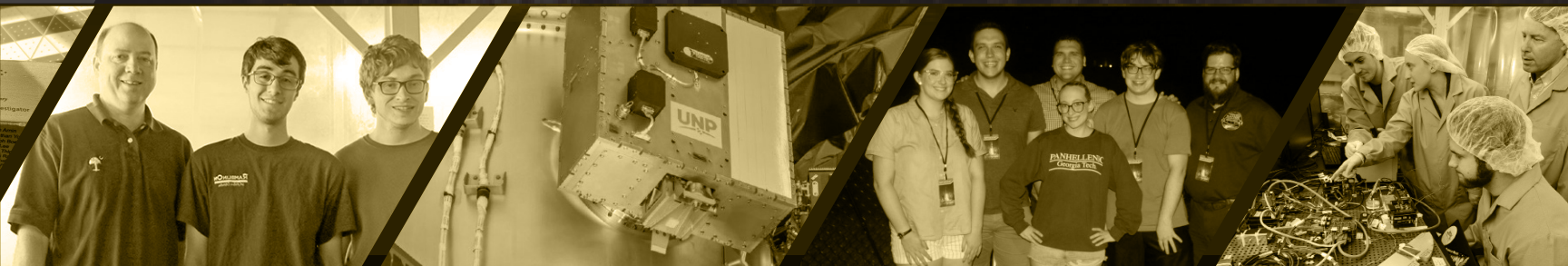


# INVESTING IN THE FUTURE



FY'19 ANNUAL REPORT

### Educational excellence. Cutting-edge research. Time. Money.

Over the last year, AE Chair Mark Costello and his leadership team — professors Stephen Ruffin and Mitchell L. R. Walker II — have juggled these oft-competing priorities with energy and finesse. The experience has confirmed their faith in the AE School's legacy — and its future.

"Every goal we put before ourselves as a school comes down to the people who are doing the research, defining the future," said Costello. "That's why we've invested time listening to our people — AE students, faculty, alumni. And I'm once again amazed by the wisdom they possess. In a very short amount of time, we've seen a great return on that investment."

### Freeing Up the Undergraduate Curriculum

A major overhaul of the undergraduate curriculum undertaken five years ago gave students more freedom to individualize their educational experience, Ruffin noted, but its popularity prompted new problems.

"Students had begun telling us that they couldn't take full advantage of that freedom because there simply weren't enough options courses being taught each semester," Ruffin explained. "And they were already having a hard time getting scheduled into their required core courses. We had a great curriculum on paper, but, in reality, we needed more capacity."

The team is addressing this by offering more options courses and expanding the number of core course sections offered each semester.

"Those changes were critical," adds Walker. "But from the standpoint of young students who are trying to figure out how to realize their career goals, they needed more than scheduling freedom. They needed guidance."

The AE faculty created 10 new AE Specialty Areas to address this 'career guidance gap' in the advising process.

Explains Costello: "We listened to what students were saying about what jobs they wanted, and we were always hearing from industry about the positions they were trying to fill. So we asked ourselves: what combination of technical courses, humanities courses, and social sciences courses would help our students perform well in those fields, in those jobs?"

Each of the Specialty Areas makes career-savvy course suggestions, but it stops short of dictating specific course sequences. Those decisions are still hashed out between student and advisor.

"This gives students just enough freedom to dream big, without getting themselves — or their advisors — lost in the details," notes Ruffin. "And we are already getting great feedback from prospective students and their parents. They see what we are doing with this, and it makes sense to them."

Dovetailing with the Specialty Areas is a new initiative — the Alumni Mentorship Program — that will, in the coming years, match individual undergraduates with alumni mentors who can give industry-specific insight and guidance.

### Freeing Up Faculty to Think Big

As they move into their second year as a team, Costello, Ruffin and Walker have identified faculty enhancement as a top priority. That's why they've committed to dramatically increasing the number of tenure track faculty over the next several years. They've also created and filled two new positions — AE lecturer and AE professor-of-the-practice — that add a critical new capacity to the school's teaching mission.

Explains Walker: "These new positions are teaching focused, which frees up our research-focused faculty to think big — to explore new research, create new graduate-level courses, and mentor the next generation of graduate scholars. And, especially now that we've fully committed ourselves to teaching more core courses, adding these highly qualified teaching-focused faculty to our team really commits us to success."



