TFM-AID CHALLENGE

TRAFFIC FLOW MANAGEMENT APPLICATION INTEGRATION DESIGN

ACADEMIC CHALLENGE 2022-2023

Contents

CHANGE LOG

If changes or updates are made to this document post-publication, they will be listed here.

- 9/26/22 – Document is published online.
- 10/12/22 – Added Resource #10
- 11/1/22 – Deadline for Expression of Intent (EOI) submissions extended to January 30, 2023.
- 11/3/22 – Resource #3 and Resource #4 updated
- 11/9/22 – Removed Resource #10 (duplicate of #4)
- 11/18/22 – Page 6, under Design Constraints: First bullet updated to clarify multiple monitors allowed.
    - New Text: You can plan on more than one monitor for your UI design, although we suggest you not plan on more than two. Expect each monitor to have 24.0 inches viewable area and 1920 x 1200 native resolution @60 Hz. Information layering within the display is allowed.
    - Old Text: UI design must fit within a single integrated display with 24.0 inches viewable area and 1920 x 1200 native resolution @60 Hz. Information layering within the display is allowed.
- 2/2/23 – Updated Expression of Interest deadline to "Rolling," allowing for EoI submissions until the PDR deadline.
- 3/3/23 – Deadline for Preliminary Design Review (PDR) Package submissions extended to March 9, 2023.
- 6/5/23 – Clarified appendices for CDR submission on page 15

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Overview

The Traffic Flow Management Application Integration Design (TFM-AID) Challenge was developed to provide increasing opportunities to college and university students, including underserved students, to be involved in the Federal Aviation Administration's (FAA's) mission. The purpose of the FAA TFM-AID Challenge is to pursue design and development enhancements to air traffic management capabilities while fostering a passion for aviation science, technology, engineering, and mathematics (AvSTEM) at the university level.

Through the FAA TFM-AID Challenge, teams will prototype ideas for an interactive Graphical User Interface (GUI) design for FAA's new automation system, Flow Management Data and Services (FMDS). The FAA is actively developing future requirements for FMDS to replace the current Traffic Flow Management System (TFMS) in support of air traffic flow management (TFM) across the National Airspace System (NAS).

In the FAA Air Traffic control System Command Center (ATCSCC) and in FAA facilities across the NAS, traffic managers, such as National Traffic Management Specialists (NTMSs) and Traffic Management Coordinators (TMCs), perform TFM by balancing air traffic demand with system capacity to ensure a safe, orderly, and expeditious flow of traffic while minimizing delays. This goal is realized through continued analysis, coordination, and dynamic utilization of traffic management initiatives (TMIs) such as rerouting aircraft around congested areas or implementing programs that delay aircraft on the ground to control demand for congested airspace.

The FAA TFM-AID Challenge seeks designs for a proposed GUI that supports traffic managers (e.g., TMCs and NTMSs) in performing these tasks with a more streamlined and modernized interface than they have today, thereby minimizing user training requirements. The scope of the FAA TFM-AID Challenge will center on designing an integrated display to support traffic managers in an Airspace Flow Program (AFP) scenario (Resource #3).

Initial participation in the FAA TFM-AID Challenge involves the development of a Preliminary Design Review (PDR) submission package, which will be reviewed and evaluated by judges. After receiving feedback from the judges on the PDR, up to five finalist teams will advance in the competition. Each finalist team will submit their final proposal via a Critical Design Review (CDR) Package and compete at the onsite TFM-AID Forum. The first place overall winning team will receive the prize award of $25,000 and a trophy.

Background

FMDS will replace the existing Traffic Flow Management System (TFMS) used in FAA facilities across the NAS, including:

- The Air Traffic Control System Command Center (ATCSCC) near Washington, DC.

- Twenty-one Air Route Traffic Control Centers (ARTCCs) across the US that manage air traffic en route between airports (typically beyond 30nm from the departure or arrival airport).
- Terminal Radar Approach Control (TRACON) facilities across the US that manage air traffic within 30-60nm of the departure or arrival airport.
- Air Traffic Control Tower (ATCT) facilities across the US that manage air traffic into and out of controlled airports, as well as surface traffic (i.e., aircraft on taxiways) at controlled airports.
- Airspace user facilities such as airline and military operations centers.

