AOE DEPARTMENT SAFETY REVIEW FORM FOR
EXPERIMENTAL RIGS

In the context of this form 'rig' refers to any potentially hazardous piece of equipment whose safe operation requires more detailed instructions and procedures than can be included in the Experimental Workspace Safety Review form for the area in which the rig is housed. Examples include a wind tunnel, laser system, high pressure tank, material testing machine, rotating system.

Before any such rig in the Department of Aerospace and Ocean Engineering is brought into operation, and **at least once per year** thereafter, a copy of this form must be completed, signed and submitted by the responsible faculty/staff member (usually the principal investigator). When an existing rig undergoes modifications which could affect its safety, a new copy of this form must been submitted by the responsible faculty/staff member at that time, and before it is operated again.

Completed forms should be submitted to the AOE Assistant Department Head for Facilities (Michael Philen) and should also be made available to other faculty/staff with relevant expertise, or with direct involvement in the rig or space where it is housed. Any advice resulting from this interaction should be copied to the Assistant Department Head, as well as being transmitted back to the responsible faculty/staff member. Once the responsible faculty/staff member is satisfied that all safety concerns have been met the final version of the form should be signed and submitted and a copy displayed in a prominent position on or adjacent to the rig and on the department safety website. The responsible faculty/staff member may then authorize its operation. Under no circumstances may a rig be operated without a completed, current copy of this form prominently displayed.

Date of form 7/15/2023 ..... Form expires (no more than 1 year after form date): 7/15/2024 .....

Name of Rig Virginia Tech Stability Wind Tunnel Anechoic System (comprising the anechoic chambers and supports and the acoustic test section). All users of the anechoic system must also adhere to the Stability Wind Tunnel Safety Form .....

Workspace where rig is located Randolph Hall, Stability Wind Tunnel .....
Include room, building and name given to the space on the EHS training website.

Faculty/staff member responsible for the rig and its safety William J Devenport .....

Office Address 660 McBryde Hall ..... Phone 1-4456 ..... Email devenport@vt.edu .....

1. An evaluation of the above rig has been performed and the following safety risks have been identified (append details where necessary):

- **Risk of crushing. Both anechoic chambers and the acoustic test section are heavy (weighing up to 5 tons each). They are also mobile when being installed or removed using the gantry crane system or the air-pad system. There is a risk of crushing from being underneath or in the way of any of the system components when they are being moved.**
- **Fall risk. The anechoic chambers and test section are tall items, particularly when mounted. Climbing on top of, or around the outside of them will place users at risk from falling and resulting injury. During certain maintenance operations gaps may be present between the chambers and test section which may pose a risk from falling. Entering a Kevlar chamber without adequate care may also expose a user to risk from falling.**
- **Risk of injury from Kevlar window failure. The interior of the anechoic chamber segments may be separated from the air flow through the test section by large tensioned Kevlar sheets. Flow through the test section may be as fast as 80m/s and, depending on the models being tested, the Kevlar windows may be placed under substantial load. Failure of a Kevlar window at high speed would place anyone standing inside the chamber at risk for injury from the torn Kevlar and the airflow itself.**

2. The following actions have been taken to minimize those risks (append details where necessary):

The risks described above have been minimized by developing and ensuring adherence to safe operating rules and procedures. These are described in attachment 1.

3. A safe operating procedure has been developed (attach the procedure to this form). This includes protective equipment to be worn, whether users may operate the rig alone and, if necessary, precautions to be taken by others working in the same laboratory. The procedure is in a form suitable for posting on the rig.

See attachment 1

4. Check one and include a list: ☐ *The rig may only be operated by the following individuals.*
☒ *The rig may only be operated under the supervision of the following individuals.*
(List individuals here)

As a general purpose part of the Stability Tunnel facility the anechoic system serves a broad range of users. All users must obtain the advance approval of the wind tunnel director, deputy director, or the wind tunnel engineer before beginning work in the facility, and are only authorized after signing attachment 1.

5. The above individuals are all registered on the EHS training website at https://secure.hosting.vt.edu/www.ehss.vt.edu/training/training_report.php and have taken all appropriate safety training courses. Their training is current and is recorded on the EHS website, under the above workspace name. The appropriate safety courses are (list here):
For faculty, staff, employees, graduate students and undergraduate researchers directly affiliated with the wind tunnel:

- Personal Protective Equipment (PPE) Awareness
- HAZCOM RTK
- Electrical Awareness
- Lockout/Tagout Awareness
- Portable Fire Extinguishers
- Ladder Safety
- Fall Hazard Awareness
- Laser Safety

Other requirements that may be added depending on individual responsibilities include

- Aerial Lift Observation and Training
- First Aid/CPR/AED-Adult
- Lockout/Tagout Authorized Person
- Overhead Crane Observation and Training

Other wind tunnel users include personnel associated with a particular entry. The training requirements for these users depend on the nature and extent of the work they are performing in the facility, and therefore the hazards that they will be exposed to. The determination for the appropriate training will be made by the faculty member responsible for the entry during the planning stages for the work, with the stipulation that the training be completed before the start of the entry.

Signature of faculty/staff member
responsible for workspace and its safety  Date 7/15/23

ATTACHMENT 1
VIRGINIA TECH STABILITY WIND TUNNEL ANECHOIC SYSTEM.
TO BE PROVIDED TO, AND SIGNED BY, ALL USERS

This document describes procedures for users of the Virginia Tech Stability Wind Tunnel. All wind tunnel users must read and sign a copy of this form before beginning work in the wind tunnel. A user is anyone who wishes to enter the wind tunnel facility for the purpose of setting up, performing or assisting with a wind tunnel test.

