National Aeronautics and
Space Administration

PROPOSAL GUIDELINE

NASA Spacesuit User Interface Technologies for Students

August 30, 2021

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

Team Name

Optional Team Logo

Academic Institution Name
Address

Team Contact
Student Name
Email Address
Phone Number

Team Members
(Please list ALL team members)
Team Member Name --- Role
Email Address --- Academic Year / Academic Major
Team Member Name --- Role
Email Address --- Academic Year / Academic Major
Team Member Name --- Role
Email Address --- Academic Year / Academic Major
Team Member Name --- Role
Email Address --- Academic Year / Academic Major
Team Member Name --- Role
Email Address --- Academic Year / Academic Major

Faculty Advisor
Name
Email Address
Phone Number

Faculty Advisor Signature Date

Table of Contents

(Note: **The Technical Section is limited to 10 pages**. Include enough pictures within those 10 pages to describe your tool. If you want to submit many pictures, use an Appendix. Other sections and appendices **will not count against your 10-page limit.**)

1. Introduction

The Extravehicular Activity Office and the Office of STEM Engagement at NASA's Johnson Space Center is proud to host another year of the NASA Spacesuit User Interface Technologies for Students (SUITS) Design Challenge. We intend to conduct in-person device testing onsite at Johnson May 19-24, 2022 pending Covid-19 health and safety guidelines.

This document serves as a resource and reference to help all potential NASA SUITS challengers with the requirements to enter and succeed. Included are important steps to the challenge and required components of an official proposal. Please also review the eligibility requirements for NASA SUITS at our website https://go.nasa.gov/nasasuits.

2. Eligibility

Each prospective onsite team member must be enrolled as an undergraduate or graduate student at an accredited U.S. institution of higher learning (community college, military academy, technical college, or university) or faculty member at the time the proposal is submitted.

- **Team members must be 16 or older before arrival in Houston.**
- **To attend onsite testing activities, participants must be U.S. citizens or legal permanent residents.**
- **All participants must attend the Orientation and Virtual Design Review.**
- Primary team members may only participate with one team in the same competition.
- Student experiments must be organized, designed, and operated by student team members.
- Each team must be accompanied by an adult age 21 or older to serving as the faculty advisor.
- Enrollment verification may be requested for team members.
- NASA interns involved in the design of a NASA SUITS challenge may not participate as a member of a team in that same cycle of the NASA SUITS challenge; however, they may serve as a team advisor.

- Support team members may be comprised of university students of any level, faculty members, professional consultants, etc.
- Any support team member under the age of 18 accompanying the team to Houston must provide a signed JSC parental consent form.
- Current NASA Covid-19 policies stipulate visitors to JSC and WSTF must complete a form to attest their vaccination status, and to keep the form on their person while onsite. Should visitors not be fully vaccinated, they will need to provide a negative COVID-19 test that is less than 72 hours old to come on the site. **These policies are subject to change.**

3. Letter of Intent

S**ubmit a letter of intent by September 30, 2021** indicating the team's intention to submit a written proposal. The letter of intent should follow the format below and be written in the body of an email. Send the email directly to NASA-SUITS@mail.nasa.gov.

- Provide team contact information – this should be a student team member
    a. Sample: Doe, John (DoeJ@institution.edu) Sophomore / Software Engr
- Provide the academic institution (community college, military academy, technical college, or university) your team represents. Your team should designate a lead institution even if members come from multiple institutions.
- State: "NASA SUITS Challenge Letter of Intent" in the subject line and body.

4. **Proposal Requirements**

- Each team must submit one electronic copy of an original proposal on the NASA SUITS engagement opening on the NASA STEM Gateway.
- Each proposal must be submitted in a three-section format containing the required sections in the following order: Technical, Outreach Plan, and Administrative.
- Sections or components shall not be skipped/omitted under any circumstance.
- The Technical section shall not exceed 10 pages including the title page.
- The report body must use 12-point font.
- All information on the title page must be complete.
- Figures and tables must be labeled and referenced within the text.

