Treatments for Adhesive Bonding

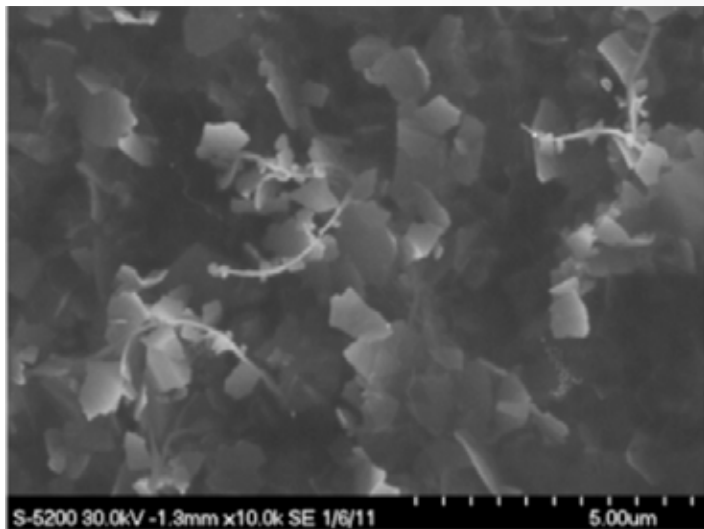


NIA Research Engineer, Dr. Franklin Palmieri, is conducting research involving laser ablation of both titanium alloys and carbon fiber reinforced plastics as a means of creating topographical and chemical changes to a surface which can lead to increased bond durability. A laser ablation based surface preparation would provide an alternative to chemical-dip, manual abrasion and grit blast treatments which are expensive, hazardous, polluting and less precise. Adhesive bonding offers many advantages over mechanical fastening, but requires certification before it can be incorporated in primary structures for



commercial aviation without disbond-arrestment features or redundant load paths. Surface preparation is widely recognized as the key step to producing robust and predictable bonds needed for certification.

Carbon Nanotubes (CNTs) and Graphene



CNT-Graphene Hybrid Composites: CNTs and graphene are both nanoscale carbon allotropes with high surface area, high mechanical strength, and excellent electrical and thermal properties. The combined use of both of them as nanoinclusions in composites may help in the design of tailored functions for specific demands. In the second year of our NSF-funded research, NIA Research Fellow, Dr. Cheol Park developed a series of hybrid nanocomposite systems to understand the roles of various nanoinclusions, including single-walled CNTs (SWCNTs), graphene oxide (GO), boron nitride nanotubes (BNNTs), boron nanoparticles (BNP), and their combinations. The characteristics of each inclusion will be exploited by combining together to create synergistic functions that are not achievable with a single inclusion. The image above is a high resolution scanning electron micrograph of a well dispersed reduced GO/SWCNT/polymer composite. Currently, a new laser ablation system for the synthesis of CNTs has been installed.

Nanomaterials-Based Superstrong Structures: The goal of this research being conducted by Dr. Jae Woo Kim, NIA Senior Research Scientist, is to develop multifunctional structural materials to enable super lightweight nanomaterials based structures. This includes nanomaterials fabrication/processing and characterization tool development to support the Nanomaterials Based Multifunctional Superstructures project being funded under NASA's Nanotechnology program. Nanomaterials to be investigated include, but are not limited to, various forms of nanostructures such as CNTs and graphene sheets. Utilizing the full mechanical capabilities of individual nanotubes is a primary research goal in nanotube reinforced nanocomposite materials. Most studies on structural applications of nanomaterials such as CNTs have focused on attempts to improve dispersion in structural matrices to achieve or exceed the performance of state-of-the-art carbon fiber reinforced polymer composites, the aerospace structural material of choice. However, there has been little success since CNTs have not been demonstrated with load carrying capacity superior to carbon fibers due to poor inter-tube load transfer and physical defects created during processing and fabrication. Therefore, a more practical use of these nanomaterials requires creating stable and strong linkages between nanotubes without sacrificing their mechanical advantage. Currently,

cross-linking between shells and amorphous carbon binding between tubes via electron beam irradiation have been studied and offer a viable approach to improve tube-to-tube load transfer and hence, mechanical properties.

Metal-Carbon Nanohybrids: Dr. Yi Lin, NIA Senior Research Scientist, is investigating Metal-carbon nanohybrids (i.e., metal or metal oxide nanoparticle-decorated CNTs or graphene) which can offer synergistic properties of nanocarbon substrates and the deposited nanoparticles that are not available for each component alone. In our recent effort published in *ACS Applied Materials and Interfaces* (2011, 3, 1652-1654; doi: 10.1021/am200209e), microwave technology was used to prepare metal or metal oxide-carbon nanohybrids materials in a quick flash without the use of any solvent. Nanoparticles of noble metals (e.g. silver, gold, platinum, palladium) and transition metal oxides (iron oxide, titanium dioxide, zinc oxide) were deposited on CNT and graphene surfaces [and non-carbon substrates such as hexagonal boron nitride (h-BN)] to form nanohybrids. CNT yarns, a commercially available CNT superstructure made from as-grown nanotubes, were also used and the substrate to support nanoparticles. The rapid (completion with seconds), scalable (no limit), and solventless (friendly to both industrial processing and environment) nature of the method may allow the convenient preparation of a large sample library of varying compositions in screening for targeted uses. This may further lead to potential applications such as multifunctional composites for aerospace explorations, organic and fuel cell catalysis, energy storage for supercapacitors and batteries, and sensing of trace gaseous molecules or organic/biological analytes.

Atmospheric Sciences Research

Studies of Scavenging and Transport Processes Using the Global Modeling Initiative Chemistry Transport Model

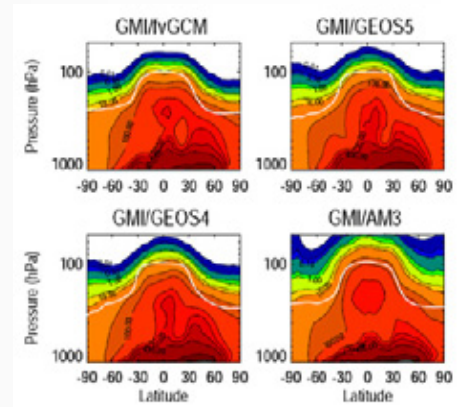
NIA Associate Research Fellow, Dr. Hongyu Liu, uses 3-D chemistry and transport models to characterize the distributions and evolution of chemically and radiatively important trace gases and aerosols in the troposphere and to understand how complex interactions between chemistry and dynamics determine these distributions.

Dr. Liu is a science team member of the Global Modeling Initiative (GMI), a NASA-led activity to develop state-of-the-art modeling tools for the purpose of quantifying and reducing uncertainties in global atmospheric model results. In support of GMI, he assessed with the GMI modeling framework the utility of cosmogenic beryllium-7, a natural aerosol tracer, for evaluating cross-tropopause transport in global models. The study concluded that the observational constraints from beryllium-7 can be used routinely for a first-order assessment of this transport process in global models.

