AIAA Ground Test Technical Committee

GTTC Website

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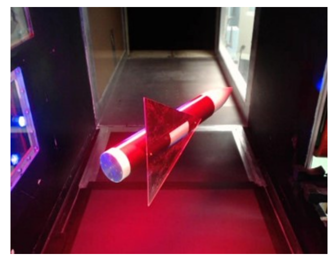
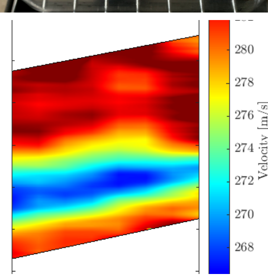
GTTC Newsletter

Orlando, FL
Winter 2020
Issue No. 48





Chairman's Message

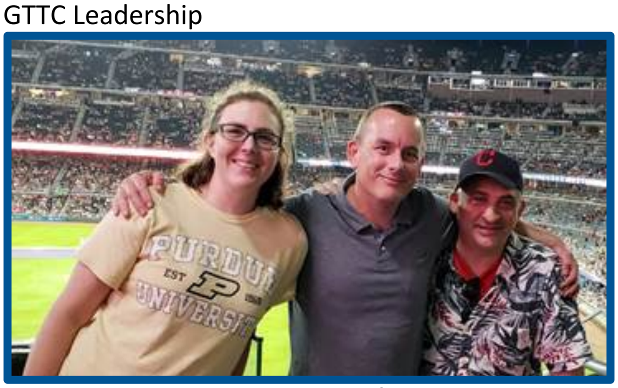
Thank you for reading through our Ground Test Technical Committee (GTTC) Newsletter. This newsletter is meant to keep AIAA members informed on GTTC activities with some highlights from across the industry. I hope you find it interesting and worth your time to read.

The GTTC is pleased to be part of the AIAA SciTech Forum 2020 in Orlando, FL. We welcome a number of new members, and have many technical activities planned, including meetings about awards, publications, standards, education, conference proceedings, and student activities. Our active Technical Committee (TC) members also participate in a number of working groups in technical focus areas like internal balances, flow quality, wind tunnel model attitude/deformation, dual flow reference nozzle, uncertainty standards, the future of ground testing, and statistically defensible experiments.

We like to say we put the "T" in TC, so try to come to our technical sessions to see what kinds of testing activities are being presented and documented. GTTC technical sessions are listed in the conference program and all are welcome to attend the working group meetings and actively participate in this process. If you are interested in becoming a GTTC member, applications can be input through the AIAA web site, www.aiaa.org.

We are always looking for ways to improve the GTTC and our overall value to the aerospace community. Your ideas and participation are greatly appreciated. The AIAA is a tremendous forum for exchange of ideas, learning, advocating for our industry, and networking – we try to emulate that within the GTTC as we work hard, enjoy each other's company, and have fun. We're increasingly using our web site (within the AIAA Engage platform https://engage.aiaa.org/home) for communication and posting of our latest information – please check it out if you get a chance. If you have any questions or want more information about the GTTC, please contact me by email at victor.a.canacci@nasa.gov or by phone at 216-536-7845.

GTTC Leadership



Pictured Left to Right: (Vice-Chair/ Stephanie Simerly, Secretary/Ryan Kew, & Chair/Vic Canacci).

Thank you,
Vic Canacci
GTTC Chairman

The World's Forum for Aerospace Leadership

Upcoming GTTC Conferences

AIAA SciTech Forum 2020
6 - 10 January 2020 | Orlando, Florida

AIAA AVIATION Forum 2020
15 - 19 June 2020 | Reno, Nevada

About the GTTC

The GTTC is one of more than 60 technical committees sponsored by the American Institute of Aeronautics and Astronautics (AIAA). It is made up of approximately 50 professionals working in various areas of the ground testing world.

Our membership addresses important technical issues that affect ground testing through several means, including the development of guides and standards, dissemination of information through technical sessions at conferences, and the development and sponsorship of short courses.

The GTTC also participates in Congressional Visits Day, which is a vital tool for making sure that aeronautics and space-related research and testing are supported at required levels.

One of the primary functions of every technical committee is the sponsorship and development of conferences and technical sessions. The GTTC supports two conferences each year. Every January, the GTTC meets at the AIAA Science and Technology Forum and Exposition (AIAA SciTech), where we sponsor several technical sessions. In the summer, the GTTC also attends and sponsors sessions at the AIAA Aviation and Aeronautics Forum and Exposition (AIAA AVIATION).

Best Paper Award

The AIAA Ground Testing Technical Committee hosts sessions in the summer AVIATION and winter SciTech conferences. GTTC annually recognizes several outstanding papers from both the AVIATION and SciTech conferences. These "Outstanding Papers" are reviewed each spring to select one "Best Paper" for the entire year. The recipient(s) of the 2020 Ground Testing Best Paper Award will be recognized during the AIAA awards luncheon held at the 2020 AVIATION conference in Reno, NV.