"Every goal we put before ourselves as a school comes down to the people who are doing the research, defining the future."

July 2019



As a researcher, an educator, and an entrepreneur, I've always believed in making sound investments. The future belongs to those who make a down payment on it.

Never has the wisdom of this practice been more obvious to me than in the last year - my first, as the chair of the Daniel Guggenheim School of Aerospace Engineering.

By far, the most critical investment I made this year has been in people – new leadership, new faculty, and new connections with the students who are the lifeblood of the AE School. Joining me were Prof. **Stephen Ruffin** and Prof. **Mitchell L.R. Walker** – two trusted colleagues who bring more than 40 years of teaching and research experience to their new roles, as the associate chairs of undergraduate and graduate programs, respectively. Their commitment to the AE School is matched only by the insight and energy they bring to the task of leading our academic programs forward.

Our investment in new faculty has always been central to the AE School's mission. We are always looking for good talent, and, this year, we found the best. In addition to our new space faculty, Prof. **Koki Ho** and Prof. **John Dec**, (profiled in this report), we were fortunate to be able to fill a new position (lecturer) with a familiar and well-respected colleague, Dr. **Kelly Griendling**, Ph.D. AE '11. A former member of the Aerospace Systems Design Lab research faculty, Dr. Griendling had many times over demonstrated her outstanding leadership, mentorship, and research skills. Inviting her to fill this key new teaching position was truly an easy decision to make.



*Dr. Kelly Griendling*

The pages of this Annual Report provide an elegant testament to what happens when we invest in our students. In 2019, our students continued to earn the awards, accolades, scholarships, and job offers that bespeak the indomitability of their intellect and their ambitions. I am proud that the AE School has played a role in that success, but I am not lulled. Neither are our students. Each month, when I hold open office hours, the AE students who visit me talk boldly about investing in new labs, research, course offerings, and more.

Some of those ideas clicked. Others needed tinkering. But the investment I made in listening was the best one I made all year.



Mark F. Costello  
William R. T. Oakes Professor and School Chair



## FACULTY HIGHLIGHTS

In recognition of the many contributions made by professor, researcher, and former chair, Prof. Vigor Yang, the AE School renamed one of its most celebrated learning and teaching spaces in his honor. The Dorothy and Vigor Yang Aero Maker Space was formally unveiled in November... The AIAA chose a book co-authored by Yang, "Turbine Aerodynamics, Heat Transfer, Materials and Mechanics," as the July 2018 Book of the Month... The American Statistical Association recognized Yang with its 2019 Physical Engineering Sciences Award... Yang was also chosen to receive an honorary doctorate from Taiwan's National Cheng Kung University, one of the largest and most influential universities in Asia... Prof. Panagiotis Tsiotras was named to the AE School's David and Andrew Lewis Chair... Tsiotras was also named a Fellow by two prestigious professional societies: the Institute of Electrical and Electronics Engineers (IEEE), and the American Astronautical Society... Tsiotras received the IEEE Control Systems Society's 2018 Award for Technical Excellence in Aerospace Control. The award annually recognizes recipients for "outstanding contributions in control theory and transitions to aerospace applications"... Longtime professor Daniel Schrage was granted Professor Emeritus status on the occasion of his retirement from fulltime teaching... Prof. Dimitri Mavris has been named the director of the Professional Master's in Applied Systems Engineering (PMASE) program at Georgia Tech... Prof. Jonathan Rogers was selected as the new Lockheed Martin Associate Professor of Avionics Integration ... For the second year in a row, Prof. Joseph H. Saleh was named Professor the Year by Sigma Gamma Tau, the aerospace engineering honor society... Prof. Julian J. Rimoli was selected to receive Georgia Tech's Class of 1934 Outstanding Innovative Use of Education Technology Award in recognition of his work developing Truss Me — an app that helps students gain an intuitive grasp of truss behavior... Prof. Tim Lieuwen was selected as a Regents Professor — the highest academic and research recognition bestowed by the University System of Georgia... Lieuwen and his colleague Prof. Suresh Menon were named Fellows by the Combustion Institute... Prof. Adam Steinberg was selected as an Associate Fellow by the American Institute of Aeronautics and Astronautics (AIAA)... At Georgia Tech's first-ever Prestigious Faculty Awards Dinner, professors Dewey Hodges