Dr. Liu and his colleagues have incorporated the meteorological fields from the NOAA's new climate model AM3 into the GMI with an aim to improve our understanding of uncertainties in model predictions due to the use of different input meteorological fields. The GMI/AM3 simulations of ozone have been evaluated with ozonesonde and satellite observations.

Using the other NASA-supported model (GEOS-Chem), Dr. Liu and his colleagues examined the characteristics of spatial distribution and variability and quantified the sources of springtime tropospheric ozone in South Asia, as constrained by ozonesonde observations. The results suggested that the model underestimated the contribution of lightning nitrogen oxides emissions and stratosphere-troposphere exchange to tropospheric ozone in the region.

Dr. Liu's research also includes studying transport and wet scavenging of soluble species in NASA's GEOS chemistry-climate model, the impact of convection and lightning on ozone in the upper troposphere over the continental United States, and the effects of aerosols and clouds on global tropospheric chemistry.



Annual zonal mean ²²²Rn concentrations as simulated by GMI model driven by the fvGCM, GEOS-4, GEOS-5, and AM₃ meteorological fields. White lines indicate thermal tropopause

Researcher Awards

Several NIA researchers were recipients of NASA Langley's prestigious Henry J.E. Reid Award for Best Paper in 2011. Dr. Kenneth Sutton, Senior Fellow, won 1st prize for his paper "Non-Boltzmann Modeling for Air Shock-Layer Radiation at Lunar-Return Conditions" that was published in the *Journal of Spacecraft and Rockets*. Drs. Yi Lin, Kent A. Watson, and Sayata Ghose won 3rd place for their paper "Rapid, Solventless, Bulk Preparation of Metal Nanoparticle-Decorated Carbon Nanotubes," published in *ACS Nano*.

Feedbacks from Biomass Burning to Air Quality and the Climate System

NIA Senior Research Scientist, Dr. Amber Soja, uses NASA satellite data and science to explore the interactive relationships between the biosphere, biomass burning (BB) and the climate system. Under the control of climate and weather, fire is the driving force of vegetation change that forces ecosystems to move more quickly towards a new equilibrium with the climate system. It is predicted that fire regimes (severity, burned area, fire season length) will increase as climate warms, particularly in the Northern Hemisphere.

The team is involved in several interrelated research projects under the NASA Inter-Disciplinary (IDS), Decisions Support Systems (DSS), Land Cover Land Use Change (LCLUC) and Terrestrial Ecology (TE) programs to use satellite data and models to estimate current and future direct fire emissions and to explore where our estimates and understanding may be deficient. The DSS program is attempting to enhance burned area estimates in agricultural and rangelands to support the National Emissions Inventory (NEI) and to use Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) data to expand understanding of the height to which smoke plumes are injected in the atmosphere, which ultimately affects their transport.

The team is in the process of quantifying the large- and small-scale regional, and potentially global, effects of fire-related emissions and ecosystem change in Northern Eurasia under future climate change scenarios. The meteorological conditions that precede severe fire events show perturbations in temperature, precipitation, humidity and winds. Changes in cloudiness, temperature and humidity lead to perturbations in the surface energy fluxes including the radiative flux budgets. Additionally, large biomass burning events lead to large but temporary changes in the aerosol amounts and sudden changes in land cover, first from burn scars and then vegetative successional processes.



Specifically, the team seeks to improve the understanding of current feedbacks by producing novel BB emissions that are explicitly linked to fire weather and ecosystem-specific fuels; use these emissions in Goddard Chemistry Aerosol Radiation and Transport (GOCART) and Weather Research and Forecasting (WRF-Chem) chemical transport models and compare their results with solar radiation budget data and other coincident satellite and field data. The team will then use GOCART and WRF-Chem to examine the affect of future changes in LCLUC and biomass burning on the quantity and distribution of atmospheric gases and aerosols, patterns of precipitation, cloud cover and the radiation balance.

Airborne In-situ CO₂ Measurement and Analysis of Field Campaign Data

Dr. Yonghoon Choi, NIA Research Scientist is conducting research to provide fast response (1 Hz), high precision (< 0.01 ppm) and high accuracy (< 0.25 ppm), in-situ CO₂ measurements aboard NASA aircraft such as the DC-8, P3-B and other research aircraft (UC-12B at NASA Langley Research Center) to support the DISCOVER-AQ (Deriving Information on Surface Conditions from Column and VERTically Resolved Observations Relevant to Air Quality) and ASCENDS (Active Sensing of CO₂ Emissions over Nights, Days, and Seasons) NASA field campaigns. The key objective is to elucidate spatial distributions of radiatively active greenhouse gases of atmospheric CO₂, and to develop, calibrate and validate remote CO₂ sensors from analyses of resulting data sets. Airborne observations of this notable greenhouse gas is essential for progress in understanding climate forcing, changes in atmospheric composition, and for improving the predictive capability of the climate system's future evolution through global and carbon cycle models. This research will provide valuable information for the understanding of global warming by explaining the spatial and temporal distribution of carbon dioxide gas in the Earth's atmosphere.

The AVOCET (Atmospheric Vertical Observation of CO₂ in the Earth's Troposphere) in-situ CO₂ measurement system conducted the successful flights for the DISCOVER-AQ field mission over the Washington DC and Baltimore areas to monitor the air quality and to enable more effective use of current and future satellites to diagnose ground level conditions influencing air quality. ASCENDS field missions were performed during between April and August of 2011. In-situ CO₂ instrument (AVOCET) missions were conducted on science flights in Virginia, over the Central Valley of California, the Pacific Ocean, the Railroad Valley of Nevada, British Columbia, the Four Corners region, Iowa and Wisconsin with the NASA Langley, NASA Goddard, and NASA JPL remote sensing teams to validate the performance of laser instrument.

NextGen Human Factors and Wake Vortex Research for FAA

The relationship between NIA and the FAA has continued to develop and is currently an integral part of NIA's research success. In FY09 NIA signed a three year agreement with the FAA to conduct leading-edge human factors research to support the FAA's prime initiative, NextGen. NextGen addresses aviation challenges of the future and defines new paradigms that will require the full use of existing and new technologies, especially with regards to human factors. Under this agreement, NIA has performed research tasks related to flight and ground operations; aircrew, controllers and maintenance personnel and their environments; equipment; training; safety; and standards. Additionally, a follow-on five year task is forecast to enable NIA to continue leading an established team of cutting-edge companies and subject matter experts (SMEs) who are highly skilled professionals in the fields of commercial, corporate, and general aviation. NIA also maintains the advantage of associations that include many offices of the FAA. This cadre of expertise enables the necessary research of changes in roles and responsibilities between pilots and controllers, as well as the allocation of functions between humans and automation. Under these tasks, NIA is providing essential research, studies, and solutions to help the FAA meet the developing requirements of NextGen and the fundamental changes that will have profound effects in the cockpit and Air Traffic Control Centers while benefiting the customers and stakeholders. In addition, NIA has had an agreement in place with the FAA since August 2008 to perform Wake Vortex Encounter research which extends over the course of five years and has successfully completed its third program year. The research is focused on the characterization of wake physics, wake turbulence impacts on the National Airspace System, assessment of wake turbulence impacts on aircraft, and support for national and global wake mitigation activities. As the FAA deploys NextGen, explores wake vortex concerns, and requires the innovative research of emerging issues, NIA is solidly positioned to assist the FAA in exceeding its future goals.