Safety in the wind tunnel is taken very seriously. This document outlines some identified hazards and procedures that, when followed, my help to reduce risk of injury or damage. Ultimately, however, you the user bear the primary responsibility for your own safety and the safety of others around you.

CONTACT INFORMATION

Wind Tunnel Director: William J. Devenport, devenport@vt.edu, 231 4456
Deputy Director: Aurelien Borgoltz, aurelien@vt.edu, 231 1959
Wind Tunnel Engineer, William P. Oetjens, boetjens@vt.edu, 231 5012

IDENTIFIED SAFETY RISKS

1. Risk of crushing. Both anechoic chambers and the acoustic test section are heavy (weighing up to 5 tons each). They are also mobile when being installed or removed using the gantry crane system or the air-pad system. There is a risk of crushing from being underneath or in the way of any of the system components when they are being moved.
2. Fall risk. The anechoic chambers and test section are tall items, particularly when mounted. Climbing on top of, or around the outside of them will place users at risk from falling and resulting injury. During certain maintenance operations gaps may be present between the chambers and test section which may pose a risk from falling. Entering a Kevlar chamber without adequate care may also expose a user to risk from falling.
3. Risk of injury from Kevlar window failure. The interior of the anechoic chamber segments may be separated from the air flow through the test section by large tensioned Kevlar sheets. Flow through the test section may be as fast as 80m/s and, depending on the models being tested, the Kevlar windows may be placed under substantial load. Failure of a Kevlar window at high speed would place anyone standing inside the chamber at risk for injury from the torn Kevlar and the airflow itself.

GENERAL SAFETY GUIDELINES FOR WORKING WITH THE ANECHOIC SYSTEM

1. Users should take extreme caution when working in the acoustic test section of anechoic chambers. Probes, models, model supports, microphone supports, traverse equipment and other items may pose a hazard if sufficient care is not taken.
2. Any models, equipment or instrumentation mounted in the flow path must be carefully inspected and securely fastened before turning on the fan.
3. Users who bring in their own instrumentation, materials or other items for use in or with the tunnel are solely responsible for ensuring that appropriate safety precautions are taken in the use of these items. The wind tunnel director, deputy director or engineer may deny use of any such item if they feel safety procedures are inadequate.
4. Maintain and organized and clean work area. Access paths should be kept clear. Cables should not be draped across passages. Approved covers must be used for any cables on the floor.
5. If in doubt about the safety of performing any test, using any piece of instrumentation, or undertaking any other wind-tunnel related operation or using any configuration of the anechoic system, DO NOT proceed. No experimental result or setup is worth an injury. Ask for assistance from the Wind Tunnel Engineer.
6. If any component of the anechoic system appears faulty, it is your responsibility to report it immediately to the wind tunnel engineer.
7. Do not dispose of any chemical substance (down the sink, in the trash can or anywhere else). Disposal of such materials will be handled by the wind tunnel engineer. Any chemical spills (however small, e.g. mercury from a thermometer) must be reported to the wind tunnel engineer.
8. It is your responsibility to immediately report all injuries, accidents and "near-misses" that you are aware of to the wind tunnel director or deputy director.

RULES AND RESTRICTIONS WHEN WORKING WITH THE ANECHOIC SYSTEM

1. Only the wind tunnel engineer, the permanent AOE machine shop staff, and the tunnel director may be present during installation or removal of the anechoic system. Other personnel may present only with the explicit authorization of the wind tunnel director.
2. No user may work with the anechoic system (whether operating the facility or not) without a second authorized user present inside the wind tunnel control room.
3. No user may be present in either of the anechoic chambers at test section flow speeds exceeding 30m/s.
4. Users entering or leaving either anechoic chamber segment must use a properly set mobile stair or ladder.
5. No user may be in, or may enter the flow path, when the wind tunnel fan is on. When the fan is off, users may enter the test section but only after placing rubber mats or other protection on the test section floor to protect the flow surface.
6. Models and other equipment may be mounted in the anechoic test section only with the approval of the wind tunnel engineer, the wind tunnel director, or deputy director.

7. No modifications to any anechoic system components may be made without the approval of the wind tunnel engineer, the wind tunnel director, or deputy director.
8. Users may not climb over the outside or on top of the acoustic test section, anechoic chambers or elsewhere where there is a risk of falling.

EXCEPTIONS

Requests for exceptions to the above restrictions will be considered on a case by case basis and only where there is a compelling need. Explicit approval of the wind tunnel director (or, in his absence, the deputy director or wind tunnel engineer) is required for any exception, and will be conditional on additional safety precautions that may include appropriate training and/or use of suitable safety equipment.

ACCESS TO THE FACILITY

1. Access to the control room is regulated using a card swipe system installed on the inner airlock door.
2. A valid HokiePassport or visitor pass is required to gain access to the facility.
3. A valid HokiePassport or visitor pass can be granted access after approval by Dr. William J. Devenport, Dr. Aurelien Borgoltz, or the wind tunnel engineer.
4. Requests for access need to be submitted to the Dr. William J. Devenport, Dr. Aurelien Borgoltz or the wind tunnel engineer.at least a day in advance.
5. Users may not grant access to the wind tunnel to unauthorized personnel without prior approval from Dr. William J. Devenport, Dr. Aurelien Borgoltz or the wind tunnel engineer.

SIGNATURE

I have read and understand all the above risks, rules, restrictions and procedures. I have been provided with a copy of this form

Name of tunnel user_____

Signature _____

Date_____