Prof. Vigor Yang



Prof. Panagiotis Tsiotras



Prof. Jonathan Rogers



Prof. Julian Rimoli

and Marilyn Smith were each honored for career-defining awards they received over the past year: Hodges, for receiving AIAA's Structures, Structural Dynamics & Materials (SDM) Award, and Smith, for receiving a NASA Group Achievement Award — an honor that recognized Smith's team for developing FUN3D, a suite of computational fluid dynamics tools to benefit the fields of aeronautics, space technology and exploration... Hodges was also selected to give the William R. Sears Memorial Lecture at the University of Arizona. His talk, "Unified Approach for Accurate and Efficient Modeling of Composite Beams, Plates, and Shells" explored the unified approach, which facilitates accurate and efficient modeling of composite helicopter rotor blades for loads, dynamics, aeroelasticity, and stress recovery... Prof. Marilyn J. Smith was elected to fill the Academic seat on the board of the Vertical Lift Consortium, a consortium of academic and industry partners who team together to solve Army applied research for rotorcraft... Prof. E. Glenn Lightsey has been chosen to receive the 2019 Mechanics and Control of Flight Award, an honor given annually to individuals who have made outstanding technical or scientific contributions to the field of mechanics, guidance, or control of flight in space or the atmosphere. AIAA officials praised Lightsey and his "far-reaching advances toward low-cost space mission concepts through groundbreaking technological developments in sensor and actuator systems for small satellites" ... Prof. Karen M. Feigh has been chosen to attend AIAA's 2019 Frontiers of Engineering Symposium, a select gathering of early-career engineers from industry, academia, and government... Prof. Adam Steinberg was named an Associate Fellow by AIAA... Prof. Kyriakos G. Vamvoudakis was one of three experts selected by the Army Research Office to organize "Distributed Reinforcement Learning and Reinforcement Learning Games," a two-day workshop on reinforcement learning and reinforcement learning games... Vamvoudakis was also selected by the ARO for the 2019 Young Investigator Award, which includes a 3-year, \$360K research award... "Measurement of Methane Autoignition Delays in a Shock Tube under Supercritical Carbon Dioxide Conditions," a paper co-authored by Prof. Wenting Sun was selected to receive ESSCI's prestigious 2018 George H. Markstein Best Paper Award.



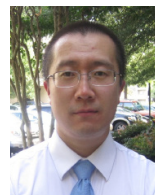
Prof. Tim Lieuwen



Prof. E. Glenn Lightsey



Prof. Karen Feigh



Prof. Wenting Sun

## National Academy of Engineering Elects Krishan K. Ahuja

The National Academy of Engineering announced the selection of AE professor and GTRI researcher Krishan K. Ahuja as a 2019 inductee to the Academy. Renowned for more than 35 years of research in aircraft noise research, acoustics facilities design, flow control, state-of-the-art instrumentation, and advanced signal processing, Ahuja joins his AE colleagues, professors Vigor Yang, Tim Lieuwen, and Ben T. Zinn who were previously named to the NAE. "Krish is known worldwide for his seminal contributions in aeroacoustics," said AE Chair Mark F. Costello. "We are fortunate and proud to have such a great colleague."



## COMPETITION MAKES US SHARPER.

Dozens of AE students took to the skies this year, entering fixed-wing, drone, and space vehicle competitions that tested their knowledge, skills, and dedication to the field. As in past years, they left those competitions with top awards in hand — and a desire to do better next year. Here are some of the highlights:

In the 2019 Society of Automotive Engineers Aero Design East competition, ColumBuzz, a blended wing body aircraft, and Buzz^2, a five-pound UAV, came in first and second, respectively, in their classes. Both were products of months of hard work and testing by students in AE's Aerospace Systems Design Lab (ASDL)...Another ASDL team prevailed at the 2019 AIAA Design Build Fly competition, where their battery-operated aircraft, Buzzformer, took home second place... ASDL student engineers teamed up with classmates from Tuskegee and Clemson universities to win the Best 3D-printing, Manufacturing, and Autonomy prize in the 2019 Boeing AeroSPACE competition...The Ramblin Rocket Club organized a team comprised mainly of AE undergrads that took a top prize in the 2019 SpacePort America Cup Fly-off. Their submission — a 13.5-foot, 110-pound rocket named Sustain Alive — bested dozens of teams in its category by ascending to an altitude of 28,140 feet. The team also nabbed second place overall and the Charles Hoult Award for Modeling & Simulation...Team Icarus, a group of 10 students from the Autonomous Control and Decision Lab of AE professor Evangelous Theodorou, is currently in the finals for a \$1 million grand prize in the 2019 Alpha Pilot Competition. Their challenge? Design an artificial intelligence/machine learning framework that is capable of flying a drone through challenging multi-dimensional race courses.