AIAA Ground Test Award

The Ground Test Award is given to an individual or team that has made significant contributions to the field of ground testing in the aerodynamic and propulsion disciplines during their careers. Recipients are selected based on several criteria including: excellence in technical or managerial ground testing, participation in professional societies, authoring publications and papers, and teaching or mentoring activities. The AIAA Ground Test Award winners were recognized during the AIAA awards luncheon held at the 2019 AVIATION conference in Dallas, TX. The winners for 2019 were:

James Heineck, and **Edward Schairer**, NASA Ames Research Center, Moffett Field, California

"In recognition of outstanding contributions to the areas of optical measurement technique development and implementation, flow visualization, and high-speed photography across the NASA ground test community."

Anyone can submit nominations for the Ground Test Award. Simply login to your AIAA account at http://www.aiaa.org and click "Honors and Awards" to start a new nomination for the Ground Test Award. Nomination packages must be submitted no later than October 1 of a given year to be considered for the following years' Ground Test Award. Please contact Vic Canacci (victor.a.canacci@nasa.gov) for more information.

Focus Groups

The primary function of a focus group is sharing of information within the ground-test community. Focus groups typically meet twice a year at AIAA conferences where members exchange of ideas, lessons learned, and build technical knowledge.

Current GTTC Focus Groups

- US Industry Test Facilities
- Statistically Defensible Test Methods
- Turbine Engine Test
- Dynamics Space Simulation

Active Working Groups

GTTC working groups are established to address technical needs in the aerospace ground testing community. These provide a forum for discussion and the development of solutions and standardization in technical areas. Members include GTTC, non-GTTC, and non-AIAA industry and academia experts. Anyone interested in these working groups are encouraged to attend the meetings. See the end of the newsletter for meeting rooms and times. The active GTTC Working Groups include:

Dual Flow Reference Nozzle

Chair: David Myren - ASE FluiDyne
Vice-Chair: Kevin Mikkelsen - ASE FluiDyne

Develop a recommended practice AIAA document for defining a standard configuration for dual flow reference nozzles.

Future of Ground Testing

Chair: Steven Dunn – NASA Langley
Vice-Chair: John Micol – NASA Langley

Develop a roadmap for non-engineers demonstrating the importance of experimental and computational tools necessary to support aerospace mission requirements.

Internal Balances Technology II

Chair: Ray Rhew - NASA Langley
Vice-Chair: David Cahill - Sierra Lobo, Inc.

Investigate a wide variety of technical issues associated with the use of internal strain-gage balance technology for wind-tunnel testing.

Model Attitude Measurement

Chair: John Hopf - AEDC
Vice-Chair: Kenneth Toro - NASA Langley

Develop a recommended practice that discusses methods to measure model attitude in wind-tunnel testing.

Model Deformation

Chair: Melissa Rivers - NASA Langley
Vice-Chair:

Develop a recommended practice that discusses methods to measure model deformation and twist in wind-tunnel testing.

Measurement Uncertainty Analysis

Chair: Erin Hubbard - NASA Glenn
Vice-Chair: Tyler McElroy - NASA Glenn

Develop best practices and/or standards for the measurement and reporting of experimental uncertainty associated with wind-tunnel testing.

Wind Tunnel Flow Quality

Chair: Ben Mills - AEDC
Vice-Chair: Rajan Kumar - Florida State Univ.

Develop best practices and/or standards for the measurement and reporting of unsteady or fluctuating flow parameters related to wind-tunnel testing.

High Speed WT Calibration

Chair: Matt Rhode - NASA Langley
Vice-Chair: Mike Mills

Develop a recommended practice AIAA document for the calibration of high speed (supersonic and higher) wind tunnels.

Technical Writing Qualities

Chair: Pat Goulding II - AEDC NFAC
Vice-Chair:

Improve the quality of technical publications to be of the greatest possible utility to the various ground test communities.

GTTC Task Subcommittees

Task Subcommittees (SC) are comprised of current GTTC members and are responsible for most of the duties necessary to operate the GTTC each year. This includes planning conference sessions, awarding outstanding papers and workers in the field of ground testing with nationally recognized awards, maintaining and generating new publication materials, recruiting and appointing new members, and coordinating student outreach and educational activities.

GTTC Steering Committee

Chair: Victor Canacci – Jacobs, GRC
Vice-Chair: Stephanie Simerly – NASA Glenn
Secretary: Ryan Kew – Calspan FMS

The Steering committee provides the bulk of the administrative efforts for the GTTC. The Steering committee reviews policy, AIAA business and all matters of global interest to the GTTC. The Steering committee is composed of the GTTC chair and vice-chair as well as the Primary and Tasks subcommittee chairs and vice-chairs.

Awards and Upgrades

Chair: John Micol - NASA Langley
Vice-Chair:

The Awards and Upgrades Subcommittee coordinates and participates in the selection process for the annual Ground Testing Award presented by AIAA for outstanding achievement in the ground testing field. The committee also manages the Outstanding Paper Award process that recognizes the technical quality, relevance, presentation, and readability of papers presented at the various GTTC sessions.

Conferences

Chair: Pat Goulding II – AEDC NFAC
Vice-Chair:

The Conference Planning Subcommittee plans and organizes GTTC conferences and sponsored sessions for the annual SciTech forum in the winter and the AVIATION forum in the summer. Activities include electing conference chairs, selecting session chairpersons, planning the conference program and the site meeting rooms, preparing the Call for Papers, and planning of coordinated short courses, tours, luncheons, and special exhibits.