Langley Distinguished Professor

Professor William Edmonson – North Carolina A&T

Professor Edmonson recently completed his first full year as North Carolina A&T State University Langley Professor. He joined the Electrical & Computer Engineering Department in August of 2010. At NCA&T, he is Co-Director of the NSF Industry/University Collaborative Research Center titled, "Advanced Space Technologies Research & Engineering Center – ASTREC." This Center's research focus is to provide leading-edge research that is industry-driven to produce integrated, concurrent small satellite design including technology development, fabrication, verification, validation and technology transfer.

This year, Professor Edmonson founded the Center for Reliable Autonomic Small Satellite Systems at NIA. This Center's role is to perform research to increase the reliability of small satellites in the pico/nano/micro-class through the use of formal methods in the design stage of the life-cycle. In addition, research will be performed to develop a heterogeneous suite of this class of satellites that will have the ability to operate autonomously while being able to self heal, optimize and reconfigure. The objective is to enable deep-space missions with little to no human interaction. Additional benefits include providing cost effective access to space due to the small volume and mass, thus allowing many universities to develop, build, and launch this class of satellites as part of their aerospace program and stimulates student recruitment to STEM.



Prof. William Edmonson

Researcher Awards

A paper by Dr. Amber Soja, Senior Research Scientist, titled "Climate-Induced Boreal Forest Change: Predictions Versus Current Observations", *Global and Planetary Change*, 56 (2007): 274-296) was cited as one of the "Top-50 most cited articles" published in *Global and Planetary Change* January 2006 - February 2011. In fact, it was the most cited paper for this time period. Dr. Soja was presented the award in April 2011 at the 2011 European Geosciences Union General Assembly meeting in Vienna.

Professor Chris Fuller – Virginia Tech

Professor Chris Fuller is the new Virginia Tech Langley Professor at the National Institute of Aerospace. He began the Langley Professor position in the first quarter of 2011 after moving from Virginia Tech in Blacksburg, VA where he was the Roanoke Electric Steel Professor of Engineering and Director of the Vibration and Acoustics Laboratories. His research interests are in acoustics, vibration, active noise control, advanced composite materials for noise reduction and beam forming techniques. Recently he has begun working in energy harvesting and multi-functional materials as well as medical applications of acoustics in conjunction with the Eastern Virginia Medical School (EVMS). He holds a secondary appointment as a Professor of Basic Science at the VT Carilion Medical School in Roanoke, Virginia.

Prof. Fuller's overall research goals at NIA are to:

- (1) Develop an internationally known program in acoustics and vibration which supports NASA Langley Research Center and the commercial aviation industry;
- (2) Continue with his research in acoustics and vibration aerospace applications;
- (3) Develop new research in acoustic meta materials, wind turbine noise and medical applications of acoustics;
- (4) Develop a program of research in medical applications of acoustic in conjunction with EVMS;
- (5) Develop a strong education-based program in acoustics and vibration;
- (6) Expand significantly the number of students and Research Scientists that work at NIA in these areas; and
- (7) Form and implement an advanced laboratory in acoustics and vibration at NIA.



Prof. Chris Fuller

Professor Fuh-Gwo Yuan – North Carolina State

Professor Fuh-Gwo Yuan of North Carolina State is the newest Langley Professor – having joined NIA in October of 2011. He has established a Center for Smart Structures and Materials at NIA that will perform research in the fields of embedded sensors, structural health monitoring, damage tolerance of composite structures, and fracture and life prediction of advanced materials and structures. Professor Yuan will continue developing wireless sensors that monitor structural integrity and methods for in-situ mounted sensors for multi-functional composite structures. He will also pursue his research interest in the field of bio-inspired morphing technologies for civil, mechanical, and aerospace structures.

Prior to joining NIA, Professor Yuan served as a Professor of Mechanical and Aerospace Engineering at NC State since 1989. While at NC State he served as the Director of the Mars Mission Research Center. He has also been selected to serve as the Professor Erwin Schrodinger Visiting Fellow at Magdalen College at the University of Oxford, England. He has also served as a Distinguished Visiting Professor at SouthEast University, Huazhong University, and Nanjing University in China.



Prof. Fuh-Gwo Yuan

NIA Research and Innovation Laboratories



2011 represented a significant year of progress on NIA's new Research and Innovation Laboratories, located across the street from the current Headquarters at 1100 Exploration Way in Hampton, VA. NIA anticipates that the facility will be completed in February 2012. The first floor will be dedicated to laboratory research facilities, and the third floor is planned to house a small business high-tech incubator, as well as a computer lab and offices for the Virginia Tech College of Engineering.

Current labs that have been identified for the new building include: the Morpheus Unmanned Aerial Vehicle Lab (Dr. Hubbard, University of

Maryland); the Laser and Sensors Lab (Dr. Gupta, University of Virginia); the Laser and Plasma Technologies Lab (Dr. Gupta, LPT LLC); a Boron Nitride Nanotube (BNNT) Lab (Dr. Park, NIA); the Bruel & Kjaer Vibration and Acoustics Lab (Dr. Fuller, Virginia Tech), the Rapid Prototyping Lab (NIA), the Tao Systems Embedded Sensors Lab (Tao Systems), and the Space Systems Computer-Aided Design Lab (Dr. Wilhite, Georgia Tech and Dr. Edmonson, North Carolina A&T). There are also plans to install a low-speed wind tunnel research facility and a low-Reynolds-number water tunnel research facility.

Researcher Awards

Dr. Natasha Neogi, Senior Research Engineer, is the recipient of the 2012 Robert A. Mitcheltree Young Engineer of the Year award given by the Hampton Roads Section of the American Institute of Aeronautics and Astronautics. The citation for Dr. Neogi reads in part "...for her key contributions in leading a major effort to accelerate research in near-term to long-term aviation problems under the emerging area called Cyber-Physical Systems"

Atmospheric Science

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Researcher Awards

Dr. Sayata Ghose, Senior Research Scientist, received the 2011 Society of Manufacturing Engineers (SME) Outstanding Young Manufacturing Engineer (OYME) Award. Since 1980, the OYME award has honored innovators age 35 and younger in both academia and industry for exceptional accomplishments, such as technical publications, patents, or technical-professional leadership. This award was presented during a ceremony at SME's annual conference in June 2011 in Seattle.