Team Sustain Alive with their rocket.

## SCHOLARSHIP MAKES US COMPETITIVE.



Aarohi Shah

Doctoral student, Aarohi Shah received the Vertical Flight Foundation's Jing Yen Cost Awareness Scholarship to continue her work on reduced order damage models for fatigue prediction in rotorcraft vehicles...Also receiving a VFF scholarship was doctoral student Feyyaz Guner whose research focuses on inflow modeling for multi-rotor configurations....Doctoral student Benjamin

Leon received the American Helicopter Society's Robert Lichten Award for his work "Ground and Flight Tests of a Cable-Driven



Benjamin Leon

Four-Bar Linkage Robotic Landing Gear for Rotorcraft"... The National Science Foundation selected AE grad student Sara Miller to receive a Graduate Research Fellowship to continue her work on the characteristics of engine degradation in electric propulsion engines...Miller also received AIAA's Aerospace Power Systems Best Student Paper award for "The SPACE Computer Code for

Analyzing the International Space Station Electrical Power System: Past, Present, and Future," a technical paper she co-authored with several of her full-time NASA colleagues....The AIAA Southeastern Regional Student Conference selected ASDL grad student Johnie Sublett to receive a top award for his paper "Design and Testing of a Fault-Tolerant Space Suit"... Graduate students



David Gomez

David Gomez and William Jun each received a NASA Space Technology Research Fellowship to pursue doctoral research on Hall thruster efficiency and novel space navigation architectures... Doctoral student Jack Ridderhof received AIAA's Guidance, Navigation, and Control Best Student Paper Award for "Minimum-Fuel Powered Descent

in the Presence of Random Disturbances" a paper he co-wrote with his advisor, Prof. Panagiotis Tsiotras....Undergraduates Vaibhav Kumar and Frank Koziel were selected by Aviation Week Network and AIAA for inclusion in The 20 Twenties list of Tomorrow's Technology Leaders, an annual recognition of high-achieving aerospace students whose civic and or research contributions show promise...

Doctoral student Yu-Hung Chang received the 2018 ILASS-Americas Simmons Award from the Institute for Liquid Atomization and Spray Systems for her presentation, "Highly Efficient Spatiotemporal Flow Dynamics Prediction via Data-driven Analysis and LES-based Surrogate Model"... Doctoral students Harleen Brar and Alex M. Moushegian received the prestigious Science Mathematics And Research for Transformation Scholarship from the United States Department of Defense... Doctoral student Debolina Gupta was selected to receive AIAA's 2018 Martin Summerfield Graduate Award in Propellant and Combustion... Undergraduates Ashleigh Bunch, Rukmini Roy, and Saumya Sharma were selected for 12-week mentored internships as a part of the 2019 Brooke Owens Fellowship program...

Undergraduates Sahaj Patel, Shravan Hariharan, Patrick Miga, and Josh Ingersoll were named to the 2019 cohort for the Matthew Isakowitz Fellowship, an honor that matched each of them to an aerospace engineering summer internship and a year-long mentorship with a professional in the commercial aerospace field.



William Jun



Jack Ridderhof



Yu-Hung Chang



## Brian German: New Center for Urban and Regional Air Mobility Launched



Prof. Brian German

Professor Brian German's specialization in electric propulsion aircraft, autonomous flight, and emerging aviation markets attained new prominence this past year when he joined together with School of Civil & Environmental Engineering professor Laurie Garrow to establish the Center for Urban Regional Air Mobility (CURAM) at Georgia Tech.