Key FMDS functions that the GUI will need to support include:

- Monitoring the NAS for bottlenecks and constraints that will impact traffic flows (e.g., weather, high traffic volume, space launch/reentry operations).
- Modeling and issuing TMIs that modify traffic flows by changing aircraft routes, delaying aircraft on the ground, and/or increasing spacing between aircraft operating in the airspace.
- Coordinating TMIs among FAA facilities and key airspace users.
- Logging and communicating TMIs across facilities.

The expected outcome/end product of the FAA TFM-AID Challenge is a prototype of an interactive graphical user interface (GUI) to support FAA's new Flow Management Data and Services (FMDS) functions in a modernized, streamlined workflow. The FAA TFM-AID Challenge will focus on support for traffic managers at the ATCSCC.

Traffic Flow Management Background

*A high-level overview of TFM is provided here; for more information, participants are directed to the references cited in the **Resources** section of this document. Definitions of key terms and acronyms are provided in the **Definitions** section.*

Effective traffic flow management (TFM) first requires traffic managers to identify time periods when demand is likely to exceed capacity. They use different types of information to understand demand relative to capacity, including planned air traffic and traffic management initiatives (TMIs) being considered and/or implemented by other facilities.

Traffic managers monitor the demand for National Airspace System (NAS) elements (e.g., airports, fixes, sectors) based on the projected trajectories for scheduled and airborne flights. NAS elements have pre-established default capacities. The automation compares demand against this pre-established capacity and then issues alerts for NAS elements predicted to experience excess demand.

In addition, a traffic manager can use Flow Evaluation Areas (FEAs) and Flow Constrained Areas (FCAs) to understand demand for a given NAS resource or region of airspace. Traffic managers draw one or more FEAs/FCAs, set the valid time period based on their expectation of when a demand-capacity imbalance may occur, and set filters to view the flights of interest (e.g., departures from a given airport, aircraft operating between selected altitudes). They can then view the number of flights meeting the filter criteria expected to intersect the FEA/FCA over time and the list of flights in each time period. Traffic managers compare this demand with the expected capacity for the region of airspace – based on guidelines and their

experience with the type of scenario they expect to play out – to determine what kind of TFM strategy is most appropriate.

A TFM strategy typically involves one or more TMIs and a plan for when the TMIs will be re-evaluated to determine if they should be implemented, modified, or cancelled. The traffic manager uses automation to model the TMIs and associated flow rates in either 15-minute or hourly intervals. Depending on the type of TMI, FMDS will then calculate the number of flights affected by the TMI, and the average and maximum delay that the TMI would impose on those flights.

After the traffic manager is satisfied with the modeled TMI, they discuss it with other NAS stakeholders on the next Operations Plan webinar. During planning webinars, held every two hours throughout the day and evening, revisions are made to the previous Operations Plan based on updated demand, constraint, and capacity forecasts.

Information sharing promotes productive collaboration in the development, implementation, and management of TMIs. Once a set of TMIs has been agreed to, traffic managers implement them by issuing an advisory if the TMI is a Ground Delay Program (GDP), Airspace Flow Program (AFP), Collaborative Trajectory Operations Program (CTOP), or reroute. The advisory generally includes the start and end time of the TMI, characteristics of the flights affected (e.g., departure/arrival airport), and any suggested flight plan modifications. Once a TMI has been issued, it is logged for future reference.

If the TFM strategy involves a GDP, AFP, or CTOP, FMDS allocates arrival slots for the constrained resource to NAS users and computes Expect Departure Clearance Times (EDCTs) for all included flights that are still on the ground.

Once a TMI has been implemented, traffic managers monitor its effectiveness and can modify or terminate the TMI as needed. If the TMI is modified or terminated, the update is disseminated via a new advisory.

Project Description

Required Capabilities

FMDS needs to support FAA traffic manager and National Airspace System (NAS) user workflows to execute TFM functions, including monitoring demand relative to capacity, modeling and implementing traffic management initiatives (TMIs), and monitoring TMI effectiveness. More information about TFM and relevant TFM elements is available at the references listed under **Resources**.

User Interface (UI) design entries will be judged according to their ability to demonstrate support for Air Traffic Control System Command Center (ATCSCC) traffic managers in carrying out the following tasks described in the Airspace Flow Program (AFP) scenario (Resource #4).

- Create FCA to examine a region of airspace expected to be affected by weather.
- View flight demand in the affected timeframe.
- Model an AFP for managing traffic impacts of weather, including setting parameters and viewing expected delays that would be assigned to aircraft included in the AFP.

