

**Competition Handbook
Virtual International Submarine Race (vISR)**

**Version 2.00
12 April 2021**

**Produced by the
Foundation for Underwater Research and Education (FURE)
International Submarine Races Committee**

"The Foundation for Underwater Research and Education (FURE) is a 501(c)(3) nonprofit organization dedicated to advancing marine technology and ocean engineering by investing in today's youth pursuing marine related scientific and engineering research and educational opportunities."

Virtual ISR 16 (vISR) – June 2021

1. Background

The Foundation for Underwater Research & Education Inc (FURE) is a 501(c)(3) nonprofit organization dedicated to advancing marine technology and ocean engineering by investing in today's youth by pursuing marine related scientific and engineering research and educational opportunities. One of the primary and most recognizable efforts of FURE to achieve this goal is sponsorship of the International Submarine Races (ISR).

For over 30 years, FURE has sponsored the ISR. The ISR has been conducted fifteen times in multiple venues with the next competition scheduled for June 2021. The conduct and student participation in the ISR has established and sustain the ISR as a premier capstone Science, Technology, Engineering, and Mathematics (STEM) event. On average, over 20 teams, composed of over 400 young men and women from around the world, supported by over 100 volunteers participate in this week-long event.

Successful conduct of the ISR requires an appropriately equipped facility for a weeklong period. Since 1993, Naval Surface Warfare Center, Carderock Division, has graciously hosted the last twelve races in the David Taylor Model Basin. Program Executive Officer Submarines (PEO SUBS) and the Office of Naval Research (ONR) have proudly joined as sponsors of this outstanding event.

The global pandemic, COVID 19, and the safety constraints required to combat the spread of the disease, have severely negatively impact the ability of teams to design, build and test their designs for ISR 16 as well as FURE's ability to provide a safe venue in which to host the event. In addition, the availability of sufficient sponsor funding and other resources, particularly the quantity of volunteers required to ensure safe racing conditions, may also be insufficient to conduct a safe race.

2. Decision - Adapting to the Constraints during Novel Corona Virus Pandemic

The FURE Board of Directors has elected, with due caution of the realities of the COVID 19 pandemic, to establish and hold a virtual competition instead of cancelling ISR 16 outright. Although the Board knows there is no substitute for the in water events that the biennial race provides contestants and spectators, a virtual International Submarine Race (vISR) in 2021 will help maintain continuity within the participant teams and provide a venue to continue to develop skills and gain knowledge in the ocean engineering fields relevant to the Human Powered Submarine Projects.

3. **vISR Competition**

3.1 **Approach.** The vISR approach is to present the participating teams an opportunity to respond to any number of the “Design Challenges” described below. Teams will be required to provide to FURE written documentation, video documentation, 3D models, and/or physical 3D models as indicated by the specific design challenges. In some cases, live on-line video teleconferencing will be utilized, with the intent of providing an interactive forum for the participants and judges and volunteers from industry and academia to engage. All submittals, along with the on-line video discussions, will be part of the judging and awards process.

FURE judges will be augmented by subject matter experts from the United States Navy and industry. Team submissions will be evaluated against uniform judging criteria. Submissions may be evaluated using analytical, experimental, and or computational means as well as the overall merit of the submission as determined by the panel of judges.

3.1.1. Potential Future

Depending on the success of the vISR and based on feedback from participants and supporters as well as resource availability and team participation, FURE will consider continuing to sponsor the vISR on a regular basis to support continued technical developments and future in water races. The virtual ISR may become complimentary to the biennial International Submarine Races (ISR), which is planned to resume in June 2023.

4. **Virtual ISR 16 Design Competition**

4.1. Design Challenges – Sub-system development.

For each of the challenges listed in 4.1.1 through 4.1.4, teams will submit a representative design for the specific challenge. The design submittal may include computer models, sketches, computer renderings, and/or other suitable information that will accurately and adequately describe the solution being presented.