The multi-disciplinary, collaborative center is dedicated to the exploration and development of urban air mobility (UAM) - literally, the use of specially designed aircraft to meet the routine, local, transportation needs of densely populated urban areas. It will achieve this by supporting cutting-edge research and prototyping of electrically powered vertical take-off and lift (eVTOL) vehicles and by supporting policy research that will allow UAM to be integrated into the evolving transportation infrastructure.

More than 100 academics, entrepreneurs, and policy-makers flocked to Atlanta in January for CURAM's kick-off event – a day-long exploration of the challenges - and possibilities - posed by UAM.

"This is not just about a really cool technology. It's about creating a door-to-door, multi-modal transportation infrastructure," said Uber Elevate's director of vehicle systems, Mark Moore, a keynote

## Joseph H. Saleh: Maintenance and Inspection as Risk Factors in Helicopter Accidents

"Maintenance and Inspection as Risk Factors in Helicopter Accidents: Analysis and Recommendations," a paper by Prof. Joseph Homer Saleh and a team of student researchers, is challenging stakeholders in the rotorcraft industry to recommit to a more robust safety culture for helicopter maintenance and inspection procedures.

Published in PLOS-One this past February, Saleh's work examines the association of maintenance and inspection with helicopter accidents from both an epidemiological and a physics-of-failure perspective. The researchers stressed that helicopters are extremely effective for a growing number of civilian and military applications, but also noted that their operational safety poses unique engineering challenges.

"The fundamental feature of a helicopter design, a rotating wing, enables a host of new flight regimes that go far beyond the reach of fixed-wings airplanes," Saleh said.

"By the same token, this fundamental feature raises a host of design and operational challenges related to the vibrating nature of the craft and the heightened risk of wear-out of its components. As a result, maintenance and inspection of helicopters are particularly crucial for the continued airworthiness and operation of these machines."

After analyzing 10 years worth of helicopter accident data, Saleh and his co-authors — Archana Tikayat Ray, Katherine Zhang, and Jared Churchwell — found that 34 percent the errors that were made during a maintenance or inspection stop led to accidents that

speaker at the CURAM event. "We could cut peak commute times by more than 50 percent, and reduce our energy use by a factor of 10."

German and Garrow share Moore's vision. Through CURAM, they plan to bring together experts who will put that vision into practice.

Garrow has been surveying the demand among 2,500 commuters in five geographic locales to determine the potential demand for an air taxi service that would replace what is currently a one-way 30-minute commute.



Prof. Laurie Garrow

Meanwhile, continued improvements in battery life and autonomy promise to further reduce the cost of UAM, making it a game changer for commuters at all income levels.

"At present, there are over 100 eVTOL aircraft under development by different companies, including traditional aircraft manufacturers and startups" said German.

"That's exciting, but we need to focus not only on the vehicle, but on the 25-35 U.S. cities – and a 50-mile radius around them – that are potential future markets for UAM. With a cruising speed of 150-200 miles-per-hour, this new breed of vehicles could morph the demographics of cities like Atlanta whose roadways are often idled by commuter traffic."

Find out more about CURAM at <https://airmobility.gatech.edu/>

occurred within 10 flight-hours. Another significant cluster of maintenance-related crashes occurred after 20 flight hours.

Saleh described this pattern as something of a pathogen — in the form of poor or unperformed maintenance/inspection – that transitioned into an accident after incubation periods of varying lengths.

"These are maintenance errors that are unforgiving and offer little or no grace period," Saleh noted. "But this transition can also occur over longer time periods of flight-hours with maintenance errors slowly metamorphosing into accidents."



Prof. Joseph H. Saleh

The team used both case studies and case series to gain greater depth in their analysis. Based on their findings, they proposed a set of preliminary recommendations that derive from the safety principle of defense-in-depth — the notion that multiple lines of defenses or safety barriers should be placed along potential accident sequences, and that safety should not rely on a single defensive element. The recommendations included common-sense interventions, such as providing better training and certification of maintainers, especially when handling the critical hotspots conducive to errors the researchers identified.

Read their findings in <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0211424>

## RESEARCH HIGHLIGHTS

### Adam Steinberg: Expanding our grasp of hypersonic travel

A recent gift from Leidos is allowing AE professor Adam Steinberg to explore methods for controlling, propelling, and detecting air-breathing hypersonic vehicles – an area of research that holds promise for a multitude of commercial and military applications.

