

Scott E. Munro
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Education

Georgia Institute of Technology, Atlanta, GA 30332

Aerospace Engineering, PhD., May 2002

- Dissertation: *Jet noise of High Aspect-Ratio rectangular nozzles with Application to Pneumatic High-Lift Devices*

Purdue University, West Lafayette, IN 47906

Aeronautics and Astronautics, M. S., December 1996

- Thesis: *Effects Of Elevated Driver-Tube Temperature On The Extent Of Quiet Flow In The Purdue Ludwig Tube*

Aeronautical & Astronautical Engineering, B. S., May 1994

Current Position

Engineering and Technology Dept.
Southern Utah University

Associate Department Chair (July 2017 - Present)

Responsible assisting the Department Chair with administering of academic programs including curriculum proposals, degrees, and articulation agreements. Coordinating and promoting academic proposals, changes, reviews, specialized accreditation, and other academic matters. Planning and executing assessment efforts for ABET accreditation. Determining faculty workloads, course scheduling and space utilization. Approving student submittals such as course substitutions, graduation papers, retroactive enrollments/withdraws, grade appeals, permission forms, etc. Determining needed program resources and preparing budget requests in consultation with program faculty. Ensuring that students are receiving adequate academic and career advising.

Associate Professor of Engineering (July 2015 - Present)

Responsible for teaching courses at the undergraduate level in the Engineering degree program, including course material development (lecture notes, projects, labs, exams, etc.), instruction, and additional interaction with students to achieve the learning goals of the course. Course topics include: Engineering in the 21st Century, Statics, Dynamics, Applied Statics and Strength of Materials, Fluids, Senior capstone, Vibrations and Technical Project Management. Additionally, responsible for assembling material relevant to ensuring the ABET accreditation of the program. Member of the department curriculum committee, responsible for ensuring the curriculum meets the requirements of ABET and provides the students with the skills necessary to be successfully employed in engineering positions after graduation.

Professional Experience

Research Department

NAVAIR Weapons Division, China Lake, CA 93555

Aerospace Engineer (Mar. 2002 - July 2015)

- *Deputy Director, Irregular Warfare Technology Office (IWTO) (Feb. 2014 – July 2015)*

Responsible for day-to-day management of IWTO projects, including monitoring technical, financial and schedule progress. Act as Chief Engineer for the IWTO, ensuring projects are making adequate technical progress and have acceptable risk, and assist project leads in developing a tailored systems engineering process for each IWTO project (providing systems engineering fundamentals without overburdening small projects). Provide support to the IWTO Director, developing IWTO overview materials, sponsor development and project planning.

Command Program Manager for Advanced Technology Integration Office (ATIO) (Feb. 2011 – July 2015)

Program manager for all ATIO tasks executing at NAWCWD. Primary responsibility is to coordinate all tasks to ensure adequate resources and technical support are available for various efforts. Support the Navy program manager in project planning (funding, technical scope, and execution) for future efforts. The Command PM is responsible for monitoring all local efforts and ensuring they are conducted appropriately (financial, technical and schedule).

- *Chief Engineer, Counter-Air Future Naval Capability (CA FNC) Program (Aug. 2010 – December 2013)*

CA FNC is a technology development program to develop an advanced solid propulsion motor for counter-air missiles. The program plans to demonstrate motor performance (propellant and nozzle), and develop a composite case design suitable for transition. The Chief Engineer is responsible for day-to-day execution, including supervision of tasks executed by the Government (propellant development) and Contractor efforts (composite case and nozzle). Tasking includes leading the government/contractor team, including reviews, tiger-team management, and is lead technical POC between contractor and government. The Chief Engineer also reports directly to the principle investigator (PI) and is responsible for conducting all program reviews including the PDR, CDR and other program meetings. The Chief Engineer provides input to the PI and sponsor relative to technical progress, risk, budget and schedule.