Visitors@NIA

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Visiting Scholars:

Michael Arntzen

NLR, The Netherlands; Aircraft Noise Simulation

William Atwell

Boeing; Durability, Damage Tolerance & Reliability

Mauricio Ayala-Rincon

University of Brasilia, Brazil; Spacecraft Autonomy for In-Space Operations

Geoff Brian

Defence Science and Technology Organization, Australia; Aircraft Modeling

Hector Cadavid-Rengifo

Colombia School of Engineering; Space Autonomy for In-Space Operations

Pedro Camanho

University of Porto, Portugal; Improved Failure Criteria and Material Degradation Models for Composite Laminates

Alessandro Carrella

University of Bristol, UK; Frequency Response Functions

Nestor Catano

University of Madeira, Portugal; Formal Methods

Jerzy Floryan

University of Western Ontario, Canada; Effect of Surface Corrugations on Viscous Drag

Marco Gherlone

Politecnico di Torino, Italy; Structural Health Monitoring using Inverse Finite Element Method, Structural Analysis of Multilayered Composite and Sandwich Plates

Craig Johansen

Queen's University, Canada; Development of Laser Vased Measurement Techniques for Hypersonic Flows

Jernan Juang

National Cheng Kung University, Taiwan; System Identification of Spinning Membranes

Elena Kukavskaya

Russian Academy of Sciences; Siberian Biomass Burning Emissions Estimates

Matthew Lythgoe

Newport News Public Schools; Aeroelastic Rotor Experimental System Data Acquisition System Development

Junhong Park

Hanyang University, South Korea; Finite Element Model Based Designs for Aircraft Sidewall Noise Reduction

Martin Rinker

Fraunhofer Institute, Germany; Debond Growth in Composite Sandwich Aircraft Structures

David Spencer

Georgia Tech; Tracing of Chemical Distributions in the Coastal Oceans Utilizing Collaborative Observations from Remote Sensing and In-Site Assets

Marco Straubel

DLR, Germany; Analysis and Assessment of Lightweight Space Structure Concepts

Albert Turon

Universitat of Gerona, Spain; Composite Structures

Alfonso Valenzuela

University of Seville, Spain; Separation Assurance

Frans van der Meer

Delft University of Technology, The Netherlands; Computational Modeling of Failure in Composite Laminates

Gerhard Venter

Stellenbosch University, South Africa; Reliability Based Design

Paul Weaver

University of Bristol, UK; Analysis Methods for Buckling-Design of Anisotropic Plates and Shells

Visiting Students:

Marco Cordini

University Politecnica of Valencia, Spain; Spacecraft Autonomy for In-Space Operations

Kshitija Deshpande

Virginia Tech; Antarctic Dual Frequency GPS Receivers

Jordan Handler

University of Michigan; Composite Structures and Materials

Chung-han Hung

National Cheng Kung University, Taiwan; Structural Dynamics and Control

Pankaj Joshi

Virginia Tech; Multi Objective Design Optimization

Cyrus Kosztowny

University of Michigan; Composite Structures and Materials

Benedik Kriegesmann

Leibniz University, Hannover, Germany; Buckling Processes of Cylindrical Shells under Axial Loading

Xiaomei Lu

Beihang University, China; Building Climate Record using CALIPSO Data

Sz-Chin Lin

Penn State; Tunable Band Gap Technologies

Luis Lopez Pons

University Politecnica of Valencia, Spain; Spacecraft Autonomy for In-Space Operations

Joseph Macon

Virginia Tech; Antarctic Ground Magnetic Data and Interhemispheric Electrodynamics

Alexander Meuer

Leibniz University, Hannover, Germany; Buckling Processes of Cylindrical Shells under Axial Loading

Maria Elisa Palena

Politecnico di Torino, Italy; Static and Dynamic Test on Sandwich Panels

Paolo Peraudo

Virginia Tech; Aerodynamics of Truss-braced Wing Aircraft

Camilo Rocha-Nino

University of Illinois – Urbana-Champaign; Software Verification Algorithms

Laura Tolliver

North Carolina State; Finite Element Modeling

Daniel Versino

Politecnico di Torino, Italy; Refined Zigzag Theory based Structural Analysis

Nis Wegmann

University of Copenhagen, Denmark; Health Systems Monitoring

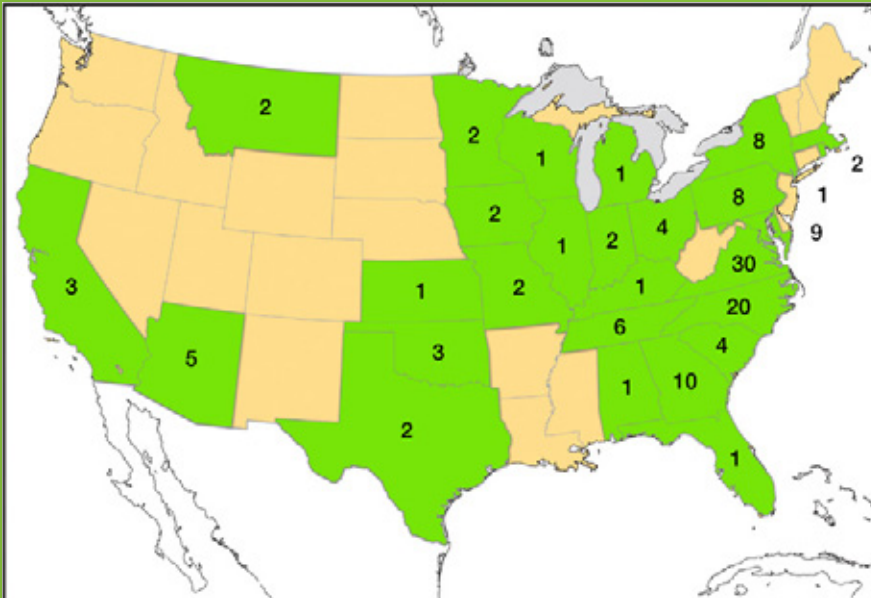
Takashi Yanase

University of Tokyo, Japan; Fabrication and Physical Properties of Organic Tricolor Superlattice

In 2011, NIA continued our robust graduate program, with 55 full-time graduate students in spring semester and 44 full-time graduate students in the fall semester. Of the 44 students in the fall semester, 57% were Ph.D. candidates and 18% were female. In addition to the full-time graduate students, NIA had 36 part-time graduate students in the program. In terms of graduates, 2011 was a milestone year, surpassing 100 graduates in our program since the first graduate in December 2004. By year end, the total had reached 105 degrees awarded, with 28 Ph.D.s and 77 Masters degrees.

In the Spring Semester 2011, Langley Professor James Hubbard taught a new course on Emerging Technology in Aerospace, which looked 30 years and more into the future and included guest lecturers from Langley Research Center comprised of key researchers and administrators. The follow on course on Mars Aerial-Exploration is set for Spring 2012.

NIA students have been recruited from...