Education and Student Activities

Chair: John VanHorn – NASA Ames
Vice-Chair:

The Education and Student Activities Subcommittee encourages interaction between GTTC members and their local schools. New ideas for experiments and/or testing kits for students who want to learn about flight and aviation are always needed.

Membership

Chair: Stephanie Simerly - Jacobs, GRC
Vice-Chair: Ryan Kew – Calspan FMS

The Membership Subcommittee, which is comprised of the vice chair of the GTTC and the vice-chairs of the Aerodynamics and Propulsion subcommittees, strives to provide a balance in the technical background and represented organizations when reviewing applications for new members. Selected new members are notified in March. Applicants who are not selected in the year that they apply are eligible for consideration the following year.

Publications

Chair: David Chan – NASA Langley
Vice-Chair: Bob Griffiths – AeroTEC

The Publications Subcommittee promotes the efforts of the various GTTC subcommittees through dissemination and publication of technical information, journal articles, and use of other forms of media. In addition to the annual Aerospace America Highlights article, the committee is responsible for preparing the GTTC newsletter and maintaining the technical committee's web site. Ground-testing-related articles and news items for use in Aerospace

America Highlights and the GTTC newsletter are solicited from current and former GTTC members and others in the ground testing community.

Standards

Chair: Chris Jorgens – Boeing
Vice-Chair: Brianne Williams – Aerospace Corp.

The Standards Subcommittee oversees the AIAA standards, recommended practices, and guides that are created and maintained by the GTTC. Activities include working to get documents approved and published by AIAA and determining when a document is in need of updates.

AIAA Standards, Recommended Practices, and Guides Published by the GTTC

AIAA Recommended Practice for Wind Tunnel Testing — Part 1 (R-092-1-2003e)

AIAA Recommended Practice for Wind Tunnel Testing — Part 2 (R-092-2-2003e)

AIAA Recommended Practice for Calibration and Use of Internal Strain-Gage Balances with Application to Wind Tunnel Testing (R-091-2 003e)

AIAA Recommended Practice for the Calibration of Subsonic and Transonic Wind Tunnels (R-093-2003e)

Assessment of Experimental Uncertainty with Application to Wind Tunnel Testing (S-071A-1999e)

AIAA Guide to Assessing Experimental Uncertainty — Supplement to S-071A-1999 (G-045-2003e)

AIAA Guide to Nomenclature and Axis Systems for Aerodynamic Wind Tunnel Testing (G-129-2012e)

Considerations for First Flight of a Prototype Electric Aircraft

By: Joshua Esfeld, AeroTEC, Inc.

Submitted by : Bob Griffiths, AeroTEC, Inc.

The world is rapidly trending away from dependence of fossil fuels towards utilizing alternate means of powering vehicles in more environmentally friendly ways. To contribute towards this effort, AeroTEC is retrofitting a Cessna Caravan 208B with both a MagniX magni500 electric motor and lithium ion batteries as an Electric Aircraft Flying Test Bed (the eCaravan FTB), to complete development of and certify the motor and electric powertrain.

The MagniX magni500 3 phase electric motor (courtesy of MagniX)

Extensive rig testing is already underway at MagniX's facility in Gold Coast, Australia, immediately followed by a series of full system integration ground tests to be conducted at AeroTEC's test facility in Moses Lake, Washington in early 2020. The ground testing campaign will serve as a buildup to first flight in order to verify the newly installed system functionalities, interfaces and failure modes, as well as to systematically expand the on-ground capabilities of the eCaravan via low speed and high-speed taxi tests.

Preparing for first flight of such a unique prototype aircraft with a non-traditional electric propulsion system involves a highly disciplined approach of planning, modeling and analysis to ensure the flying vehicle performs successfully with adequate levels of safety and reliability. To aid with this effort, an electric powertrain modeling tool is being developed by utilizing aerodynamic models of the airframe and propeller, as well as electric motor, inverter and battery performance data.

The tool will output expected vehicle performance (e.g. range and endurance) to support test planning, electric powertrain characteristics (e.g. battery temperature profile) that will contribute to analysis for the safety of flight determination along with justifying the creation of operational limitations for first flight.

The eCaravan FTB prior to its modification with the electric powertrain (courtesy of AeroTEC and MagniX)

First flight of the eCaravan is planned for 2020. Following first flight, the program will expand the flight envelope of the FTB and conduct the analysis and testing necessary for a Supplemental Type Certification (STC) of the MagniX Electric Propulsion Unit (EPU).

Beyond this program, the eCaravan will be reconfigurable to perform as a versatile FTB, able to accommodate a wide range of emerging technologies.

Wind Tunnel Testing Completed on the Langley Aerodrome No. 8 (LA-8) Urban Air Mobility Technology Testbed

By: David North, NASA Langley

Submitted by : Ray Rhew, NASA Langley

Wind tunnel testing has been completed on the Langley Aerodrome No. 8 (LA-8) Urban Air Mobility Technology Testbed. The LA-8, a tandem tilt-wing electric VTOL with distributed electric propulsion, is the first in a series of planned wind tunnel and flight models that will be used to investigate new technologies and test techniques for Urban Air Mobility.