But it also poses some significant challenges, even for seasoned combustion experts.

“Ballistic missiles are hypersonic vehicles that have been around for a while, but we do not have much control over their flight. They launch and they crash,” says Steinberg, who heads up the Lasers and Fluids Group within AE’s Ben T. Zinn Combustion Lab.

“If we want to control hypersonic vehicles, we need to know more about the external aerodynamics, the propulsion system, and the heat transfer to the vehicle. Looking at the engine, the internal fluid mechanics, chemistry, and thermodynamics are very interesting topics.

“If a vehicle is traveling at hypersonic speeds, the kinetic energy of the gas relative to the vehicle is very high. Replicating these conditions – which result in high stagnation temperatures, high stagnation pressures – is a huge challenge.”

### Marilyn J. Smith: Leading the Vertical Lift Research Center of Excellence

Dr. Marilyn J. Smith’s exceptional renown in rotorcraft technology and design was twice hailed by her peers over the past year. In November, Smith was named the new director of the Vertical Lift Research Center of Excellence (VLRCOE), a nationally recognized hub of rotorcraft research and education housed at Georgia Tech. The longtime AE professor and AE alumna succeeded AE professor Daniel Schrage, who has held the post for 32 years.

A month later, Smith was elected to fill the Academic seat on the board of the Vertical Lift Consortium, a group of academic and industry partners who team together to solve Army applied research for rotorcraft. Announcement of Smith’s VLRCOE promotion was made by Smith’s colleague, Mark F. Costello, the William R. T. Oakes Chair of the Daniel Guggenheim School of Aerospace Engineering.

Steinberg says this research will put him at the intersection of physics, facilities, and measurement methods for years to come. Backed by research colleagues from GTRI and the AE School, he is confident that that work will produce realistic insights on hypersonic flight and engine conditions.

“Tech has the right capacity, in terms of our expertise and our facilities,” he said.

Right now, his work is focused on replicating hypersonic conditions -- speeds in excess of 5,000 miles/hour and temperatures exceeding 2,700 degrees Fahrenheit.

Using the Zinn Lab’s supersonic wind combustion tunnel is allowing him to gather helpful engine data over experiments that can last for minutes, though not at full hypersonic conditions. A recently created shock tunnel is allowing him to attain realistic hypersonic flow conditions for about five milliseconds. While it seems short, that’s long enough to gather a lot of information about the vehicle’s surface temperatures, wake composition, and external aerodynamics, Steinberg noted.

And that’s a good beginning.

“Professor Smith is a well-respected scholar by both academic and industry leaders around the world for her rotorcraft research as well as for her mentorship of the next generation of vertical lift engineers,” he said.

The VLRCOE at Georgia Tech conducts basic research focused on scientific barriers in technologies that support current and future vertical lift capabilities. Funded by a consortium of sponsors that includes the US Army, US Navy, and NASA, the VLRCOE at Georgia Tech is part of a national network of state-of-the-art research programs housed at academic institutions. Over the course of its 36-year history, Georgia Tech’s VLRCOE has promoted research that has resulted in software algorithms and simulation models that are now in regular use across the vertical lift community.



Prof. Adam Steinberg



Prof. Marilyn J. Smith



#2  
2018 ranking for undergraduate program, U.S. News & World Report

#4  
2019 ranking for graduate program, U.S. News & World Report

80%  
of GT-AE undergrads have conducted research by the time they graduate

For more than a decade GT-AE's undergraduate and graduate programs have been ranked in the top 5, nationally.

~31% of GT-AE undergrads have completed a co-op program in the field

1,464 students enrolled in Fall 2018 (971 undergraduate 493 graduate students)