United States

- Alabama 1
- Arizona 5
- California 3
- Florida 1
- Georgia 10
- Iowa 2
- Illinois 1
- Indiana 2
- Kentucky 1
- Massachusetts 2
- Maryland 9
- Michigan 1
- Minnesota 2
- Montana 2
- North Carolina 20
- New York 8
- Ohio 4
- Oklahoma 3
- Pennsylvania 8
- Puerto Rico 1

International

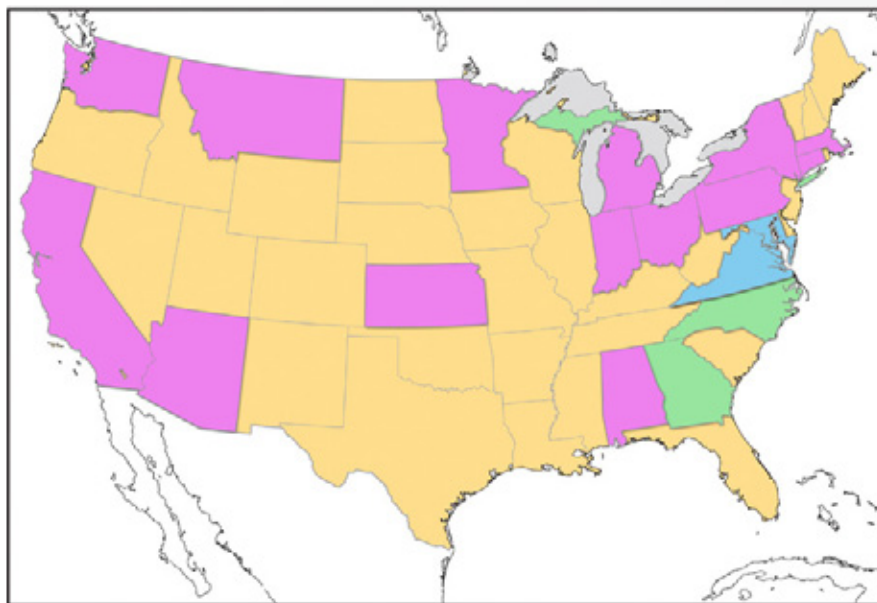
- Austria 1
- China 5
- India 1
- Israel 1
- Korea 1
- Morocco 1
- Taiwan 1
- United Kingdom 1



Martin L. Drews Scholarship

The 2011 Martin L. Drews Scholarship has been awarded posthumously to Alex Brown, who was a University of Maryland Ph.D. candidate studying at the National Institute of Aerospace.

Geographic diversity of NIA graduates



Graduates have been employed by...

Government

NASA Langley Research Center

Hampton, VA

NASA Goddard Space Flight Center

Greenbelt, MD

Air Force Research Laboratory

Dayton, OH

Army Research Laboratory

Hampton, VA

Army Research, Development and Engineering Command

Fort Eustis, VA

Naval Research Laboratory

Washington, DC

Industry and Non-profits

Applied Biomathematics

Seatauket, NY

Knolls Atomic Power

Laboratories

Saratoga Springs, NY

Bettis Atomic Labs

Pittsburgh, PA

Charles Stark Draper

Laboratory

Cambridge, MA

Boeing

Renton, WA and Mesa, AZ

Orbital Sciences Corp

Dulles, VA

Raytheon Missile Systems

Tucson, AZ

The Aerospace Corporation

El Segundo, CA

Johns Hopkins Univ /

Applied Physics Lab

Laurel, MD

General Electric Aircraft

Engines

Evendale, OH

National Institute of

Aerospace

Hampton, VA

a.i. solutions

Lanham, MD

Integrity Applications, Inc.

Chantilly, VA

Analytic Mechanics

Associates

Hampton, VA

Cessna

Wichita, KS

Dynamic Concepts

Huntsville, AL

United Technologies

Research Corp

East Hartford, CT

Exxon Mobil Research and

Engineering

Fairfax, VA

Applied Materials Inc.

Santa Clara, CA

NIA graduates have continued their studies at...

Member and Non-member Universities

National Institute of Aerospace

Columbia University

Georgia Tech

North Carolina State Univ.

University of Maryland

University of Massachusetts

University of Michigan

University of Virginia



Alston



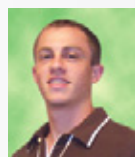
Arney



Billingsley



Busnardo



Cimet



Covington



Doane



Faierson



Gibbons

Christie Alston

Old Dominion University, September 2011

M.S., Aerospace Engineering, Dr. Robert Ash

Present Employer: The Boeing Company

Jennifer Arney

University of Virginia, August 2011

M.S., Mechanical Engineering,

Dr. Robert Lindberg

Present Employer: Northrop Grumman, Virginia

David Barnes

University of Virginia, August 2011

M.S., Materials Science and Engineering

Present Position: Pursuing Ph.D. at the University of Virginia

David Billingsley

University of Maryland, June 2011

M.S., Aerospace Engineering, Dr. James Hubbard

Thesis Title: "The Design, Fabrication, and Flight Testing of an Academic Research Platform for High Resolution Terrain Imaging"

Present Employer: AAI Corp., Maryland

David Busnardo

North Carolina State University, May 2011

M.S., Aerospace Engineering, Dr. Robert Tolson

Thesis Title: "LIDAR-Aided Insterial Navigation over Rough Terrain"

Charles Cimet

North Carolina State University, December 2011

M.S., Mechanical and Aerospace Engineering, Dr.

Robert Tolson

Thesis Title: "The Effect of Atmospheric Uncertainty on Mars Entry, Descent, and Landing"

Present Employer: MIT Lincoln Laboratory, Massachusetts

David Covington

Old Dominion University, September 2011

M.S., Aerospace Engineering, Dr. Colin Britcher

Stargel Doane

Old Dominion University, August 2011

Ph.D., Aerospace Engineering, Dr. Drew Landman

Eric Faierson

University/Date: Virginia Tech, August 2011

Ph.D., Materials Science and Engineering,

Dr. Kathryn Logan

Dissertation Title: "Structure-Property Relationships of Tantalum Carbide Foams and Synthesis of an Interpenetrating Phase Composite"

NASA Mentor: Dr. Roger Lepsch

Present Employer: Quad Cities Manufacturing Laboratory, Illinois

Luke Gibbons

Virginia Tech, September 2011

Ph.D., Materials Science and Engineering,

Dr. Don Leo

NASA Mentor: Dr. Peter Lilihei

Present Employer: NIA Consultant, Virginia



Grauer

Jared Grauer

University of Maryland, June 2011
Ph.D., Aerospace Engineering, Dr. James Hubbard
Dissertation Title: "Modeling of Ornithopter Flight Dynamics for Feedback Control"
NASA Mentor: Dr. Eugene Morelli
Present Employer: NASA, LaRC, Virginia



Kupcella

Eric Greenwood

University of Maryland, May 2011
Ph.D., Aerospace Engineering, Dr. James Hubbard
NASA Mentor: Dr. Mike Marcolini
Present Employer: NASA LaRC, Virginia

Ryan Kupchella

North Carolina State University, August 2011
M.S., MAE, Dr. Paul Cooper
Thesis Title: "Modeling the Evolution of Mesoscale Morphology in C/Sic Ceramic Matrix Composites"
NASA Mentor: Dr. Kim Bey
Present Employer: Corvid Technologies, North Carolina



McQuigg

Thomas McQuigg

Virginia Tech, December 2011
Ph.D., AOE, Dr. Rakesh Kapania
NASA Mentor: Dr. Stephen Scotti/Dr. Sandra P. Walker
Present Employer: Orbital Sciences Corp., Virginia

Daniel Nelson

Virginia Tech, December 2011
M.S., Aerospace and Ocean Engineering, Dr. Bernard Grossman
Present Employer: USAF