The modular design of LA-8 allows the model to be easily reconfigured to investigate alternate aircraft types like tilt-rotors, lift + cruise, and extreme short takeoff and landing aircraft. The wind tunnel testing used a Design of Experiments (DOE) approach to fully characterize the aerodynamics of the vehicle in all flight modes from hover to wing-borne flight including all wing angles during transitional flight.

Free flight testing of the vehicle has begun with hover testing and will soon be moving into transition testing. The focus of free flight testing will be on the development of robust transitional flight control and off-nominal flight control.


The LA-8 model in the NASA Langley 12-Foot Low Speed Tunnel

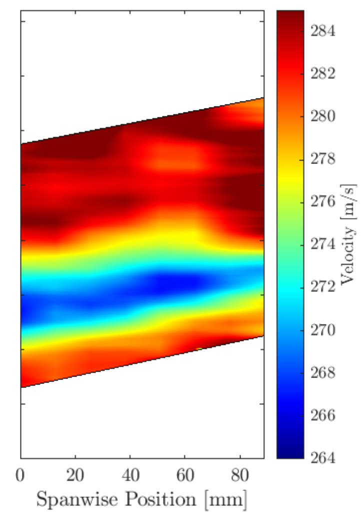
Pulsed Laser Beam Measurement System Implemented in NASA Langley's National Transonic Facility (NTF)

By: Daniel Reese and Paul Danehy, NASA Langley

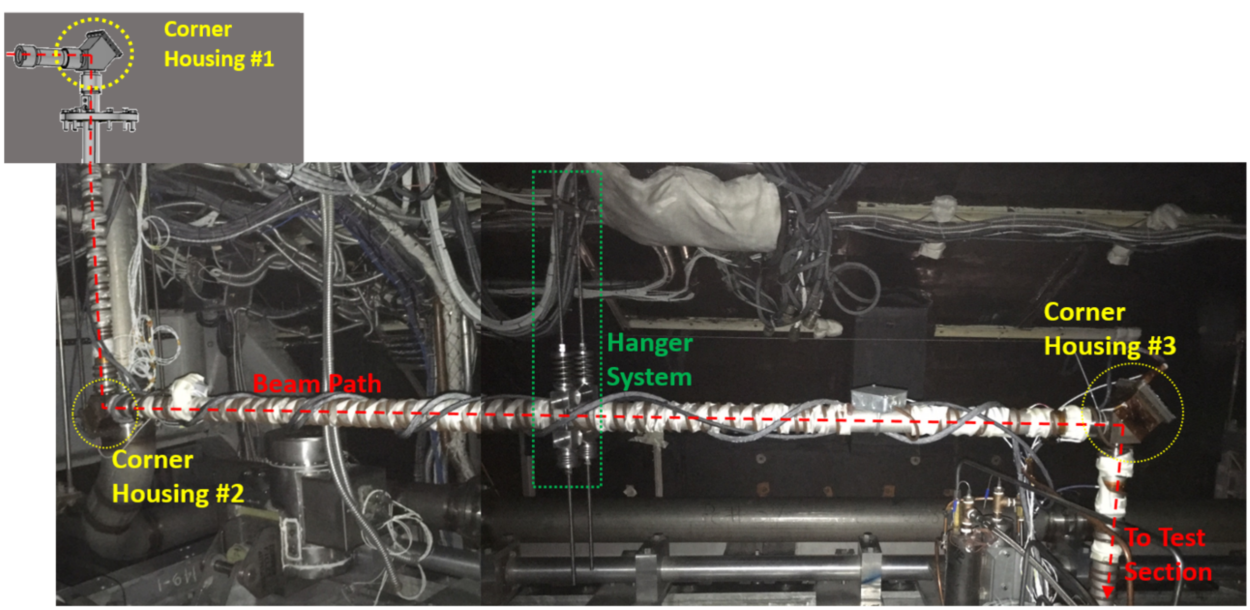
Researchers at NASA Langley Research Center, in collaboration with Spectral Energies LLC, have developed a new diagnostic tool for measuring gas velocity and density in the National Transonic Facility (NTF).

A laser beam delivery system has been implemented to provide velocity measurements at high-pressure, cryogenic conditions using the femtosecond laser electronic excitation tagging (FLEET) technique. Density can be measured from Rayleigh scattering using the same laser and camera. The first application of the new laser delivery system afforded velocity measurements in the freestream ahead of a survey rake, and showed measurements using this technique to be in agreement with those provided by the tunnel data acquisition system.

During a second entry, modifications to the system hardware provided the ability to scan the location of the laser, yielding two dimensional velocimetry in the wake of the Common Research Model (CRM) wing. With minor additions and adjustments, the newly-implemented laser beam delivery system will allow for a number of laser diagnostic techniques, ultimately providing multi-parameter measurements of the flow. Current efforts include ruggedizing the system to allow measurements under full cryogenic conditions (-250 degrees F) and high pressure (>100 psi).