# INVESTING IN THE NEXT GENERATION OF SPACE EXPLORATION

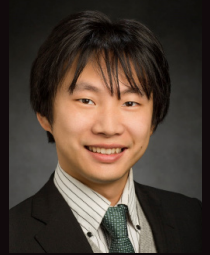


## Meet the Daniel Guggenheim School's Newest Space Faculty

Dr. John Dec, Professor of the Practice // Dr. Dec joins the AE faculty as a professor of the practice, having most recently served as the program manager at Terminal Velocity Aerospace (TVA). During his 16 years at NASA Langley Research Center, Dec worked as a senior thermal engineer specializing in planetary entry, descent, and landing as well as satellite thermal control. His work at NASA included projects such as the Hypersonic Inflatable Aerodynamic Decelerator (HIAD) flexible thermal protection system (TPS), the Crew Exploration Vehicle Thermal Protection System Advanced Development Project, NASA Engineering and Safety Center (NESC) Autonomous Aerobraking Project, Mars Reconnaissance Orbiter (MRO) Aerobraking, Mars Odyssey Aerobraking and the Mars Sample Return Earth Entry Vehicle. His research activities focus on planetary entry, descent, and landing technology development, including: thermal protection system design and optimization and hypersonic aerothermodynamics. Dec earned a B.S. in aeronautical engineering from Rensselaer Polytechnic Institute and a M.S. and a Ph.D. in aerospace engineering from Georgia Tech.



Dr. Koki Ho, Assistant Professor // Dr. Koki Ho joins the AE faculty from the University of Illinois at Urbana-Champaign where he directed the Space Systems Optimization Laboratory. His research focuses on the development of mathematical theories and their application to rigorous space mission analysis, design, and optimization. Some of his specific research interests include (1) network modeling for campaign-level space mission design; (2) optimization and probabilistic modeling for in-space infrastructure design and operations; (3) mega-scale satellite constellation design, deployment, and maintenance; and (4) sensor steering planning for space situational awareness. His unique research connecting optimization, systems engineering, and space applications has been and will continue providing substantial impact to modern and future space missions that involve multiple missions, multiple vehicles, and reusable infrastructure elements. Ho earned his Ph.D. at MIT and his bachelor's and master's degrees at the University of Tokyo. He is the recipient of the Luigi Napolitano Award, and is the co-author of one of the most downloaded Acta Astronautica articles on the topic of the assessment of technical feasibility of the Mars One mission plan. His research has been funded by NASA, DARPA, and industry.



## RANGE and Prox-1: Two AE Satellites that Launched Hundreds of Careers

For hundreds of current and past AE School students, the successful launches of the RANGE and Prox-1 satellites this past year were nothing short of life-changing events. Accepted as payloads on two separate SpaceX rocket launches in December and June, the two Georgia Tech-built satellites have been, for years, learning labs for students with big dreams.

With their launches, RANGE and Prox-1 catapulted those students into the elite ranks of engineers who have designed, built, and sent their own technology into space.

"Never in my life, growing up, would I have dreamed of attending a school like Georgia Tech — even less so, working on a project of the caliber of Prox-1," said Kevin Okseniuk, BSAE '16, who took a break from his doctoral studies at Stanford so he could fly to Florida to witness Prox-1's launch in June. "Someday Prox-1 will de-orbit, but the lessons learned will stay in my heart forever."

The two spacecraft carved unique niches in the AE School's history as well: Prox-1, as the first-ever Tech-built small satellite project, and RANGE, as the first Tech-built satellite to be launched into space (December 2018). For AE professors Brian Gunter and E. Glenn Lightsey — the educators behind these projects — there is no need to rank their value. Several more CubeSat projects are



Recent AE alumni and current AE students flew to Florida to cheer on Prox-1's launch in June.

already in the pipeline — or in space. All of them demonstrate space technology and conduct scientific research.

"RANGE has the ability to enable whole new classes of mission concepts," said Gunter.

"Both projects have given so many Georgia Tech students such valuable hands-on experience with spacecraft design and flight," added Lightsey. "A lot of the students who started with Prox-1 and RANGE are now working in the field — at NASA, JPL, DOD, and private industry."

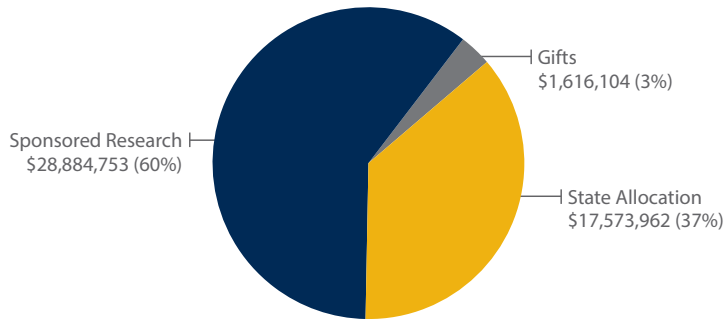
## FINANCES

In FY'19, the Daniel Guggenheim School of Aerospace Engineering had expenditures of 48,074,820 which were funded by a combination of the School's state allocation from the Institute, sponsored research contracts, and gifts.