THE EXPECTATION IS THAT THE SOLUTION PRESENTED MUST BE COMMUNICATED WITH SUFFICIENT DETAIL THAT AN INDIVIDUAL WHO HAS NOT BEEN A PARTICIPANT IN YOUR DESIGN PROCESS WILL UNDERSTAND YOUR OFFERING.

The information that is provided should reflect the process used, decisions made, materials that would be used, fabrication processes that would be used, and pre-race testing to verify operation and any calculations that drove your solution set. Please also note that the requirements below are minimum requirements and should not be construed as all that is needed for a successful entry. The submissions for the design challenges need not be related in any way – i.e., the submissions should be considered as independent designs.

THE DESIGN REPORT SUBMITTED FOR EACH CHALLENGE IS LIMITED TO FIFTEEN (15) WRITTEN (NO SMALLER THAN TIMES NEW ROMAN 12 FONT)

PAGES. THE TITLE PAGE, TABLE OF CONTENTS, AND BIBLIOGRAPHY PAGES DO NOT COUNT AGAINST THE FIFTEEN (15) PAGE COUNT . ANYTHING IN EXCESS OF FIFTEEN (15) WRITTEN PAGES WILL NOT BE EVALUATED. SKETCH PAGES, COMPUTER MODELS, CALCULATIONS, AND COMPUTER RENDERINGS, IF SUBMITTED, WILL NOT COUNT AGAINST THE FIFTEEN (15) PAGE COUNT.

- 4.1.1. **Human Factors Engineering Design Process** – in a human powered submarine, the human is the critical interface for submarine performance. Teams will submit a report that describes the design process used to interface the human into a submarine design that can accommodate all required human functions within the submarine hull envelope. Additionally, teams must submit a rendering of the human in the design hull envelope.
 - 4.1.2. **Drivetrain Design** – Teams will submit a report that describes the approach used to determine the type of drivetrain selected for use in the submarine. The report should describe at a minimum the factors considered during the selection, any tradeoffs that were considered, what constraints were considered, and the expected performance characteristics of the selected drive train.
 - 4.1.3. **Thrust Production Device Design** – Teams will submit a report that describes the approach used to determine the type of thrust production device selected for use in the submarine. Describe how your device produces thrust. The report should describe at a minimum the factors considered during the selection, any tradeoffs that were considered, what constraints were considered, what material and manufacturing processes were considered and the expected performance characteristics of the selected thrust production device.
 - 4.1.4. **Maneuvering and Control Design** – Teams will submit a report that describes the approach used to determine the type of maneuvering and control design selected for use in the submarine. The report should describe at a minimum the factors considered during the selection, any tradeoffs that were considered, what constraints were considered, and the expected performance characteristics of the selected Maneuvering and control design. Additionally, a sketch of the control surfaces on your proposed submarine must be included.
- 4.2. **Future Submarine Technical and Design Challenges** (NOTE: TO PARTICIPATE IN vISR 16, EACH TEAM MUST PARTICIPATE IN THIS CHALLENGE - THIS IS A MANDATORY SUBMISSION BY EVERY TEAM).
- Your Next Human Powered Submarine** - Teams will identify the design, technical, and or testing challenges they believe they will have for their next in-

water design and build of a human powered submarine. A report will be submitted that (1) identifies the challenges; (2) ranks the challenges and describes the ranking criteria; (3) discusses how the challenges will be approached; (4) identify any technologies that will be required; and (5) identify resources that are required to address the challenges. Additional information can be included. THE REPORT FOR SECTION 1.2.1 MUST NOT EXCEED FIFTEEN (15) PAGES (Font no smaller than Times New Roman 12). THE TITLE PAGE, TABLE OF CONTENTS, AND BIBLIOGRAPHY PAGES DO NOT COUNT AGAINST THE FIFTEEN (15) PAGE COUNT. ANYTHING IN EXCESS OF FIFTEEN (15) WRITTEN PAGES WILL NOT BE EVALUATED.

