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 8/29/2023..... Form expires (no more than 1 year after form date): 8/15/2023.....

Name of Rig Class IV Laser Capabilities .....

Workspace where rig is located Corporate Research Center Research Building 2 suite 101 .....
Include room, building and name given to the space on the EHS training website.

Faculty/staff member responsible for the rig and its safety Todd Lowe .....

Office Address McBryde 660A ..... Phone 540.231.7650 ..... Email kelowe@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 injury (corneal or retinal burns, cataract formation, damage to the retina or optical nerve resulting in limited ortotal blindness) to the eyes from exposure to the primary beam, specular reflections or diffuse reflections
•Risk of injury (photosensitive reactions, burns, or excessive dryness of the skin) from exposure to the primary beam,specular reflections or diffuse reflections
•Risk of electrical shock (can result in death) from the laser and associated electrical equipment due to the high level ofvoltage
•Risk of fire from laser beam incident on flammable solvents, gases, or combustible materials
•Risk of injury from explosion (shattering) of the laser target and elements in the optical train
•Risk of rupture of compressed air lines and tanks

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

•Portable laser curtains are available to enclose laser work areas and contain concentrated laser beams.
•Laser safety signs posted on entrances
•Impact tolerant laser safety goggles available outside of the enclosed area
•All users have been assigned safety training which includes laser safety training and vision testing as well as electrical safety

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.

Users should establish and keep standard operating procedures for their individual lasers and setups. These should be reviewed in collaboration with Dr. Lowe, and printed for any Class IV laser use in the lab. Details of the laser in use should be written on the door, and access controls must be in place during use of the Class IV laser.

An example SOP is given below for use of a low-speed stereoscopic PIV system:

The Stereoscopic Particle Image Velocimetry (SPIV) system utilizes a frequency-doubled 532nm wavelength pulsed laser which delivers two pulses of light in rapid succession containing approximately 200 mJ of energy each. Extreme, proficient care must be taken when operating this laser, as severe injury, particularly to the eyes, can result from improper use. **All users (users defined as those researchers who setup and operate the SPIV) must read the laser manual and discuss the laser's safe use with Todd Lowe before operating the lasers, in addition to attending the EHSS laser safety training course.**

1.All users must complete the EHSS laser safety training course and baseline checkup prior to working with the SPIV laser.
2.Appropriate warning signs (shall include the laser hazard symbol and bear the words "Danger- Laser Radiation- Avoid Eye orSkin Exposure to Direct or Scattered Radiation," the class, and type of laser) and labels should be displayed on equipment and onall doors leading to the facility. Additional precautions or protective actions should be observed as needed.
3.Access to the controlled area should be restricted to authorized personnel during the operation of the laser. This is accomplishedby locking the door leading to the basement corridor during laser operation.
4.Laser safety eyewear should be worn at all times while the SPIV laser is emitting radiation.
5.Always ensure that the laser beam is not at eye level and that the laser beam is not directed at people or allowed to propagateoutside of the lab.
6.Potentially hazardous beams should be terminated by a permanently attached beam stop or attenuator. The beam stop should benon-reflecting and fire-retardant
7.Specular surfaces should be removed from the beam path, if possible. If removal is not possible the surfaces should be painted aflat black color or covered with a diffuse material. The intended target should be a diffuse, absorbing material to preventreflections
8.To reduce the possibility of specular reflections personnel should not wear watches or jewelry in controlled areas
9.Make sure that the laser control panels and the path to them from the rest of the lab are clear of obstructions.
10.Make sure all personnel in the lab are aware of the location of the emergency stop key (and the need to turn to the off position incase of emergency) before starting the lasers.

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)

Todd Lowe, Gwibo Byun, Humza Butt, Utkun Malkocoglu, Monica Shanmugam

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): Laser safety

Signature of faculty/staff member responsible for the rig and its safety ..... Todd Lowe Date 8/29/2023