- Share FCA and modeled AFP with other facilities.
- Implement the AFP by issuing an advisory.
- Monitor the effectiveness of the AFP while it is in progress by monitoring actual throughput, traffic demand, and delays.
- Modify the AFP parameters in response to updated weather forecast and traffic demand data, and collaboration with NAS users on the Operational Planning webinars. Modifications include different flow rates, earlier or later start/stop times, and different included groups of flights.
- Log TFM actions for post-event analysis.

Design Constraints

- (UPDATE ON 11/18/22) You can plan on more than one monitor for your UI design, although we suggest you not plan on more than two. Expect each monitor to have 24.0 inches viewable area and 1920 x 1200 native resolution @60 Hz. Information layering within the display is allowed.
- UI design must allow for the end-user to customize their display and save/recall preferred settings.
- Information within the UI design must be readable from a viewing distance of four feet away from the display.
- The use of color in the UI design should consider the following typical rules of thumb:
  - ***Red*** is used for information that the user should attend to right away, such as a situation that requires action, emergency conditions, or a system malfunction. For example, red might be used to indicate that demand exceeds capacity for a NAS resource and the traffic manager needs to take action to reduce the demand.
  - ***Yellow*** is used for information that the user should review, such as circumstances requiring caution or an unexpected delay in system response. In our example, yellow might be used to indicate that demand may exceed capacity for a NAS resource if all flights depart at their currently planned times and the traffic manager should review the situation.
  - ***Green*** is used to indicate that the system is operating as normal. For example, green might be used to indicate that demand is not expected to exceed capacity for a NAS resource.
- The GUI design should distinguish between the following aircraft/vehicle categories: jet, prop, heavy, super, unknown (vehicle or flight), unknown flight, ground vehicle.

Assumptions

UI designs should include the following assumptions:

- TFM personnel will collaborate with personnel from other facilities by telephone and webinar teleconference regularly and as needed. The UI design will support information sharing during these person-to-person collaboration activities.
- FMDS will receive flight, weather, and other data from multiple sources and transform that data as needed into unified representations. That is, Challenge entries do not need to demonstrate how this data will be ingested from other sources and processed for display.
- Default capacities of NAS resources (fixes, sectors, airports) will remain unchanged.
- Existing algorithms will compute delays and other metrics associated with AFPs and other TMIs. These algorithms are not needed for this project and will not be provided. Challenge entries should illustrate the results of such calculations (i.e., show sample metrics) but do not need to perform such calculations.

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Considerations and Expectations

- Teams are encouraged to consider existing TFMS UI elements that can be retained to minimize user training requirements.
- Teams should facilitate logging of TFM decisions and actions in a way that supports detailed post-event analysis while minimizing the burden on the user.
- Teams should give attention to:
  - Innovative UI design approaches.
  - Integrated UI design elements that support streamlined workflows.
- At the PDR submission, teams are expected to submit a wireframe (a rough sketch of the application), a mock-up (detailed static representation of the UI), and an image of their design.
  - This is the minimum expectation. To learn more about the difference between a Wireframe, Mock-Up, and Prototype, please visit Springboard.com and/or Mockplus.com.
- For teams selected as finalists, it is expected that their final end product at the CDR stage will be a prototype: a high-fidelity representation of the UI that simulates user interface interaction.

Participant Provisions

- Orientation to TFM tasks from operational subject matter experts (SMEs).
- Shared Q&A sessions with operational SMEs.

Key Evaluation Elements

- The FAA-FAA TFM-AID Challenge Evaluation Criteria.
- Adherence to the requirements and constraints of the design competition.
- Feasibility and improvement to the user experience.

Eligibility

The FAA TFM-AID Challenge is open to full-time or part-time undergraduate and graduate students at an accredited U.S.-based community college, college, or university. Teams may include senior capstone students, clubs, multi-university teams, and/or multi-disciplinary teams. The FAA advocates for inclusion and diversity in all teams. Interdisciplinary teams and minority-serving institution students are encouraged to apply.

Eligibility Requirements

- Eligibility is limited to students from colleges and universities in the United States.
- Student team members must have been enrolled in a U.S.-based college or university for at least one semester (or quarterly equivalent) during the 2022-2023 academic year.
- Team members, including all faculty advisors and students, must be citizens or permanent residents of the United States.
- Each member of the team must meet the eligibility criteria.
- An individual may join more than one team.
- There is no charge to enter the competition.
- Team sizes may vary. From the lead academic institution, the core team must contain, at a minimum, one faculty advisor who has worked on the project, and two students who can be available to present the final project at the culminating FAA TFM-AID Challenge Forum in late June 2023. A maximum of ten students may participate on any single team.