4.3. **Operational Problem-Solving Challenges - Team real-time problem solving.**

4.3.1. Teams will meet via video chat with the team of vISR judges and will, in real time, respond to a scenario depicting a real-world problem-solving opportunity that could be encountered during a typical race event that is presented by the judges. Teams will be judged on team interaction, internal discussions, decision making, and action planning to respond to and resolve the issue presented. The evaluation period will be time limited to 40 minutes. A detailed schedule will be promulgated when available.

4.4. **Educational / Training Interactive Video sessions.** Interactive video presentations will be made by subject matter experts over a period of several weeks prior to the race. The content of these sessions is expected to range from Naval Architecture design to Diver Safety and Operations during the conduct of the ISR. A detailed schedule will be promulgated when available.

5. **vISR Schedule and Requirements**

5.1. **Participation**

Teams must register prior to 23 April 2021 and commit to the design competition(s). Teams may participate in as many of the individual competitions (4.1.1 through 4.1.4) but may only submit one entry per category. All teams must participate in 4.2. All design reports for section 4.1.1 through 4.1.4 and 4.2 must be submitted no later than 31 May 2021 via Dropbox file transfer software. The operational problem-solving challenge video exercise will be conducted in June 2021.

5.2. **Eligibility**

Eligibility is open to any students, schools, academic groups, hobbyists, and interested parties who desire to participate. Professional Engineering firms are NOT allowed to participate. FURE reserves the right to refuse entry/participation to any students, schools, academic groups, hobbyists, and interested parties without providing a reason.

5.3. Registration

A registration form and directions for completing and submitting the form has been provided attached as Appendix A. The registration form, along with the registration fee, is due no later than 23 April 2021 to FURE.

5.4. Registration fee

A Registration fee of \$100 is required for each competing team and is payable no later than 23 April 2021. The entry fee provides for entry to as many design challenges as a team desires to participate in. If any team is resource constrained by COVID 19 circumstances and desires to participate but cannot generate the \$100 payment, they should contact the FURE President at fure.president@internationalsubmarineraces.org and request a waiver of fees.

5.5. Submission of Design Reports / Competitive Entries

Responses to Design Challenges including Sub System Development (4.1.1 through 4.1.4) and Your Next Human Powered Submarine (4.2) must be submitted no later than 31 May 2021 via a DropBox file sharing portal. Each team will provide three names and their email addresses that will be the authorized individuals who will have access to the team's portal. Submissions of any material after the deadline will not be accepted for judging. Additional information regarding the links to the portal will be promulgated separately.

5.6. Liability and Copyright Release.

Each team will complete and submit the Liability and Copyright Release forms included as Appendix B. These forms are due no later than 31 May 2021 and will be signed and submitted via each team's DropBox file sharing portal. It is FURE's intent to make available for public release all material submitted by all teams. Material that is submitted and does not have a Liability and Copyright release form submitted will not be allowed as part of the competition.

6. Judging Criteria.

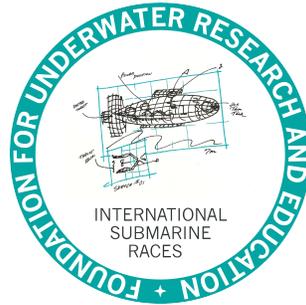
Judges from the Foundation for Underwater Research and Education, Inc., Industry and US Navy activities will serve as judges.

Design reports submitted in response to Sub System Development (4.1.1 through 4.1.4) and Your Next Human Powered Submarine (4.2) design challenges will be evaluated with a view toward the adequacy of the report in addressing the challenge presented, the substantiation of key data used in the design, the completeness of the report and the wholeness of the report (i.e., does the report "flow" in how it presents the proposed design solution).

For the Operational Problem-Solving Challenges (4.3), teams will be judged on team interaction, internal discussions, decision making, and action planning to respond to and resolve the issue(s) presented.