- *Deputy Project Manager, Navy Jet Noise Reduction Project (Aug. 2009 – Aug. 2010)*

Deputy to Project Manager at the Office of Naval Research is the senior technical representative involved in details of the program execution and interfaces with the top level management for program planning. Responsible for project planning and execution, including; budget and submission to the POM process for funding, oversight of all activities in the project (basic research efforts, technology development activities and transition of successful technologies to the fleet), and providing technical guidance to the PM. Responsible for reporting to senior management and other leadership within the Navy and DoD. Led task to develop a Military Standard for the measurement of jet noise for tactical aircraft (ANSI/ASA S12.75-2012).

- *In-house Laboratory Independent Research and Independent Applied Research Program Manager (Jan. 2009– July 2015)*

Program manager (PM) for in-house basic research programs at NAWCWD. Responsible for setting the program calendar, proposal call, proposal evaluation, mid-year and final reviews, and yearly program plan. PM interfaces with the principle investigators for individual projects to monitor progress, ensure deliverables and metrics are being met and provides guidance for transition of the project to higher maturity. PM publishes call for proposals, oversees the proposal submission process, coordinates the evaluation of proposals and makes final program plan for each year based on the proposal review panel recommendations, budget, and alignment with NAWCWD technology goals. ILIR/IAR PM is responsible for reporting program progress to the sponsor at ONR and NAWCWD management, and supporting technology transition opportunities for individual projects with potential sponsors.

- *Air Vehicle, Integration, and Performance Lead, RATTLRS Program (Aug. 2002 – Aug. 2010)*

Government lead for the air vehicle for the Revolutionary Approach To Time-critical Long Range Strike (RATTLRS) program. Tasking included leading the government air vehicle team to support the prime contractor including, reviews, tiger-team management, lead technical POC between contractor and government, management of the government technical team budget (~ \$1.5M/yr). Reported to program Chief Engineer and supported all program reviews including the PDR, CDR and other program meetings. Led “Air Vehicle” source selection team during the competitive phase. Led the airframe team as part of an initial program study determine program structure, schedule and goal development.

- *Project Lead for Advanced Technology Integration Office (ATIO) (Dec. 2007 – July 2015)*

Project lead for technology effort under the ATIO. The primary responsibility is to provide technical direction to the project as a whole as well as for individual contractors working under the project. In addition, the project lead supports the program manager in project planning (funding, technical scope, and execution) and execution of current projects. The project lead serves as the lead government technical expert for the area as well as contracting officer’s representative (COR) on contracts under the project and is responsible for monitoring the contractor’s progress (financial, technical and schedule) and supporting technology concept testing.

- *NAWCWD Acoustics S&T Lead (Oct. 2006 – July 2015)*

Local lead for acoustics technology efforts. Includes supporting a variety of technology efforts to assist the warfighter. Tasking includes coordinating the efforts of the NAWCWD acoustic test team, such as test planning, execution, data analysis and technical oversight. Responsible for improving the acoustic capability at NAWCWD and pursuing external funding to support the acoustics team. Additional tasking includes program consultant for requirements definition, acoustic testing methodology and noise reduction. Recognized acoustics expert within the Navy. Participated in solicitation drafting and proposal evaluation for multiple DoD entities.

- *Air Vehicle Engineer, 1/2 knot Program (Oct. 2002 – May 2005)*

Coordinated and led team in design and development of concept demonstration vehicle. Consisted of budget management to design and develop a small vehicle through flight demonstration. 1st year demonstration was with remote control, second year demonstration included launch simulation and integration of seeker and autopilot for full mission simulation. Other tasks included coordination with other program elements (seeker, controls, etc.), reports to program management and sponsor, and program planning for additional phases.

- *Other Experience*

Proficient in FORTRAN, MATLAB and Visual BASIC.