Dennis O'Connell

Old Dominion University, May 2011
M.S., Aerospace Engineering, Dr. Jerry Creedon

Jesse Quinlin

Georgia Tech, August 2011
M.S., Aerospace Engineering, Dr. Alan Wilhite
Thesis Title: "A Preliminary Systems-Level Analysis of Candidate Active Space Debris Removal Architectures"
Present Position: Pursuing Ph.D. through NIA at the University of Virginia



Spells

Courtney Spells

Georgia Tech, August 2011
M.S., Aerospace Engineering, Dr. Alan Wilhite
Present Employer: Jacobs Engineering, Virginia

Casey Ray Thomas

North Carolina State University, May 2011
M.S., Mechanical and Aerospace Engineering, Dr. Robert Tolson

Rick Wilder

Virginia Tech, May 2011
Ph.D., Electrical Engineering, Dr. Bob Clauer
Dissertation Title: "The Nonlinear Electrodynamic Coupling between the Solar Wind, Magnetosphere, and Ionosphere"
Present Employer: Astra, LLC, Colorado



Thomas



Wilder

NIA Graduate Student Brett Bathel was awarded the Best Paper in Aerodynamic Measurement Technology for 2010, presented at AIAA Aerospace Sciences Meeting, January 2011

He was cited for his research paper, "Multiple Velocity Profile Measurements in Hypersonic Flows Using Sequentially-Imaged Fluorescence Tagging" coauthored with his NASA mentor, Dr. Paul Danehy of the Advanced Sensing and Optical Measurements Branch and his advisor, Prof. Chris Goyne, of the Mechanical and Aerospace Engineering Department at the University of Virginia.

NIA Graduate Student Thomas McQuigg won the 2011 Paul E. Torgersen Award for outstanding Ph.D. Dissertation Research in the College of Engineering at Virginia Tech.

His dissertation is entitled: "Compression After Impact Experiments and Analysis on Honeycomb Core Sandwich Panels with Thin Facesheets."

His advisor is Prof. Rakesh Kapania of the Aerospace and Ocean Engineering Department and his NASA mentors are Sandra Walker and Steve Scotti of the Structural Mechanics & Concepts Branch.

To stimulate and sustain the development of a workforce prepared to work in Science, Technology, Engineering and Math (STEM) disciplines, NIA designs and implements a multifaceted educational and public outreach program that serves the general public, students, educators and the professional STEM community.

Educator Programs and Classroom Resources

NIA offers best in class, leading edge pre-service and in-service teacher workshops/experiences.

NIA offers best-in-class, leading edge pre-service and in-service teacher workshops/experiences. These efforts, developed and led by NIA's award winning team of Educators in Residence (EIR), Program Managers and Producers deliver a pioneering approach to STEM education.

Based on the Principles of 21st Century e-Teaching and 21st Century Skills as identified by the Partnership for 21st Century Skills, our EIRs train teachers across the country to effectively apply and integrate instructional technology and STEM content into the classroom within core academic subjects.



NASA Pre-Service Teacher Institute participant. Photo by Eileen Darland.

NASA Pre-Service Teacher Institute

The 2011 PSTI accepted 29 university students preparing for a career in teaching. Participants were provided with the skills and strategies to develop and implement integrative standards-based science, technology, engineering, and mathematics (STEM) curriculum through press release science. Authentic learning experiences within the context of new STEM discoveries were modeled for the students and a sustainable collaborative network was established to provide continued support.

All materials, resources, speakers, and pedagogy introduced throughout the Institute were carefully orchestrated to help students apply what they have learned through inquiry-based and design-based challenges.

Space Math@NASA

NIA collaborates with Dr. Sten Odenwald, the creator of SpaceMath@NASA, to align NASA eClips™ video segments and educational resources with SpaceMath@NASA problems. This work organizes the two NASA resources into a STEM educational product for middle and high school teachers that supports real world, relevant constructivist learning. New alignments are posted monthly to both the NASA eClips™ and SpaceMath@NASA websites. NIA Educators in Residence are currently working with Dr. Odenwald in the creation of a pre-algebra/Earth science resource.

NIA develops and implements best practice workshops and presentations using the paired educational resources developed within this partnership. Presentations in FY11 included NCTM regional, and NSTA and ISTE national conferences.

Virginia 21st Century e-Teacher Graduate Series and Teacher Professional Development

NIA, with its partner LearnIT-TeachIT and member university the University of Virginia, developed four graduate courses that serve as the curricula for the Virginia 21st Century e-Teacher Graduate Series. The series was piloted by NIA with Virginia Beach City Public School educators. The 21st Century eTeacher Initiative uses Web 2.0 technologies as teachers work through individual courses, each emphasizing the use of technology to support project-based learning while developing critical, creative and problem-solving skills. Courses empower teachers to develop constructivist lesson plans that effectively integrate instructional technology to support student learning in core academic subjects.

In 2011, nearly 350 Virginia Beach City Public School teachers received focused 21eTeacher training. NIA continues to work with VBCPS to shape changes within the school system's professional development.

The Virginia 21st Century eTeacher Initiative is now a state-wide initiative under the direction of the University of Virginia's School of Continuing and Professional Studies.

Public and Educational Media

New Worlds, New Discoveries

In collaboration with NASA's Planetary Science Division, NASA Langley Research Center and WGBH, NIA is producing a multi-faceted outreach program designed to enhance NASA's ambitious "Year of the Solar System" initiative.

"New Worlds, New Discoveries," which began in Fall 2010 and runs through 2012 draws on an array of creative NIA television, radio and online media resources, national events, and award-winning educational content. One example, the "Finding Life Beyond Earth" NOVA documentary, reached 7 million viewers when it premiered on October 19. Through the project, we are introducing millions to some of the most exciting new developments in planetary science, and stimulating interest in science, engineering and technology connected to NASA's Science Mission Directorate.

National conferences, Science Cafés and events featuring NASA speakers and content included live and interactive online broadcasts surrounding the launches of NASA's Juno, GRAIL and MSL with the Denver Museum of Nature and Science and Virginia Air & Space Center, the 2011 Women and Mars Conference at George Washington University, and multiple TEDxNASA events.



NASA 360™

This 30-minute magazine style TV program produced by NIA in collaboration with NASA Langley's Strategic Relations Office was nominated in 2011 for both regional and national Emmy awards for excellence in filmmaking.

Viewership swelled in 2011 with more than 75,000 views through a new partnership with Hulu. NASA 360 counts well over 8 million downloads from NASA.gov since the program began airing in 2008 and is also available on an estimated 6,500 airline flights each month.

www.nasa.gov/nasa360

Innovation Now™

In collaboration with NASA's Office of the Chief Technologist, NIA developed and launched a new radio series, "Innovation Now." Each 90-second episode features compelling stories of revolutionary ideas, emerging technologies and the people behind the concepts that are shaping the future.

With 260 episodes scheduled to be produced annually, the series is available as a podcast through iTunes and other online sites. Since its debut in September 2011, "Innovation Now" already airs as daily weekday



programming on public, college and commercial broadcast radio stations across the U.S. and as far away as Australia and the Philippines. WHRO/WHRV 89.5 FM, in Norfolk, Virginia serves as the primary broadcast distribution partner for the series.