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- A faculty advisor may advise more than one team.
- A team may submit more than one proposal.
- Team members may not be federal employees acting within the scope of employment (this includes co-op students with civil servant status).

Foreign Universities (Ineligible)

Eligibility is limited to students from universities in the United States. Foreign universities are not eligible to participate in the FAA TFM-AID Challenge.

Eligibility Statement Regarding Federal Co-Op Interns

Federal Co-Op interns may participate in the FAA TFM-AID Challenge when they are on Leave Without Pay (LWOP).

TFM-AID stipends may not be used to support travel for federal employees acting within the scope of employment. (This includes co-op students with civil servant status.) Students attending military institutions such as the Air Force Academy are under the same constraints.

How to Compete in the FAA TFM-AID Challenge

1. Thoroughly review the Challenge Guidelines (this document).
2. Find a qualified advisor and a diverse team of students.
3. Ensure that your team meets the eligibility requirements.
4. Develop and submit an Expression of Intent (EOI) by the deadline.
5. (Optional) Submit questions and attend the Q&A session with the challenge sponsors.
6. Develop and submit a PDR package by the deadline.
    - Based on a review and evaluation of the PDR packages by the FAA TFM-AID Challenge judges, up to five finalist teams will be selected to advance to the next phase of the competition.
    - Judges' feedback will be provided to each submitting team. Finalist teams will receive additional feedback detailing specific areas they need to address in the follow-up CDR package.
7. Finalist teams will take feedback into consideration, update their designs accordingly, and submit a final CDR package.
    - CDR package submissions will be reviewed and evaluated by the TFM-AID judges.
8. Finalist teams will be invited to demonstrate their concepts at the FAA TFM-AID Challenge Forum, a face-to-face presentation/design review in front of subject-matter experts in June 2023.
9. The first-place overall winning team will receive the $25,000 prize award.

Travel Reimbursement

Finalist teams presenting at the 2023 FAA TFM-AID Challenge Forum will receive travel reimbursements for eligible costs (up to $6,000 per team) to facilitate travel and lodging for the Forum, held in the Washington D.C./Northern Virginia Metro Area.

Prize

A trophy with the winning university's name, participating students' names, and date of award will be displayed at an FAA facility, and a display copy of the trophy will be sent to the lead academic institution. The lead university will be presented with an award of $25,000 and finalist student(s) will each receive a copy of the winning certificate.

Dates and Deadlines

All deadlines must be met by 11:59 p.m. ET on the dates specified below unless otherwise specified. **Late deliverables will not be accepted.**

Date	Description
November 7, 2022	Deadline to submit questions for Q&A Webinar
November 15, 2022	Interactive Q&A Webinar
Rolling (Until 3/2/23)	Expression of Interest (EOI) Submission Deadline
March 9, 2023	Preliminary Design Review (PDR) Package Submission Deadline
March 30, 2023	Teams Notified of Selection Status
May 17, 2023	Deadline for Online Registration and Payment for Forum
May 27, 2023	Deadline for Hotel Reservations at Group Rate
June 7, 2023	Critical Design Review (CDR) Package Submission Deadline
June 25, 2023	Presentation File Submission Deadline
June 28-29, 2023	FAA TFM-AID Challenge Forum

Expression of Intent (EOI)

EOI SUBMISSION DEADLINE: ROLLING UNTIL MARCH 2, 2023

Interested teams are strongly encouraged to submit an Expression of Interest (EOI) to complete prior to submitting entries. Teams that indicate interest by the stated deadline will be invited to participate in an exclusive Question and Answer (Q&A) Session with the Challenge program staff and judges prior to the proposal due date. EOIs should be submitted via the online submission form. **EOIs are non-binding.** Teams have the flexibility to change and evolve their concept as they work and conduct research. The concept submitted here does not need to match the team's PDR submission.

The following information will be requested and is required to be submitted as part of the EOI:

- Name of U.S.-based lead academic institution
- Partnering academic institutions (if any)
- Name and contact information of the primary faculty advisor from the lead institution
- Name and contact information for the student team lead
- A synopsis of the concept, limited to 1000 words, providing a high-level overview of the proposed project and impact of the related research.