Two dimensional FLEET velocity map obtained using the LPS



Laser penetration system (LPS) setup at the NTF

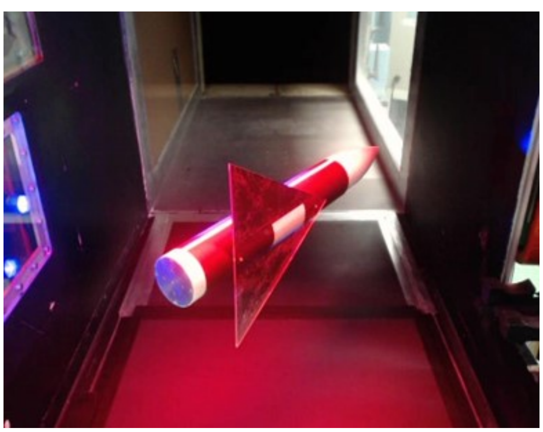
Newly Developed Magnetic Suspension and Balance System (MSBS) Capable of Suspending Aircraft Models at a High Angle of Attack of 36 degrees

By: Hiroki Sugiura, JAXA

Submitted by : Shinji Nagai, JAXA

JAXA (the Japan Aerospace Exploration Agency) has developed a magnetic suspension and balance system (MSBS) that eliminates the need for a physical model support. The MSBS avoids interference due to supports in wind tunnel tests, revealing the true aerodynamic characteristics of the model, especially at high angles of attack (AOA) and for large-scale separated flows.

JAXA succeeded in demonstrating the world's first 6-degree-of-freedom (6-DOF) force measurement of an aircraft model at a 36-deg AOA in a 20-m/sec airflow while levitating the delta-winged model in a 60 x 60-cm low-speed wind tunnel, practically doubling the previous 6-DOF measurement record of 15 deg AOA.

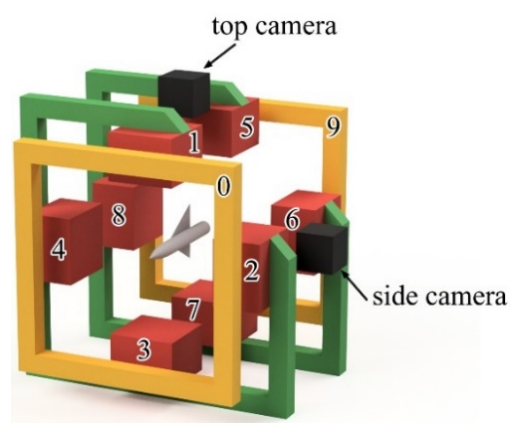


A magnetically levitated delta winged model at 36-deg AOA in 20-m/sec airflow (The model was rotated 90 degrees axially).

This was accomplished by developing and installing a new position sensing system that can continuously detect the model's position and attitude within the AOA range of ±40 degrees. The new sensing system uses a pair of 2-dimensional CMOS (complementary metal-oxide semiconductor) image sensors and utilizes a newly-developed position sensing algorithm.

In order to measure dynamic stability derivatives of the model, the model was forced to oscillate in pitch direction by varying the target value of the PID control system in a sinusoidal manner. The amplitude was set from ±1 to ±6 degrees.

The 60 cm high-AOA MSBS is incorporated in the test section of the tunnel. The MSBS can stably suspend a model and control its position and attitude using a feedback control system. The coil arrangement of the 60 cm high-AOA MSBS is shown in the figure below. The air flows through coil #0 to coil #9. Six force components can be measured simultaneously using the MSBS by calculating from coil currents needed for the levitation.



Coil arrangement of the 60 cm high-AOA MSBS

Further details will be given in session: APA-37, Unsteady Aerodynamics II, January 9, 2020 from 2:00 to 5:00 PM.

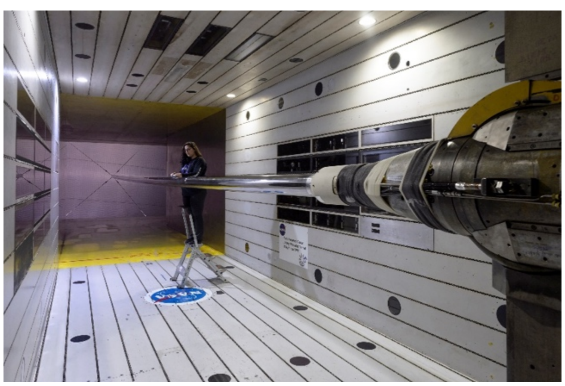
Calibration of the 11-By 11-Foot Transonic Wind Tunnel at NASA Ames Research Center

By Bethany White, NASA Ames

Submitted by Eric Paciano, NASA Ames

A static pipe calibration characterizing the streamwise static pressure distribution was conducted at the 11-By 11-Foot Transonic Wind Tunnel at NASA Ames Research Center. This data is used to determine the local Mach number within the test section and evaluate buoyancy corrections to axial force measurements.

The 60 foot long, 6 inch diameter pipe contained 444 static pressure taps spanning the test section and nozzle regions of the tunnel. The forward end of the pipe extends into the settling chamber and is held by four cables mounting to the tunnel shell, and the aft end is fixed on the institutional model support system. A hydraulic cylinder at the aft end of the pipe provides tension on the system to reduce vibration and to keep the pipe as level as possible throughout the test section.