<http://innovationnow.us>

AIAA Online Broadcasts

NIA partnered with AIAA to broadcast keynote and plenary speakers from numerous high profile, aerospace-related conferences live on the internet. This effort promotes aerospace science and engineering and increases awareness of NASA and its mission. In 2011, NIA broadcast from the 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit; the 11th AIAA ATIO Conference, AIAA Centennial of Naval Aviation Forum, Aviation Unleashed; and the AIAA Space 2011 Conference and Exposition.

<http://livestream.com/aiaa>

NASA and You (NASA y Tú)

"NASA and You" is a joint venture between NASA, NIA and Univision Communications working together to inspire and engage Hispanic students to pursue STEM careers. Combining NASA's unique STEM education content with Univision's media platforms substantially increases awareness and interest in STEM among Hispanic children and parents.

Featuring Hispanic employees from NASA as role models, NIA produces the series of 30-second videos that present new perspectives on education and STEM careers. The segments air on Saturday mornings during the Univision children's block. They are part of the Univision's comprehensive, multi-platform, three-year national education initiative called Es El Momento (The Moment is Now).

www.nasa.gov/education/nasaandyou

NASA eClips™

"NASA eClips" is an award-winning national educational program that provides short, relevant educational video segments designed to inspire and engage students by helping them see real-world connections to STEM education. NASA eClips offer unlimited flexibility in the classroom for timing, sequencing, and pacing of instruction to meet the needs of students and classroom instructors. Educational material, including the educator guides, for this program is selected based on national curriculum standards identified by NCTM, NSTA and ISTE.



This year, NASA eClips began addressing the new engineering standards to help teachers find a way to integrate engineering principles into core subjects. New production was sponsored by NASA's Planetary Sciences Division and NASA's Teaching From Space, and a total of 15 new video segments were approved, bringing the suite to a total of 231 segments. Related NASA resources are continuously aligned with video segments and posted through NASA eClips social media outlets.

www.nasa.gov/nasaclips

Internships and Design Competitions

Langley Aerospace Research Student Scholars (LARSS) Program

The LARSS Program for NASA Langley Research Center (LaRC) provides year round paid internship opportunities at LaRC for rising undergraduate juniors and seniors, and graduate students who are pursuing degrees in STEM. Participants gain exciting hands-on research experience while working side-by-side with NASA's finest scientists and engineers who serve as mentors. LARSS is NASA's largest internship program and in 2011 was recognized by Vault.com's Career Intelligence as the 6th best internship in the nation.

LARSS is NASA's longest standing internship program and was recognized by Vault, a Career Intelligence company, as one of the top 10 internship programs in the nation for 2011.

Managed by NIA and implemented by the Virginia Space Grant Consortium (VSGC), this competitive, Center-unique program is the oldest running NASA internship - boasting more than 215 participants in 2011.

Revolutionary Aerospace Systems Concepts – Academic Linkage

RASC-AL is a popular, annual, university-level engineering competition that provides students the opportunity to design projects based on NASA engineering challenges as well as offering NASA access to new research and creative approaches to solving real problems faced by the agency.

Design teams include a minimum of two students and a faculty member. Teams choose one of four themes and submit a summary of their proposed project which includes an outreach plan. A steering committee comprised of NASA and industry experts evaluates the proposals and selects teams to compete against each other at the annual RASC-AL Forum, held in Cocoa Beach, FL each June. Selected teams submit a technical report, prepare a poster and give an oral presentation at the Forum. In 2011, four graduate teams and 14 undergraduate teams competed in the challenge.

RASC-AL Exploration Robo-Ops

NIA and NASA held the first annual RASC-AL Robo-Ops competition at JSC's RockYard in May 2011. University teams design and build a tele-operated planetary rover, and through remote controls operated back at the university's home campus, demonstrate the rover's capability to perform a series of competitive tasks. Participatory Exploration is a main component of the program, whereby a large portion of the competition is judged on each team's ability to engage their university and community in the competition through social media, web media and hands-on outreach.

After exploring and designing solutions in the RealWorld phase, participants move InWorld to continue working in a 3D virtual universe.

RealWorld-InWorld NASA Engineering Design Challenge

The RealWorld-InWorld NASA Engineering Design Challenge is a unique education initiative for students in grades 9-12. It encourages them to explore and to build skills essential for successful STEM careers through two phases of project-based learning and team competition. In the RealWorld phase, teams of high-school-aged students and teachers/coaches work face-to face collaboratively as engineers and scientists. After exploring and designing solutions in the RealWorld phase, participants move InWorld to continue working in a 3D virtual universe. In this virtual environment, each newly-formed team uses 21st Century tools to refine designs and to create 3D models related to the James Webb Space telescope. Webb engineers visit and "chat" InWorld with participants throughout the challenge. The winning team receives scholarships and technology awards.



The Challenge is a collaboration between NASA, NIA, USA TODAY Education, and LearnIT-TeachIT. Funding for this project was awarded to NIA by NASA through a competitive grant solicitation. During its first year in 2010, over 700 participants registered for the RealWorld challenge, of which 20 teams were selected to continue to the next phase of InWorld modeling and simulation.

<http://www.nasarealworldinworld.org>

Knowledge Transfer: Professional Studies, Conferences, Workshops, Lectures Series

NASA IT Summit 2011

NIA supported NASA's 2011 IT Summit at the Marriott Marquis in San Francisco on August 15-17. Hosted by NASA's Chief Information Officer, Linda Cureton, the event was an open forum where NASA, federal, industry and academia IT professionals gathered to exchange ideas, share best practices, and learn what is new and cutting edge on the IT landscape. Sponsors secured by the NIA Foundation for the event included: Cisco, HP, IBM, SAIC, Turning Technologies, AIAA, Dell, EMC, LMCO, Zoom Digital Signage, Adobe, Amazon, Ambit Group, Apple, ArcSight, Aruba, ARSC Research and Technology Solutions, AT&T, Autodesk, BAH, Blue Coat, CA Technologies, CDW-G, Ciena, DLT Solutions, ESRI, Feith Systems and Software, Fishnet Security, Grant Thornton, Google, Intel, Intelligent Decisions, InuTeq, Iron Bow, M.B. Strategic, Netwitness, NITAAC/NIH, Proofpoint, Quest Software, Serena Software, SEWP, SGT, Sourcefire, Tripwire, Veeam Software, and VMware. NIA also supported Livestreaming of select keynotes and panels during the summit.



NASA Future Forums

Since 2008, Future Forums have brought together technologists, scientists, and engineers with local business, science, technology, and education leaders to discuss the agency's role in advancing innovation, technology, science, engineering and education, and NASA's benefit to the nation's economy.