7. **Awards**

There will be cash awards as well as plaques provided for the winner and runner-up in each design competition (Sub System Development (4.1.1 through 4.1.4) and Your Next Human Powered Submarine (4.2) design challenges) as well as the Operational Problem-Solving Challenge. Where there are three or fewer teams in a challenge, only a winner will be selected and awarded. The exact cash awards will be promulgated later when financial data becomes available.



vISR 16 International Submarine Races Team Entry Form

This form is for entry into the Foundation for Underwater Research and Education's 16th virtual International Submarine Races (vISR 16) engineering design competition to be conducted in the early summer of 2021, culminating on June 25, 2021 with a virtual awards program. The virtual competition will be conducted by evaluating design submissions and interactive video conferencing as described for each event over several weeks. This event is being held in conjunction with Carderock Division of the Naval Surface Warfare Center (NSWC) in Bethesda, Maryland.

To register your team and submarine:

- The Team Advisor or Team Leader shall complete the information requested on the following page and submit it to the Foundation for Underwater Research and Education's Treasurer along with your **US\$100 fee no later than April 23, 2021.**
- The Registration Form (page 2) can be forwarded in hardcopy form by Postal Service or by e-mail to FURE.President@internationalsubmarineraces.org and 'cc' to contestant.liaison@internationalsubmarineraces.org
- Payments can be made by check or by electronic wire transfer – follow directions on page 3.

***TO EMPHASIZE – REGISTRATION FORM AND PAYMENT
ARE DUE NO LATER THAN APRIL 23, 2021***

Please make every effort to provide correct information and correct spelling. The information above will be used to produce a competition program, award certificates, and provide for other administrative uses.

vISR 16 Registration Form

Team Name:

Organization Name:

Affiliation: High School College Corporate Individual

Academic Support (School Name):

Home (City, State/Province, Country):

Please indicate what events your team plans on participating in by placing an ‘X’ in the corresponding box:

Design Challenges – Sub-System Development

- 1.1.1 Design Process for Human Factors Engineering**
- 1.1.2 Drivetrain Design**
- 1.1.3 Thrust Production Device Design**
- 1.1.4 Maneuvering and control Design**
- 1.3.1 Operational Problem Solving Challenges – Team real time problem solving (via video chat)**

PLEASE NOTE THAT DESIGN REPORTS FOR 1.1.1 through 1.1.4 will be due no later than May 31, 2021

PLEASE ALSO NOTE THAT PARTICIPATION IN EVENT 1.2.1 FUTURE DESIGN CHALLENGES IS MANDATORY FOR ALL PARTICIPATING TEAMS

Please provide the following information (add another sheet if necessary)

Team Advisor - Name/Phone/Email:

Team Leader - Name/Phone/E-mail:

Team Members:

Team Sponsors:

Please make every effort to provide correct information and correct spelling. The information above will be used to produce a competition program, award certificates, and provide for other administrative uses.

For Payments Made By Check and Postal Service mail

All checks **must** be made payable to:

Foundation for Underwater Research and Education in US currency only. Please ensure the team's name is referenced on the check in some manner.

Payment (and registration form if mailing form) must be sent to:

F.U.R.E.
P.O. Box 543
Haymarket, VA 20168
USA

For Payments Made By Domestic and International Wire Transfers

If you make payments by this method, you must also complete page three of this form and send via postal service to the address above or email as indicated below.

Bank Name:	Wells Fargo Bank, NA
City/State:	San Francisco, CA
Routing Transit # (Domestic):	121000248
Routing Transit # (International):	WFBIUS6S
Acct #:	9044450121
Acct Name:	Foundation for Underwater Research and Education

Your bank may charge you an electronic wire transfer fee which you are responsible to pay. FURE will pay our bank's wire transfer fee associated with receipt of the funds. Upon receipt of your Team Entry Form and payment, you will be contacted by the ISR Contestant Liaison.

Please contact Ms. Pamela Corry at FURE.Treasurer@internationalsubmarineraces.org if you have any financial questions.

