

Exhibit CS-RH-1

Resume of Ryan Haac



T. RYAN HAAC

Analyst

Ryan Haac adds a diverse skillset to RSG's acoustics and system dynamics team. Ryan's work encompasses the full scope of environmental acoustics, including data measurement, analysis, sound propagation modeling, reporting, and results visualization. In particular, he specializes in the deployment of monitoring systems and the implementation of geospatial sound propagation models to assess environmental noise sources and their acoustical implications in communities.

EXPERIENCE

6 years

EDUCATION

MS, Mechanical Engineering,
Virginia Tech (2010)

BS, Mechanical Engineering,
Virginia Tech (2008)

PROJECT EXPERIENCE

Solar Power Projects

Vermont Solar Farmers Rooftop Array, Vermont. Performed a noise assessment for a proposed solar array on the roof of an industrial building in Manchester, Vermont. Performed sound propagation monitoring for the proposed rooftop solar array based on site plans and publicly available data. Authored a report that was ultimately submitted to the Vermont Public Service Board. (2017)

Solar Farms, Vermont. Provided noise modeling services for several proposed 500 kW ground mounted solar arrays in the state of Vermont. Performed sound propagation modeling of project noise sources to determine worst-case sound levels at nearby residences (2016).

Environmental Noise

Municipal Airport, Rangeley, Maine. Completed the noise study for an Environmental Impact Statement that was prepared to address the implications of a runway expansion at the regional airport. Utilized the FAA's Aviation Environmental Design Tool (AEDT) to model the noise emissions associated with existing operations of the airport and the future projected flight operations. (2017)

Rhino Foods, Vermont. Performed a noise impact assessment for the expansion of the production facility. An inventory of existing sources was collected, and the main sources were measured and modeled to determine the impact of modifying equipment location and building geometry. Recommended practical noise source mitigation through equipment placement and user-built noise barriers. Explored mitigation for



existing sources through manufacturer and aftermarket solutions. (2017)

VTrans Middlebury Airport, Vermont. Performed long-term monitoring and analysis of airport operations to determine community sound levels from the airport and predict the impact of expanded operations. Built and deployed autonomous solar-powered sound level meters for three months to quantify noise in the community attributable to the airport and to specific aircraft events. Built a sound propagation model using the FAA's Integrated Noise Model, which represented the specific conditions and flight patterns at the airport. Prepared a comprehensive presentation for a public meeting to address concerns regarding airport noise. (2015)

Energy Transmission

Green Mountain Power Substation Upgrades and Permitting, Vermont. Performed noise impact assessments and evaluated compliance for permitting of transformer upgrades to several GMP substations in Vermont. Conducted short-term in-situ measurements of existing equipment within the existing substation, quantifying relative sound level differences at residences between the existing and proposed configurations. Summarized monitoring and modeling results reports submitted as part of Vermont's Section 248 permitting process. (2015-current)

VELCO Substation Upgrades and Compliance, Vermont. Performed both long-term and short-term monitoring of VELCO substations in Vermont. Conducted and led short-term measurements of equipment within the existing substation to quantify sound power levels for sound propagation modeling and permit compliance. (2015-current)

Transportation

NCHRP 25-52 Meteorological Effects on Roadway Noise. Led the data processing and analyzation effort for a Transportation Research Board study to assess and convey to the public the effects of meteorology on sound immissions from nearby roadways. The research team deployed a variety of meteorological devices to measure vertical profiles of wind speed and temperature lapse to predict the propagation atmosphere for roadway noise. Assisted in developing a regression model to predict the effects that meteorological measurements at different distances from the roadway were able to describe using only publicly available regional meteorological data. (2016 – 2017)

NCHRP 25-44 Field Evaluation of Reflected Noise from a Single Noise Barrier (Phase 2). Participated in the deployment of sound level monitoring systems in Ohio along interstates with absorptive barriers. Carried the responsibility of and directly oversaw hardware preparation and deployment, including meteorological sensors, sound level meters, traffic cameras, and a speed gun. Prepared and summarized all collected data for analysis. Performed a series of controlled tests to quantify various microphone system effects including microphone orientation and high frequency roll-off, resulting in a correction factor for each microphone that was applied to the data. (2016 – 2017)