60-foot long static pipe installed in 11'x11' test section at NASA Ames UPWT

The previous calibration was improved upon by using pressure scanners with greater accuracy, ensuring a uniform pressure tube length for each tap to control pneumatic lag, optically tracking any streamwise movement of the pipe, and more tightly controlling the tunnel condition set points. Typically, this calibration is conducted with the pipe on tunnel centerline and 33 inches below centerline for sting-mounted models and semi-span (i.e. floor-mounted) models respectively, however schedule demands permitted only the centerline calibration. The semi-span calibration is planned to be completed in the summer of 2020.

Immediately following the static pipe calibration, a shorter, 9 foot static pipe used as the calibration check standard was installed to obtain its first post-calibration pressure dataset. This short static pipe consists of 148 static pressure taps distributed along the pipe section and one total pressure tap at the end of an ogive nose.

9-foot short static pipe used for calibration check standard testing

Performing the calibration test and its check standard back-to-back allows this dataset to establish a reliable baseline for future calibration check standard testing. Over time the use of a calibration check standard offers the ability to assess the stability of the calibration through statistical process control in an efficient and cost-effective manner, thereby potentially increasing the time required between full tunnel calibrations.

Hypervelocity Capabilities Advance to New Highs at AEDC Tunnel 9

By Bradley Hicks, AEDC

Submitted by : C. George Moraru, AEDC

Excerpts taken from full article at https://www.arnold.af.mil/News/Article-Display/Article/1899789/hypervelocity-capabilities-advance-to-new-highs-at-aedc-tunnel-9/

AEDC Hypervelocity Wind Tunnel 9 in White Oak, Maryland, is on the verge of delivering an unprecedented capability. In late April, the team at Tunnel 9 completed an initial shakeout of the Mach 18 system and, later this year, facility engineers are set to begin a full calibration on Mach 18. If successful, this would allow for testing at Mach Numbers never before realized in an AEDC facility.

Researchers have been working for decades to achieve a higher Mach capability, and the desire to attain such Mach Numbers dates back to the inception of Tunnel 9. Initially, Tunnel 9 was only able to deploy Mach 10 and Mach 14 capabilities. It would be some time before the significant leaps in technology needed to eclipse Mach 14 would come around due to a lack of understanding of the physics required to operate at that level.

Around 30 years ago, Dan Marren and John Lafferty worked with Dr. Wayland Griffith from North Carolina State University to research a phenomenon called supercooling, which they believed could be used to relax the need to have the facility heater operate up to 5,000 degrees Fahrenheit to achieve higher Mach Numbers. Marren, Lafferty and Griffith found that the supercooling method worked, though they did not yet have access to the advanced diagnostics needed to verify the flow physics.

Initial risk reduction efforts began in 2014 and focused on the development of three state-of-the-art efforts: a new material for the nozzle, new laser diagnostics to verify the understanding of the flow physics, and a new nozzle contour based on that understanding. This three-year effort leveraged two Small

Rob Hale, engineering technician, left, Parth Kathrotiya, system engineer, center, and Zack Russo, engineering technician, pose with the Mach 18 nozzle at AEDC Hypervelocity Wind Tunnel 9 in White Oak, Maryland. (U.S. Air Force photo by A.J. Spicer) (This image has been altered by obscuring badges for security purposes)

Business Innovation Research programs and investment funds from AEDC to successfully

achieve its goals. Following this risk reduction effort, the team at Tunnel 9 set out in 2017 to achieve Mach 18 capability in three years.

The nozzle design and build, the successful incorporation of the new nozzle throat material, and the diagnostic demonstration all occurred within the three-year timeframe and were completed within budget and on-schedule.

The Tunnel 9 team recently performed the initial calibration using the final Mach 18 hardware. To accomplish this, they aligned the facility to ready it for a test, validated the survival and performance of the new throat design, verified the thermodynamic quality of the test medium, and confirmed the facility flow is of a high quality for future acquisition customers. The full calibration to bring Mach 18 to full operating capability is set to occur in the fall.

AEDC Conducts Wind Tunnel Testing of an Innovative Aerial Refueling System at NFAC

By Chris Nykamp, AEDC NFAC

Excerpts taken from "PMA-201 Demonstrates Small Business Innovation Research (SBIR) Technology to Advance Aerial Refueling"

Arnold Engineering Development Complex (AEDC) recently conducted successful testing of an innovative hose and drogue aerial refueling system in the National Full-Scale Aerodynamics Complex (NFAC) 40- by 80 foot wind tunnel at NASA Ames Research Center in August. The wind tunnel testing was a full-scale demonstration combining two Small Business Innovation Research (SBIR) projects in simulated flight.

The first SBIR project addresses the need to provide a more stable aerial refueling platform so that the receiver aircraft could engage the drogue and receive fuel more safely and efficiently. The Actively Stabilized Refueling Drogue System (ASDRS) developed by Analytical Mechanical Associated (AMA) is a system that is able to counteract disturbances on the aerial refueling drogue in flight.

The ASDRS consists of a pair of aluminum shrouds that can rotate mounted onto the exiting hose end-refueling coupling. On these shrouds are pairs of lift and roll strakes that produce: the lift force to counteract the disturbance and the roll torque needed to generate power that will stored in a system of onboard super-capacitors. A pair of DC motors controlled by an onboard control law system drives the drogue control system. When the

The ASDRS/ORS system under test in the NFAC 40- by 80-foot Wind Tunnel system is not in active mode, the DC motors recharge the super-capacitors.