Preliminary Design Review (PDR) Package

PDR SUBMISSION DEADLINE: 11:59PM EST ON MARCH 9, 2023

PDR Expectations

- PDR packages (proposals) should be 12-15 total pages in length.
- Proposals should clearly articulate the innovation and design being proposed, including original human-computer interaction analysis planned and/or in progress.
- Submissions must be original, the work must be of the candidates, and must not violate the rights of other parties. Each submitting team represents and warrants that the team is the sole author and owner of the submission, that the submission is wholly original, that it does not infringe on any copyright or any other rights of any third party of which the team is aware, and that the electronic proposal and video submission is free of malware.
- All submitting teams will receive written feedback from the TFM-AID judges. The teams selected as finalists will receive feedback detailing specific areas they need to address in the follow-up CDR package.

The PDR Submission Packages

PDR packages must include, in the following order:

1. A **cover page** with the following information:
    - University name
    - Project title
    - Full names of all team members [including faculty advisor(s)], along with major course of study and academic level of each student (undergraduate or graduate)
    - Graphic or image of team logo (if any)
    - Faculty advisor signature of review and approval
        - Note: Submissions without a valid faculty signature will be deemed non-compliant and will not be reviewed.
2. **Quad chart**
   A Quad Chart is a way for teams to display some standardized information that helps evaluators quickly compare many projects. For the FAA TFM-AID Challenge, teams must use the provided template to create a quad chart and insert the chart into their PDR. Quad charts must address:
    - The project description/requirements
    - An image/graphic of the concept
    - Risks/Issues
    - Next Steps

3. **Technical report** – The body of the PDR package must outline/include the following elements, and must not exceed 13 pages:
    - Summary Statement (not to exceed one page)
        - An overall summary of the design, including a title of the project, an overview of the proposed design/solution, and a statement of the impact the innovative design concept will have on FMDS objectives.
    - Project Description (not to exceed 8 pages)
        - Describe how the design adheres to the constraints and guidelines.

        - Provide user personas of traffic managers to describe the decisions, factors to consider, and objectives for AFP modeling, implementation, and management.
        - Review the design at an operational level, going through the detailed use case and user interactions (include the information presented to the user, user options for action/selection, rationale, and characteristics).
        - Include initial wireframe (rough sketch of the application), mock-up (detailed static representation of the GUI), and image of the proposed design.
        - Define the technical risks of the proposed design.
        - Describe any planned testing (e.g., a usability evaluation with someone from the Human-Computer Interaction (HCI) field, a walkthrough with someone with air traffic experience) and expected results. (i.e., What do you hope to learn?)
    - Team Description (not to exceed two pages)
        - The relevant university/company affiliation, experience, expertise, and capabilities of the team members and faculty.
    - Project Plan (not to exceed two pages)
        - Include project initiation, development, design, and major reviews.
        - Include description of any risks or issues.
4. **PDR Video** – As a part of the PDR submission process, teams will be required to include a two-minute video. The intent is for the video to augment each team's PDR package by including animation, graphics, or other creative ways of showcasing unique aspects of their proposed concept.
    - Videos are limited to a maximum length of two minutes.
    - Videos should be uploaded to YouTube, and teams will provide their video's YouTube URL in the online PDR submission form. Other types of video files will not be eligible for consideration.
    - Videos need to be publicly viewable via a link. Videos should be "Unlisted" or "Public" on YouTube.
        - Troubleshooting tip: YouTube accounts sometimes need to be verified prior to being able to fully upload videos.
    - All team members should appear in the video, if possible (still images are OK).
    - The team's university name and project title should appear in text at the front of the video.
    - It is the responsibility of the team to follow copyright law. Do not use music or images that may violate copyright law. The team may use images created by the FAA. Neither the FAA nor the National Institute of Aerospace (NIA) can approve the use of other copyrighted material.

PDR Formatting Guidelines

Teams are responsible for the formatting and appearance of their PDR packages. Figures and tables should be legible without magnification. We recommend teams use image files with a minimum dpi of 150.

- PDRs should be 12-15 pages in length.