Other Relevant Experience

Contracting, Designing, and Building Grid-Tied Residential PV Systems from 3-10kW, Blacksburg, Virginia. Project manager responsible for marketing, system design, job cost estimation, coordinating projects with customers and employees, managing personnel, conducting system commissioning tests, and acting as utility company liaison. (2012–2015)*

Contracting, Designing, and Building Off-Grid Power Systems, Blacksburg, Virginia. Project manager responsible for engaging customers and gauging available resources (solar, wind, hydro). Oversee beginning to end of system process—including monitoring loads, determining power consumption, determining site-specific equipment necessary, procuring/installing equipment, and monitoring production values against predicted. (2012–2015)*

Designing and Building On-Board Sound Intensity Monitor, Blacksburg, Virginia. Concept implementation for wheel-mounted intensity monitoring device for use in measuring tire/pavement interaction noise to the AASHTO standard. Acted as Project Engineer responsible for hardware design, material procurement, construction, tooling, assembly, and equipment testing. (2011–2015)*

Designing and Building a Commercial Wood-Fired Brick Oven, Blacksburg, Virginia. Conducted the research and design process for a hybrid wood-fired oven capable of baking several rounds of bread loaves and for cooking pizzas for large gatherings. Directed the construction of the oven using volunteer labor sourced from friends, community members, and stakeholders. The oven is still in service cooking quality food at 2351 Glade Road. (2011-2012)*

**Work performed prior to joining RSG.*

PUBLICATIONS

Haac, T. R., Corcoran, J. M., Remillieux, M. C., Burdisso, R. A., and Reichard, G. (2009). "Experimental Characterization of the Vibro-Acoustic Response of a Simple Residential Structure to a Simulated Sonic Boom." *15th AIAA/CEAS Aeroacoustics Conference*, Miami, FL, May 11-13, 2009. AIAA 2009-3386.

Haac, T. R., Corcoran, J. M., Remillieux, M. C., Burdisso, R. A., & Reichard, G. (2009). "Development of a Model for Predicting the Transmission of Sonic Booms into Buildings. Part II: Experimental Characterization," Final Project Report for NASA (award number NNX07AT36A), December 2009.

Remillieux, M. C., Corcoran, J. M., Haac, T. R., Burdisso, R. A., & Svensson, U. P. (2012). "Experimental and Numerical Study on the Propagation of Impulsive Sound Around Buildings." *Journal of Applied Acoustics*, October 2012. APAC-D-11-00261.

Remillieux, M. C., Corcoran, J. M., Haac, T. R., Burdisso, R. A., & Reichard, G. (2010). "Vibro-Acoustic Response of a Simplified Residential Structure Exposed to Sonic Booms. Part I: Numerical Model," *Noise-Con (Joint conference with ASA)*, Baltimore, MD, April 19-23, 2010.

Remillieux, M. C., Corcoran, J. M., Haac, T. R., Burdisso, R. A., & Reichard, G. (2010). "Vibro-Acoustic Response of a Simplified Residential Structure Exposed to Sonic Booms. Part II: Experiment Validation," *Noise-Con (Joint conference with ASA)*, Baltimore, MD, April 19-23, 2010.

Remillieux, M. C., Corcoran, J. M., Haac, T. R., Burdisso, R. A., & Reichard, G. (2010). "Output-Only Modal Testing of Simple Residential Structures and Acoustic Cavities Using the Response to a Simulated Sonic Boom and Ambient Excitation," *Noise-Con (Joint conference with ASA)*, Baltimore, MD, April 19-23, 2010.

LICENSES, CERTIFICATIONS, MEMBERSHIPS, AND AFFILIATIONS

- Associate Member, Acoustical Society of America
- Associate Member, Institute of Noise Control Engineering