Forms can also be emailed to FURE.president@internationalsubmarineraces.org

16th Virtual International Submarine Races (vISR) Copyright Form Guidance

FURE Copyright Ownership

It is the formal policy of FURE to own the copyrights of all materials created for the virtual International Submarine Races (vISR) to all copyrightable material in its publications and to the individual contributions contained therein, in order to protect the interests of the FURE, its authors and their employers, and, at the same time, to facilitate the appropriate re-use of this material by others.

Author/Employer Rights

If you are employed and prepared “the Work”, defined as the Paper, Article, Report, Pictures, Video, Presentation or Speech, on a subject within the scope of your employment, the copyright in the Work belongs to your employer as a work-for-hire. In that case, FURE assumes that when you sign this Form, you are authorized to do so by your employer and that your employer has consented to the transfer of copyright, to the representation and warranty of publication rights, and to all other terms and conditions of this Form. If such authorization and consent has not been given to you, an authorized representative of your employer should sign this Form as the Author.

Reprint / Republication Policy

FURE requires that the consent of the first-named author and employer be sought as a condition to granting reprint or republication rights to others or for permitting use of a Work for promotion or marketing purposes.

PLEASE DIRECT ALL QUESTIONS ABOUT THIS FORM TO:

ISR Head Judge

Head.Judge@internationalsubmarineraces.org

16th Virtual International Submarine Races (vISR) Copyright Form

To ensure uniformity of treatment among all contributors, other forms may not be substituted for this form, nor may any wording of the form be changed. This form is intended for original material submitted to the Foundation for Underwater Research and Education (FURE) created for the virtual International Submarine Races (vISR), and must accompany any such material to be published by the FURE. Please read the form carefully and keep a completed copy for your files.

**TITLE OF PAPER/ARTICLE/REPORT/PRESENTATION/SPEECH
(hereinafter, "the Work"):**

COMPLETE LIST OF AUTHORS (Last name, First name):

ISR/FURE PUBLICATION TITLE (to be completed by FURE Representative only): (i.e., ISR Race Proceedings, ISR Newsletter, compilation of past ISR events)

Copyright Transfer

The undersigned hereby assigns to FURE all rights under copyright that may exist in and to the above Work and any revised or expanded derivative works submitted to FURE by the undersigned based on the Work. The undersigned hereby warrants that the Work is original and that he/she is the author of the Work; to the extent the Work incorporates text passages, figures, data or other material from the works of others, the undersigned has obtained any necessary permissions. **See below for Retained Rights and other Terms and Conditions.**

Author Responsibilities

FURE distributes its publications throughout the world and wants to ensure that the material submitted to its publications is properly available to the readership of those publications. Authors must ensure that their Work is original and it is the responsibility of the authors, not FURE, to determine whether disclosure of their material requires the prior consent of other parties and, if so, to obtain it.

General Terms

- The undersigned represents that he/she has the power and authority to make and execute this assignment.
- The undersigned agrees to indemnify and hold harmless FURE from any damage or expense that may arise in the event of a breach of any of the warranties set forth above.
- In the event the above work is not accepted or is not published by FURE or is withdrawn by the author(s) before acceptance by FURE, the foregoing copyright transfer shall become null and void and all materials embodying the Work submitted to FURE will be destroyed.
- For jointly authored Works, all joint authors should sign, or one of the authors should sign as authorized agent for the others.

1. Signature of Author/Authorized Agent for Joint Authors / Date

U.S. Government Employee Certification (where applicable)

This will certify that all authors of the Work are U.S. government employees and prepared the Work on a subject within the scope of their official duties. As such, the Work is not subject to U.S. copyright protection.

2. Authorized Signature / Date

Note: Authors who are U.S. government employees should also sign signature line (1) above to enable FURE to claim and protect its copyright in international jurisdictions.

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3. Authorized Signature / Date

Note: Authors who are British or British Commonwealth Government employees should also sign line (1) above to indicate their acceptance of all terms other than the copyright transfer.

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