5. Technical Section

The technical section must cover the design the team is proposing. This section must include any information that a technical reviewer will find informative or instructive in understanding the aims and goals of the design. Evaluators ranking the proposal for its scientific merit will read only this section, so teams should address all relevant factors as listed below.

a. Abstract

The abstract is a brief (up to 300 words) summary that touches upon the elements of the proposed prototype design.

b. Design Description

Include a brief, but detailed description of the proposed display and how you plan to tackle each aspect of the design challenge, written in such a way a practicing engineer or scientist can understand the design of the user interface (UI). Present goals along with a description of the expected results. Showing conceptual UI design ideas (portrayed via wire frames, visuals, etc.) and innovative display interaction methods/technologies are strongly preferred.

c. Concept of Operations (CONOPS)

Describe the overall high-level concept of how the user interface will meet the expectations and requirements. Describe the system from an operational perspective (the viewpoint of the astronaut) to help facilitate an understanding of the system goals.

d. Human-in-the-loop (HITL) testing

Discuss any pilot, user experience, human-in-the-loop, or human factors studies planned. A written HITL test plan should include a test protocol, possible metrics/measures, feasible subject pools, expected population/demographics of test subjects, and all planned safety measures to be used while conducting HITL tests.

e. Team Project Schedule

Provide an outline of the team's development plans with any internal key milestones. Use a Gantt or similar chart. Teams are strongly encouraged to plan time to test their code before traveling to NASA's Johnson Space Center for test week.

f. Technical References

Cite referenced works in text and in a "References" section using APA format.

6. Outreach Section

The outreach section of the proposal includes the team's plan for disseminating the results of their experiment/experience to the public. Information contained in this section should focus on the outreach activities the team intends to implement and the target audience to address. The outreach plans must be original to the team. **Do not post original proposal documents on any social media platforms or channels.**

A plan is an organized way to achieve a specific objective. Random activities, even good random activities, do not constitute a plan. An outreach plan should have two major components:

- The **plan** – a description of the team's objectives and goals; what activities are planned for the upcoming year; where and when the activities will take place; what audience is targeted, etc.
- The **activities** – what will the team do when they get there? What materials will they refer to? What are the main points that they will make?

For maximum point value, the plan should include the following:

- The team's objectives for each outreach activity.
- A description of the outreach audience (K-12 class or school groups, undergraduate research symposiums, university outreach to local schools, informal groups such as Boy/Girl Scouts, after school clubs, church groups).
- Specific plans for activities (strengthened by alignment to state or national standards will help a K-12 teacher, use of the 5E Model, or use of age/grade appropriate language during the activity).
- Letters or agreements from institutions who accept your invitation to address their group.
- A press and/or social media plan.
- A connection between curriculum/activity and NASA SUITS, a NASA Mission, Informatics and Subsystems team at Johnson Space Center, or the team's code.

7. Administrative Section

a. Institutional Letter of Endorsement

This letter must be on the endorsing institution's letterhead and must come from the institution(s) president, dean of college, or department chair. It indicates the team's institution(s) has knowledge of the team's interest in participating in this activity and endorses the team's involvement. Failing to include a letter of endorsement from their institution(s) will result in a rejected proposal.

b. Statement of Supervising Faculty

A statement of support from a faculty member indicating a willingness to supervise and work with the team during all stages of the activity. There will be no consideration for teams working without a faculty advisor. The faculty advisor must also sign off on the cover of the proposal as evidence he/she has seen the proposal and approves of the submission. The following statement should appear on an institution letterhead and include the signature of the faculty advisor:

> As the faculty advisor for an experiment entitled "_____" proposed by a team of higher education students from _____ institution, I concur with the concepts and methods by which the students plan to conduct this project. I will ensure the student team members complete all project requirements and meet deadlines in a timely manner. I understand any default by this team concerning any project requirements (including submission of final report materials) could adversely affect selection opportunities of future teams from their institution.

If your team is composed of students from more than one institution, submit the above from the lead institution. Additionally, supply a letter of support from a faculty member of each participating institution acknowledging they are aware of the participation of their student(s).

c. Statement of Rights of Use

These statements grant NASA, acting on behalf of the U.S. Government, rights to use the team's technical data, including computer software, and design concept, in part or in entirety, for government purposes. NASA, acting on behalf of the U.S. Government, may designate for certain tasks under this engagement that software (including documentation) developed for such certain designated tasks be released as "Open Source" (OS) software, as term is defined by the Open Source Definition promulgated by the Open Source Initiative on its website (see http://opensource.org/docs/osd). These statements are not required. However, teams with a

Statement of Rights of Use will receive greater consideration in the proposal selection. If choosing to include these statements, all team members and faculty advisors must sign. The statements read as follows:

> As a team member for a proposal entitled " _____" proposed by a team of higher education students from _____ institution, I will and hereby do grant the U.S. Government a royalty-free, nonexclusive and irrevocable license to use, reproduce, distribute (including distribution by transmission) to the public, perform publicly, prepare derivative works, and display publicly, any technical data contained in this proposal in whole or in part and in any manner for federal purposes and to have or permit others to do so for federal purposes only. Further, with respect to all computer software designated by NASA to be released as open source which is first produced or delivered under this proposal and subsequent collaboration, if selected, shall be delivered with unlimited and unrestricted rights so as to permit further distribution as open source. For purposes of defining the rights in such computer software, "computer software" shall include source codes, object codes, executables, ancillary files, and any and all documentation related to any computer program or similar set of instructions delivered in association with this collaboration. As a team member for a proposal entitled "_____" proposed by a team of higher education students from _____ institution(s), I will and hereby do grant the U.S. Government a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States Government any invention described or made part of this proposal throughout the world.

d. Funding and Budget Statement

This section should include a simple columnar layout showing expected expenditures associated with the proposed design such as materials, machining, operating, testing, shipping, etc. See Table 1 for an example. It is imperative teams anticipate all costs involved and actively work to seek funding. List potential sources for funding and can include institutional grants, state Space Grant funds, corporate sponsors, etc.

Teams should also identify a financial representative from their institution (college or department level). Be sure to include the representative's name, title, and email address.

Table 1 NASA SUITS Cost Example

Items	**Costs**
Flights	$4,500.00
Hotel	$2,000.00
Ground transportation	$400.00
Operating	$600.00
Miscellaneous	$500.00
Total	$8,000.00

e. Parental Consent Forms

Any team member under the age of 18 shall submit parental consent forms for general participation. Teams selected to participate will receive the parental consent forms, if applicable.

f. Hololens2 Loan Program

NASA SUITS has a limited number of Hololens2 devices we can loan to institutions. Please indicate your interest in a loaned device:

A) We do not require a loaned device because we either already have one, or plan to acquire one.

B) We need a loaned device from NASA SUITS to participate.

C) We have a device but would still like to be considered for a loan to aide in our development.

g. Proposal Scoring Method

A scoring rubric (Figure 1) with required criteria will evaluate how well a proposal addresses each of the following required components: Technical Merit, Outreach Plan, and adherence to all proposal requirements.

Additionally, teams will be asked to create a first-person point of view video of their UIs in action. Teams will submit this video, along with their code, during the software design reviews occurring in March 2022. Teams are required to submit a draft of a white paper illustrating the development of their visual informatics display system upon completion of the NASA SUITS challenge.

Factor 1: DESIGN DESCRIPTION (30% Weighted Value)

- ✓ Describe the goals of the design concept and expected results.
- ✓ Provide conceptual UI designs and display interaction methods.
- ✓ Tackle the following components of the challenge: navigation task, maintenance task, science task, controls, and implementation of the suit's telemetry.

Factor 2: CONCEPT OF OPERATIONS (15% Weighted Value)

- ✓ Describe the user interface from an operational perspective (EVA astronaut).

Factor 3: FEASIBILITY (10% Weighted Value)

- ✓ Concept demonstrates a viable solution to the technical need.
- ✓ Plan describes how the concept would be produced.

Factor 4: THE PROPOSED PROJECT SCHEDULE (5% Weighted Value)

- ✓ Comprehensive project schedule.
- ✓ Effective use of available Resources.
- ✓ Labor distribution.
- ✓ Document proposed schedule for meeting objectives.
- ✓ Detailed plan to achieve each objective or task.

Factor 5: HUMAN-IN-THE-LOOP (HITL) TESTING (10% Weighted Value)

- ✓ Provide a test plan for all HITL testing to be conducted by the team.
- ✓ Include all the requested components for the HITL plan:
  - Test protocol.
  - Possible metrics/measures.
  - Feasible subject pools.
  - Expected population/demographics of test subjects.
- ✓ HITL tests must be conducted safely with proper personal protective equipment.

Factor 6: TECHNICAL REFERENCES (5% Weighted Value)

- ✓ Referenced works are cited in text and are relevant to the proposal.
- ✓ References are presented in APA format.

Factor 7: OUTREACH (25% Weighted Value)

- ✓ Diverse list of events and activities planned.
- ✓ Includes projected audience type and number of participants.
- ✓ Detailed implementation plan.
- ✓ Virtual outreach events are acceptable.

Figure 1 Scoring Criteria

Note: Check the NASA SUITS website for the most-up-to-date activity documents http://go.nasa.gov/nasasuits.

Send questions and responses to NASA-SUITS@MAIL.NASA.GOV