As a separate SBIR project to support future readiness and reliability of the Aerial Refueling Store (ARS), an innovative instrumentation package is being developed to better monitor system performance. Part of this package is the Optical Reference System (ORS) developed by Coherent Technical Services, Inc. (CTI) which provides real time hose, drogue and receiver position. The ORS consists of a pair of high-resolution cameras, image processing algorithms, and data storage. The ORS is housed in the tanker system and can provide real time drogue and receiver position relative to the tanker aircraft at up to 20 Hz. It is also serves as the perfect drogue position feedback sensor for the ASDRS.

Both the ASDRS and ORS began as two separate Science and Technology efforts in response to two independent needs. Early in CY2019, these two programs began integrating their system performance with the goal of demonstrating integrated system performance, which was successfully tested this last August at AEDC.

The ASDRS/ORS Test team in the NFAC 40- by 80-foot Wind Tunnel, August 2019

"This integrated test effort was a significant milestone for both the Stabilized Drogue (N07-172) and Optical Reference System (N15A-T014) SBIR efforts. The active stabilization results, using the ORS as a feedback sensor, are impressive and show that these technologies have the potential to transform the aerial refueling mission. We look forward to continued development of these items and will look to transition them as part of our Advanced Aerial Refueling Store program." –CAPT John Dougherty, PMA-201 Precision Strike Weapons.

First Successful Test of Shape Memory Alloy Driven Remote Controlled Actuators at the European Transonic Windtunnel (ETW)

By Harald Quix, ETW

The European Transonic Windtunnel (ETW) is Europe's unique testing facility for high Reynolds number testing, enabling the aircraft manufacturers to test their designs at real flight Reynolds and Mach numbers under defined aeroelastic conditions. To achieve the flight Reynolds number test conditions ETW is using the combination of cryogenic temperatures and elevated tunnel pressures.

These conditions are extremely challenging for remote controlled actuators (RCA). The combination of limited space, high loads and the deep cold temperatures as well as the need for robust operation impose restrictions for the actuator selection.

Remote control actuated aileron and outboard spoiler using shape memory alloy technology

However, the possible benefits of avoiding mechanical configuration changes by RCAs is tremendous. Avoiding model transports, warm-up and cool-down times for model conditioning and the time required for the mechanical change itself, would result in a boost of productivity in line with significant cost savings.

ETW and Deharde in cooperation with Boeing adapted the shape memory alloy (SMA) technique for cryogenic wind tunnel tests within the German LuFo V-2 ISL-SMA research project, resulting in a fully instrumented cryogenic half model with three independently controlled model surfaces: an inboard spoiler, an outboard spoiler and the aileron. All three RCA controlled model surfaces were operated successfully under cryogenic conditions, showing the huge potential of the technique and pointing out some areas for future improvements. This first application of SMA-based RCAs in a cryogenic wind tunnel environment at high Reynolds numbers was judged to be completely successful.

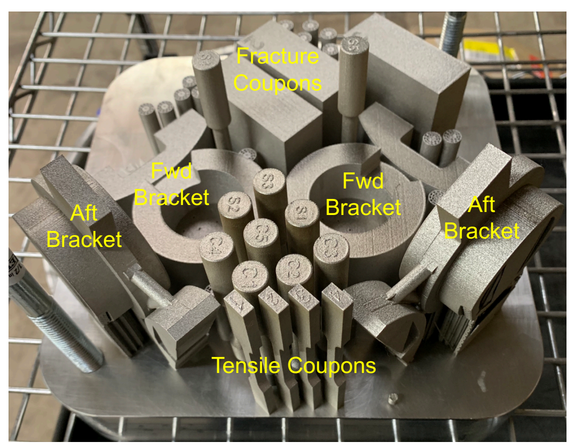
SMA-based RCA spoilers and aileron on a half-span Boeing transport model in ETW

Additive Manufactured Structural Components on a Cryogenic Wind Tunnel Model in the National Transonic Facility

By David Chan, NASA Langley

A cryogenic wind tunnel model of the NASA Space Launch System has been designed to be tested in the National Transonic Facility (NTF) at the NASA Langley Research Center in Hampton, Virginia. One of the design requirements were to measure static pressures on the body and base surfaces of the solid rocket boosters (SRB). In order to pass the pressure flowpaths through the SRB attach brackets while also maintaining geometric fidelity, additive manufacturing using Direct Metal Laser Sintering (DMLS) was required for fabrication of the SRB attach brackets out of Inconel 718 material.

However, since the SRB attach brackets are structural components for the wind tunnel model that are subjected to large loads and cryogenic temperatures during the test, there were increased fabrication and safety requirements for gaining approval to test in the NTF. Additionally, post-fabrication coupon testing and analysis as well as x-ray computed tomography (CT) scans were performed to satisfy the safety requirements of the NTF.