Collected/analyzed acoustic data as part of solid rocket propulsion research, UAV acoustic testing and other weapons fly-over testing

Developed proposed budgets, schedules and program structure for various potential programs

Written and submitted SBIR, MURI and BAA topics for release for bids and proposals. Have participated in evaluating proposals as a Navy Subject Matter Expert (SME) and/or evaluation team lead in acoustics/jet-noise, high-speed flight, UAV technologies, propulsion technology (from ~\$50k to > \$100M).

Technical POC for 5 Small Business Innovative Research (SBIR) programs.

As part of above topics have managed teams of 4 to 25 technical personnel, including budgeting for time, scoping tasks, overseeing task completion, coordination with contractor team, reviewing the technical results and reporting to program management.

Additional Academic Experience

Embry Riddle Aeronautical University, World Wide Campus China Lake, CA

Adjunct Assistant Professor (Dec. 2009 - July 2015)

- *Instructor for "Aerodynamics" (non-engineering)*

Based on the university guidance relative to the course learning objectives, responsible for developing lecture material, homework, projects and tests and conducting the course. Instructed students in aerodynamic related topics including atmospheric properties, aerodynamic forces, various flow types, evaluated detailed performance related parameters and their affects on aircraft performance.

Duties: Developed lecture material, homework assignments, tests and other projects based on broad learning objectives. Conducted classes, and responsible for all related administrative duties required relative to the course.

- *Instructor for Senior Level Capstone Course*

Based on the university guidance relative to the course learning objectives, students are required to select a topic and develop a project paper that envelopes the program objectives for their major. The instructor guides the students in topic selection and development of a proposal for the project. The instructor assists the students as necessary during the completion of the project and grades the final papers and presentations submitted at the end of the term.

Duties: Assist students in topic selection, topic proposal development and provide guidance to students throughout the project. Responsible for grading final projects and evaluating student presentations on the projects.

- *Instructor for Master's Degree Capstone Course*

Based on the university guidance relative to the course learning objectives, students are required to select a topic and develop a project paper that envelopes the program objectives for their major. The instructor guides the students in topic selection and development of a proposal for the project. The instructor assists

the students as necessary during the completion of the project and grades the final papers and presentations submitted at the end of the term.

Duties: Assist students in topic selection, topic proposal development and provide guidance to students throughout the project. Responsible for grading final projects and evaluating student presentations on the projects.

Instructor for 100 level Physics Course

Based on the university guidance relative to the course learning objectives, responsible for developing lecture material, homework, projects and tests and conducting the course. Instructed students in basic physics concepts, including; 1-d and 2-d motion, forces, energy, work and momentum, optics, kinetic theory.

Duties: Developed lecture material, homework assignments, tests and other projects based on broad learning objectives. Conducted classes, and responsible for all related administrative duties required relative to the course.

Instructor for graduate level "Research Methods" Course

Based on the university guidance relative to the course learning objectives, responsible for developing lecture material, homework, projects and tests and conducting the course. Course material covers basic research definition, components of research, types of research, common issues encountered when conducting research. Students are assigned various assignments related to research including writing research questions and hypotheses, identification of ethical issues in research topics, outlining a research effort and writing a proposal for a research project.

Duties: Developed lecture material, homework assignments, tests and other projects based on broad learning objectives. Conducted classes, and responsible for all related administrative duties required relative to the course.

Immanuel Christian School

Ridgecrest, CA

Faculty (Volunteer) (Aug. 2010 - June 2011, Aug. 2012 - June 2013)

- Instructor for "Physics"

Developed course material (lecture notes, homework assignments, projects, tests, etc.) for year-long high-school level physics course (non-calculus). Instructed students on various topics, including kinematics, Newton's laws, rotational motion, and conservation of energy related to motion. Also covered fluids, waves and sound and kinetic theory.