NIA sponsored both NASA Future Forums held in 2011. The first, held on August 11 at the University of Maryland, featured panel discussions with NASA speakers such as Chief Technologist Bobby Braun; Chief Scientist Waleed Abdalati; Deputy Associate Administrator for Exploration Systems Laurie Leshin; and astronaut and Associate Administrator for Education Leland Melvin. The second Future Forum of 2011 was held at The Museum of Flight in Seattle, Washington on December 9 and included presentations from NASA Deputy Administrator Lori Garver, Seattle's Museum of Flight President and CEO Doug King, and panelists from Aerojet, Blue Origin, Boeing, Sierra Nevada, SpaceX, the University of Washington, Virgin Galactic and the Washington Technology Industry Association.



TEDxNASA@SiliconValley

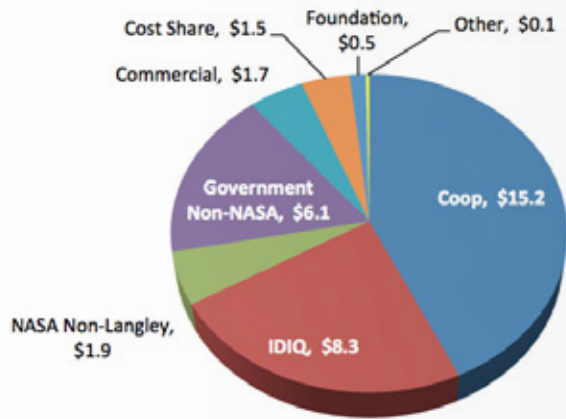
NIA joined NASA's four research centers, Ames, Dryden, Glenn and Langley to bring the first TEDxNASA event to the West Coast on August 17. TEDxNASA@SiliconValley brought together thought leaders from a wide variety of disciplines to provide a unique opportunity for the exchange of game-changing ideas under the theme "Extreme Green." Esther Dyson, chair of the NASA Advisory Council's Technology and Innovation Committee, served as master of ceremonies. The event was held at the Marriott Marquis Hotel in San Francisco and was streamed live on the internet to tens of thousands of venues around the world including audiences throughout North and South America, Europe, Africa and Asia. <http://tedxnasa.com/silicon-valley>



TEDxYouth@NASA: Get CONNECTED

Approximately 400 students from Hampton Roads attended the second annual TEDxYouth@NASA event on November 19, 2011. TEDxYouth@NASA: Get CONNECTED was created as collaboration between NASA Langley Research Center, NIA and the Virginia Air & Space Center. Feature a diverse field of presenters on topics such as inventing, imagination, biofuel, chemistry, and filmmaking, the event was one of more than 100 TEDx events around the world designed to empower and inspire young people during Universal Children's Day. <http://tedxnasa.com/get-connected>

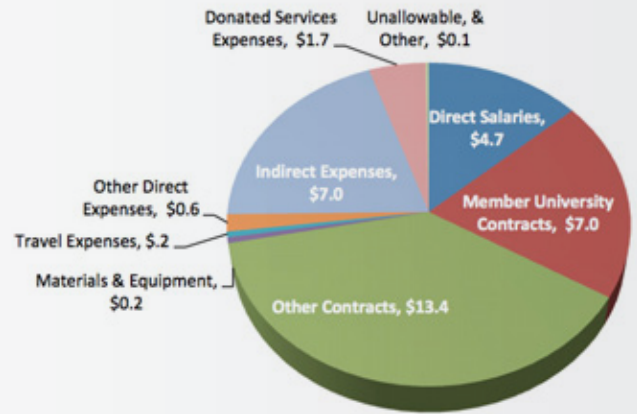
2011 Revenue Sources



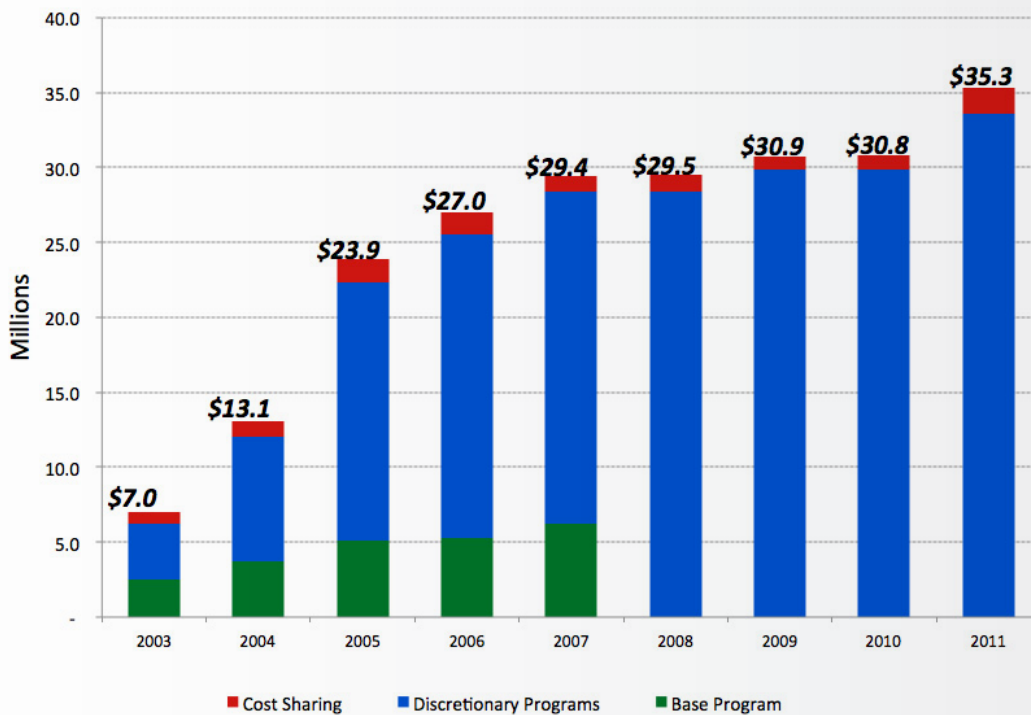
- \$15.2 - Coop
- \$8.3 - IDIQ
- \$1.9 - NASA Non-Langley
- \$6.1 - Government Non-NASA
- \$1.7 - Commercial
- \$1.5 - Cost Share
- \$0.5 - Foundation
- \$0.1 - Other

COOP: NASA Cooperative Agreement IDIQ: NASA Task Order Contract

2011 Revenue Uses



- \$4.7 - Direct Salaries
- \$7.0 - Member University Contracts
- \$13.4 - Other Contracts
- \$0.2 - Materials and Equipment
- \$0.2 - Travel Expenses
- \$0.6 - Other Direct Expenses
- \$7.0 - Indirect Expenses
- \$1.7 - Donated Services Expenses
- \$0.1 - Unallowable & Other



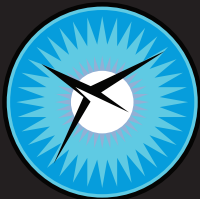
Mission

...Foster research collaboration among national laboratories, academia and industrial partners to stimulate innovation and creativity.

...Provide comprehensive graduate and continuing education in science and engineering via local campus presence and distance learning technologies.

...Incubate and stimulate the commercialization of new intellectual property developed through NIA's research activities.

...Promote aerospace science and engineering and provide outreach to the region and nation.



National Institute of Aerospace

100 Exploration Way, Hampton, VA 23666

757-325-6700

www.NIAnet.org

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