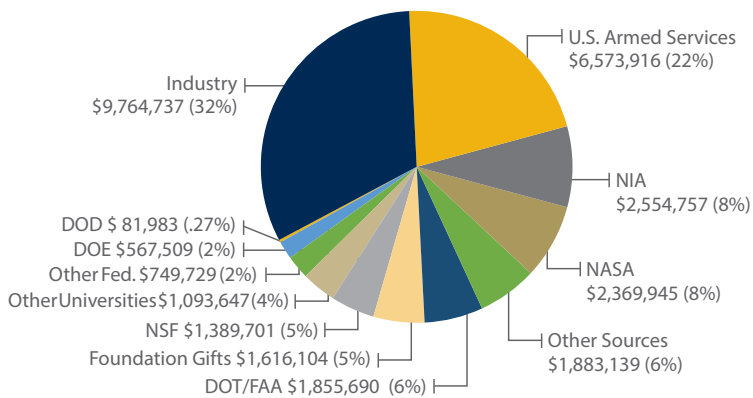
Research funding from outside sources in FY19 totaled \$30,500,858: \$17,236,877 from the federal government\*; \$9,764,737 from industry; \$1,616,104 from foundation gifts; and \$1,883,140 from other sources (e.g. local, state, and other governments). AE's state allocations were \$17,573,962.

\*Federal funds included \$1,093,647 from other universities as federal flow-through.

### FY19 Expenditures



### FY19 Research Funding



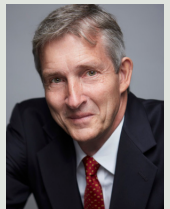
## SALUTING AE ALUMNI

The enduring legacy of Georgia Tech's aerospace engineering program is the story of the more than 6,000 men and women who earned degrees here. In saluting the following three alumni, we celebrate them all.

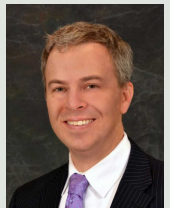
C. Perry Bankston, BAE '71, MSAE '73, and PhD AE '76, was inducted into the GT College of Engineering Hall of Fame — an honor that recognizes his countless contributions to the field during a 38-year tenure at NASA's Jet Propulsion Lab. Bankston worked on several historic space missions — Cassini, Mars Pathfinder, Mars Exploration Rover — and led the formulation phase of the NuSTAR mission. The AE School has benefited greatly from his longtime service on the School Advisory Council (AESAC), his support of the AE School building renovation funds, and his many years of support to the Annual Roll Call.



Dierk Reuter, MSAE '87, Ph.D AE '88 was inducted into the GT Academy of Distinguished Engineering Alumni. The co-founder of Lucid Markets, Reuter helped pioneer the use of math and computers to automate foreign exchange trading at Goldman Sachs and Deutsche Bank - resulting in nine patents. A current member of the AE School's Advisory Council, Reuter and his family gave generously to establish AE graduate fellowships and to renovate the School's facilities. A renowned aviation enthusiast, Reuter recently broke a longstanding record by co-piloting a Daher TBM 930 turboprop from New York to Paris in 8 hours, 35 minutes.



Kevin C. Massey, BAE '92, MSAE '94, PhD AE '97, was inducted into the GT Council of Outstanding Young Engineering Alumni. A senior supervisory engineer at Leidos, Massey leads a team supporting the U.S. Air Force in the development of hypersonic weapon systems and advanced missiles at Eglin AFB. Massey has also worked at GTRI as a research engineer, taught thermodynamics for Georgia Tech's School of Mechanical Engineering, and served both as an aerospace engineering department head and a professor at RMIT University. He has authored more than 100 technical publications and has received numerous awards. Massey remains dedicated to the AE School by mentoring AE students.



Find out how you can support the Guggenheim School of Aerospace Engineering.

Contact Farah Kashlan at [farah.kashlan@ae.gatech.edu](mailto:farah.kashlan@ae.gatech.edu)

## CONTACT US

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