Duties: Developed lecture material, homework assignments, tests and other projects. Conducted classes, and responsible for all related administrative duties required relative to the course

Previous Work Experience (prior to Phd)

Georgia Tech Research Institute (GTRI), Cobb County Facility

Georgia Institute of Technology, Atlanta, GA 30332

Graduate Research Assistant (Oct. 1996 – Mar. 2002)

- High Lift System Noise Reduction Study

Direct comparison of the acoustic emissions of two different high-lift devices.

Duties: Set-up of instrumentation and models, operation of tunnel and data acquisition, post-processing of data into a presentation format, and final write-up of data and results.

- High Aspect Ratio Rectangular Jet Noise Study

Study of acoustic characteristics of jet noise associated with extremely high aspect ratio nozzles.

Duties: Design of nozzle system, set-up of pressure and acoustic instrumentation, data acquisition, post-processing of data into a format for presentation and publication.

- Cutting Torch Technology

Implementing new technology to improve the safety and reliability of acetylene cutting torches.

Duties: Participation in development of technology applications, assisted in designing and building prototype devices, assisted in acquisition of supporting data, presentations and discussions with sponsor, day-to-day supervision of co-operative education students working on project.

- Liner Technology CFD Validation

Acquired database of acoustic data for validating CFD codes for acoustic liner performance prediction.

Duties: Acquisition of experimental acoustic data at different velocity and flow duct configurations, post-processing of data into a form suitable for use by the CFD, assisted in write-up and final presentation of data to sponsor.

- Navy Engine Test Cell Re-Design

Provided technical advice and supporting flow and acoustic data for modification of engine test facility.

Duties: Set-up of model and instrumentation, acquisition of flow and acoustic data, implemented design ideas on the scale model, assisted in final report write-up, and interaction with sponsor.

-Resonant Liner Properties Measurements in the Presence of Duct-Flow

Acquired acoustic data for several resonant liner designs using the in-situ technique.

Duties: Acquisition of acoustic data, post-processing of data and calculation of liner characteristics.

-Other Experience

Supervised student pursuing master's degree and undergraduate students.

Duties: Provided day-to-day advice and guidance on research activities and thesis composition.

Supervised the day-to-day activities of undergraduate students assisting on various projects.

Provided guidance and assistance in accomplishing tasks associated with the project on a day-to-day level.

Key Skills: Extensive use of microphones, pressure sensors, hot-wires and thermocouples, including set-up, data acquisition, and data reduction. Proficient in Matlab and Fortran coding.

School of Aeronautics and Astronautics, Purdue University

West Lafayette, IN 47906

Research Assistant (Aug. 1994 - Sept. 1996)

- Development and validation of heating system for Purdue Ludwig Tube.

Development and installation of heating system elements, initial tests of heating system, and a study of the effects of heated flow on the flow quality in the facility.

Duties: Design and installation of heating system, set-up and shake down of the system, set-up of instrumentation used in flow quality study, acquisition of flow data, post-processing of data and presentation and write-up of results and heating system user's manual.

Key Skills: Extensive use of constant-current anemometer, Kulite fast response pressure transducers, Matlab.

NASA Dryden Flight Research Center

Edwards, CA

PRC Inc. Summer Intern (located at Dryden FRC) (May. 1994 –Aug. 1994)

- Wrote computer programs to reduce raw flight pressure data for Flight Test Fixture- II.

- Designed bracket for cockpit mounting of a camera monitor, including drawings for fabrication.

Co-operative education engineering position, NASA (Aug. 1990- Aug. 1993)

Aerodynamics Branch (1/93-8/93)

- Completed Moment and dynamic lift study on X-31 EFM aircraft from flight data.

- Managed flight of a remotely controlled research model, including flight readiness briefings, scheduling, and coordination with Air Force for air space.

Aero-structures Branch (5/92-8/92), (8/91-12/91)

- Modeled and performed initial finite element stress analysis on vane hinge lug for F-18 High Alpha Research Vehicle. Extensive use of PATRAN and COSMOS/M.