DMLS Inconel 718 wind tunnel model parts and test coupons on same 8 in. x 8 in. build plate

In Memoriam

By Zakery Carr, CUBRC

In Memoriam - Michael S. Holden

Michael S. Holden, Vice President of the Aerosciences/LENS Group at CUBRC and internationally-recognized leader in the field of experimental research and ground testing in supersonic and hypersonic flows, passed away on December 8, 2019.

An AIAA Fellow and recipient of the Ground Test Technical Committee's Ground Test Award in 2011, Holden obtained his Ph.D. from Imperial College and continued a career of experimental research and testing in supersonic and hypersonic flows, authoring over 200 papers in this and related fields.

He has made unique contributions to the field over the past 30 years including the conceptualization and administration the LENS-I, LENS-II, and LENS-XX ground test facilities. Each focus on a segment of supersonic and hypersonic flow regimes where aero-thermal, aero-optical and propulsion research and testing are required to develop advanced high-speed aerospace systems.

Mike's passing represents a great loss to his family, his co-workers at CUBRC, and his colleagues from the ground testing, aerospace, tennis, and ski communities.

Connect with the GTTC

Use a QR code reader on your smart phone to quickly find us on the web.

https://engage.aiaa.org/communities/community-home?communitykey=902ba656-6f6b-419f-98fc-63533d2db28e&tab=groupdetails

http://www.linkedin.com/groups/AIAA-Ground-Testing-Technical-Committee-3742186/about

Ground Testing Technical Paper Sessions
AIAA SciTech Forum 2020

Monday January 6, 2020

GT-01: Test Measurement Techniques and Applications in Wind Tunnel Facilities
Chair: S. Simerly **Co-Chair:** T. Wayman
9:30 AM - 11:00 AM; Bayhill 24

GT-02: Modeling and Simulation of Wind Tunnel Experiments
Chair: E. Hubbard **Co-Chair:** D. Myren
2:00 PM - 3:30 PM; Bayhill 24

Tuesday January 7, 2020

GT-03. Advancement in High-Enthalpy and High-Temperature Shock Tube Facilities
Chair: C. Morris **Co-Chair:** M. Rivers
9:30 AM - 11:30 AM; Bayhill 24

Wednesday January 8, 2020

GT-05. NPAT Mini-Facilities User Meeting (Mini-FUM)
Chair: S. Helland **Co-Chair:** J. Balding
9:30 AM - 1:00 PM; Plaza Ballroom E

GT-06: Novel Facility Development, Improvement, and Characterization
Chair: R. Schmit **Co-Chair:** P. Goulding II
2:30 PM - 4:30 PM; Bayhill 24

Thursday January 9, 2020

GT-07: High Reynolds Number Aerodynamics and Testing
Chair: H. Quix **Co-Chair**: M. Wright
9:30 AM - 12:00 PM; Bayhill 24

CASE-04/GT-04. Future Workforce Development in Complex Aerospace Systems
Chair: S. Dunn **Co-Chair:**
9:30 AM - 11:30 AM; Plaza Ballroom E

GT-08. Transforming Ground and Flight Testing through Digital Engineering
Chair: Kraft **Co-Chair:**
2:00 PM - 5:00 PM; Plaza Ballroom E

GTTC Working Groups and Focus Groups
AIAA SciTech Forum 2020

GTTC working groups (WG) and focus groups (FG) are **OPEN** to anyone with an interest in the group topic. GTTC membership is NOT required to attend and participate in meetings. All are welcome!

Monday January 6, 2020

GTTC Internal Strain Gauge Balance Working Group
8:00 AM - 10:00 AM; Challenger 40

GTTC Additive Manufacturing Working Group Development
10:00 AM - 12:00 PM; Challenger 40

GTTC Writing Qualities Working Group
1:00 PM - 2:00 PM; Challenger 40

GTTC Model Deformation Working Group
2:00 PM - 4:00 PM; Discovery 43

GTTC Forming an Integration Committee: Aerospace Workforce Development
2:00 PM - 4:00 PM; Winter Park 50

Tuesday January 7, 2020

GTTC Model Attitude Measurement Working Group
8:00 AM - 12:00 PM; Columbia 37

GTTC Working Group Development Part 1: Utilizing CFD to Improve Ground Testing
9:00 AM - 11:00 AM; Discovery 43

GTTC Working Group Development: WT Model Design / Recommended Practices Guide
2:00 PM - 4:00 PM; Discovery 45

GTTC Flow Quality Working Group
2:00 PM - 4:00 PM; Discovery 46

Wednesday January 8, 2020

GTTC High Speed Wind Tunnel Calibration Working Group
8:00 AM - 12:00 PM; Columbia 36

GTTC Future of Ground Test Working Group
9:00 AM - 12:00 PM; Challenger 40

GTTC Dual Flow Reference Nozzle Working Group
9:00 AM - 12:00 PM; Discovery 43

GTTC Uncertainty Standard Working Group
1:00 PM - 4:00 PM; Columbia 36

Thursday January 9, 2020

GTTC Working Group Development Part2: Utilizing CFD to Improve Ground Testing
9:00 AM - 12:00 PM; Columbia 34

GTTC Statistically Defensible Test Methods Focus Group
9:00 AM - 12:00 PM; Boardroom

GTTC Focus Group Development: Dynamics in Internal Strain Gauge Balances
2:00 PM - 4:00 PM; Columbia 35