- Analyzed infrared images of F-18 High Alpha Research Vehicle to obtain temperature map of the thrust vectoring vanes. Involved extensive FORTRAN programming.

Aerodynamics Branch (8/90-12/90)

- Modified the controlling program for the automation of the water tunnel. Extensive use of BASIC.

Course Work and Special Skills

Viscous Flow, Laminar-Turbulent Transition, Experimental Aerodynamics, Turbulence, Noise Control, Aeroacoustics, Compressible Flow, High-Speed Aerodynamics. Programming experience in FORTRAN and BASIC as well as extensive use of MATLAB. Familiar with Hot-wire anemometers (hot and cold wire configurations), thermocouples, B & K microphone systems, Kulite fast-response pressure transducers.

Publications

- Sandall, Eric, Kalman Joseph, Quigley, John, Munro, Scott E, and Hedman, Trevor, "A Study of Solid Ramjet Fuel Containing Boron-Magnesium Mixtures," Journal of Propulsion and Power, manuscript submitted January 31, 2017.
- Munro, Scott E, "Teaching an Introductory Engineering Course that also Satisfies a Humanities General Education Requirement," at the 8th Annual First Year Engineering Experience Conference, at The Ohio State University, July 30 – Aug 2, 2016.
- Munro, Scott E, "Assessment and Lessons Learned from Partially Flipping a Statics Course," ASEE Rocky Mountain Regional Conference, Cedar City, Utah, Sept. 29 – 30, 2016.
- Co-author of ANSI/ASA S12.75-2012, "Methods for the Measurement of Noise Emissions from High Performance Military Jet Aircraft."
- Munro, Scott E., Tait, Patrick, and Buck, Pete, "The Revolutionary Approach to Time-Critical Long Range Strike (RATTLRS) Vehicle Integration and Design Challenges and Lessons Learned," AIAA Missile Sciences Conference, Monterey CA, Nov. 2006.
- Munro, Scott E., Krish K. Ahuja and Robert J. Englar, "Noise Reduction Through Circulation Control." Proceedings of the 2004 NASA/ONR Circulation Control Workshop, NASA/CP-2005-213509/PT1, March 2006.
- Munro, Scott E, Ahuja, K. K. "Development of a Prediction Scheme for High Aspect-Ratio Jet Noise." AIAA paper 2003-3255, 9th AIAA/CEAS Aeroacoustics Conference and Exhibit, Hilton Head, South Carolina, May 12-14, 2003.
- Munro, Scott E, Ahuja, K. K. "Fluid Dynamics of a High Aspect-Ratio Jet." AIAA paper 2003-3129, 9th AIAA/CEAS Aeroacoustics Conference and Exhibit, Hilton Head, South Carolina, May 12-14, 2003.
- Munro, Scott E, Ahuja, K. K. "Aeroacoustics of a High Aspect-Ratio Jet." AIAA paper 2003-3323, 9th AIAA/CEAS Aeroacoustics Conference and Exhibit, Hilton Head, South Carolina, May 12-14, 2003.
- Munro, Scott E. "Jet Noise of High Aspect-Ratio Rectangular Nozzles with Application to Pneumatic High-Lift Devices," PhD dissertation, School of Aerospace Engineering, Georgia Institute of Technology, January, 2002.
- Munro, Scott E, Ahuja, K. K., Englar, Robert J. "Noise Reduction Through Circulation Control." AIAA paper 2001-0666, January, 2001.
- K. K. Ahuja, Scott Munro and R. J. Gaeta, Jr., "Flow Duct Data for Validation of Acoustic Liner Codes for Impedance Education," NASA/CR-2000-210634, December 2000.
- Ahuja, K. K., Gaeta, R. J., and Munro, S. E. "Impedance Measurement of Acoustic Liners Exposed to a Grazing Mean Flow," GTRI Report A5777/98-1. (Proprietary information for use of Northrop Grumman Corporation), January, 1998.
- Acoustics and Aerodynamics Branch, "Modeling of Air-Cooled and Water-Cooled Test Cells," GTRI Report A-5366, Contractor Report submitted to Armour Cape and Pond Co. May 1997.

Schneider, Steven P., Munro, Scott E. "Effect of Heating on Quiet Flow in a Mach 4 Ludwig Tube." AIAA Journal, Technical Note, Vol. 36, No. 6, June, 1998.

Munro, Scott E. 1996. Effects of Elevated Driver-Tube Temperature on the Extent of Quiet Flow in the Purdue Ludwig Tube. Master's thesis, School of Aeronautics and Astronautics, Purdue University, December 1996. Defense Technical Information Center (DTIC) AD-A315654.

Schneider, Steven P., Collicott, Steven H., Schmisser, J. D. Ladoon, Dale, Randall, Laura, A., Munro, Scott E., and Salyer, T. R. 1996. Laminar-Turbulent Transition Research in the Purdue Mach-4 Quiet-Flow Ludwig Tube. AIAA Paper 96-2191.

Phd Dissertation Abstract

“Jet noise of High Aspect-Ratio rectangular nozzles with Application to Pneumatic High-Lift Devices”

This study directly compared far-field noise emissions from a state-of-the-art circulation control wing high-lift configuration and a conventional wing configured for high lift. Results indicated that a circulation control wing had a significant acoustic advantage over a conventional wing for identical lift performance. A high aspect-ratio nozzle was fabricated to study the general characteristics of high aspect-ratio jets with aspect ratios from 100 to 3000.

High aspect-ratio nozzle results showed that the jet noise was proportional to the 8th power of the jet velocity. It was also found that the jet noise was proportional to the slot height to the $3/2$ power and slot width to the $1/2$ power. Fluid dynamic experiments were also performed. Single hot-wire experiments indicated that the jet exhaust from the high aspect-ratio nozzle was similar to a 2-d turbulent jet. Two-wire space-correlation measurements were performed to attempt to find a relationship between the slot height of the jet and the length-scale of the flow noise generating turbulence structure. The turbulent eddy convection velocity was also calculated, and was found to vary with the local centerline velocity, and also as a function of the frequency of the eddy.

The high aspect-ratio nozzle and circulation control wing were directly compared in order to apply the knowledge gained from the high aspect-ratio jet experiments. It was determined that the circulation control wing noise data was contaminated by noise generated internal to the wing blowing system, and that there was an even greater potential for airframe noise reduction if internal noise were reduced.

Master's Thesis Abstract

Effects Of Elevated Driver-Tube Temperature On The Extent Of Quiet Flow In The Purdue Ludwig Tube

The purpose of the research was to develop a system to heat the driver air in the Purdue quiet-flow Ludwig tube. This system needed to effectively heat the air while not producing any disturbances that could adversely affect the quiet-flow performance. The baseline quiet-flow Reynolds number was determined to be 400,000. This agrees with previous results. The driver air was heated to 4 different desired temperatures, 100 C, 125 C, 150 C, and 180 C. Measurements were made approximately 10 cm downstream of the onset of uniform flow. The quiet length Reynolds number was found to decrease with increasing temperature. The quiet length Reynolds number dropped to 380,000 and 340,000 at driver air temperatures of 90 C, 140C, respectively. The heating system was able to heat the driver air uniformly, at least for the first second of flow. Thermocouples used to monitor the driver tube temperature were typically 25 C higher than the actual air temperature. A large heat sink to the nozzle from the driver tube prevented the first 0.3 seconds of flow from achieving a uniform temperature. The heater had difficulty maintaining a uniform temperature at 180 C. The heater also caused some problems. Oil appears to condense out of the flow during heated runs. The oil forms a film on all the nozzle surfaces and on the instrumentation inside the tunnel. Heating the driver tube also seems to have increased the deterioration of the paint on the inside surface, requiring increased maintenance of the nozzle-throat.