  - If needed, appendices are to be used for additional images, and evaluation details ONLY. Appendices do not count toward the maximum page limitations, however, please limit to 5 pages. References must be formatted uniformly and correctly. Only listing a link to the source is not acceptable.
    - Note: Judges are not obligated to look at the appendices. Include important details in the body of your paper to ensure they are reviewed.
  - Papers should be single spaced and single column.
  - Margins should be a standard 1" (2.54 cm) on all sides (top, bottom, left, and right).
- Please use fonts common to Macintosh and PC platforms, i.e. Times New Roman or Arial for text.
- Font size should be 11 or 12 pt., including in charts and graphs.
- PDR package files must be submitted as a PDF.

Tips From the Judges

- Proofread and edit your PDR package! Report quality can impact the judges' scoring. Poor grammar, typographical errors, etc., do not reflect well on your team, and you will be evaluated accordingly. Use consistent terminology across all products.
- Where there are not specific requirements listed, research and justify your assumptions. An important part of design is the ability to make reasonable assumptions to address uncertainties, and to understand the consequences of those assumptions.
- A picture is worth a thousand words and a well-conceived graphic can convey multiple pages worth of text and a deeper understanding of the problem and solutions. Pictures are a plus. Show us your innovation!
- If some results or details are not yet available or are being finalized, it is valuable to indicate when you will have them and how you are determining them. If it is not mentioned, judges will assume it is not being addressed.
- Make use of published papers and reports available to you. See the Resources section below for a preliminary list of suggested sources. Cite your references; plagiarism of any kind will not be tolerated.

Instructions To Submit PDR Package and Video

Submissions must be transmitted electronically by 11:59 PM ET March 9, 2023, via the online submission form. Late submissions will result in disqualification. Any other form of submission may be rejected.

No revisions will be accepted after submission, so please proofread your PDR and video files very carefully before submission. If there are any technical problems with the content of your PDF package or video (for example, your file was corrupted or a URL link was broken), we will try to contact you immediately, so it is very important that you provide us with up-to-date contact information on the submission form. **Late submissions will not be accepted**, and the submission form will close promptly at midnight.

The following information will be requested on the PDR Submission Form:

- Name of U.S.-based Lead Academic Institution
- Partnering Universities (if any)
- Project title
- Name and contact information of faculty advisor from lead institution
- Name and contact information for student team lead
- Name and contact information of each additional faculty advisor (if applicable)
- File upload for PDF PDR package document (max 95 MB).
- URL link for team YouTube video
    - Videos must be "unlisted" or "public." Private videos are not publicly viewable and may result in disqualification.
    - Videos should be titled as follows: "TFM-AID PDR Video: [University Name]" Abbreviations are allowable if necessary for YouTube character limits.
- A two-to-three sentence synopsis of the proposed project that briefly highlights key features and innovations (max 600 characters).

The National Institute of Aerospace (NIA) will acknowledge receipt of submissions and may request supplemental information, including supporting documents, more detailed contact information, and statements of authenticity to guarantee the originality of the work. NIA and the Federal Government assume no responsibility for lost or untimely submissions for any reason.

PDR Evaluation Criteria

The PDR Evaluation Criteria can also be found in the FAA TFM-AID PDR Scoring Matrix.

- **Description of how the team's design concept will accomplish required tasks** (max – 20 points)
    - How well do the user personas represent the ATCSCC traffic managers?
    - How well does the proposed concept align with Challenge goals and objectives?
    - How compelling is the proposed concept?
- **Description of team's UI design** (max 20 points)
    - Does the design account for all aspects of AFP modeling, implementation, and management for ATCSCC traffic managers?
    - How well does the wireframe and mock-up or image communicate the design?
    - Does the integrated UI design support streamlined workflows?
- **Innovation** (max - 20 points)
    - How innovative is the proposed solution?
    - How innovative is the UI design approach?
- **Technical merit and feasibility of proposed solution** (max – 10 points)
    - Does the proposed design provide a viable user interaction approach?
    - Is the design intuitive for ATCSCC traffic managers?
    - Does the design introduce technical risk?
- **Project plan capability** (max – 10 points)
    - Is the proposed project plan adequate and thorough?

  - Does the proposed project plan include an evaluation activity?
  - Has the proposed plan inspired confidence that the team can successfully accomplish the proposed tasks?
  - How viable is the schedule of activities?
- **Compliance and review** (max – 10 points)
  - Has the team adhered to appropriate design constraints?
  - Has the team submitted a package that has been thoroughly proof-read?
- **Video** (max – 10 points)
  - **Relevance to proposed design:** Video enhances/highlights aspects of the team's concept and/or increases understanding of the UI design.
  - **Overall impression**: Video content is aesthetic, organized, and flows. Viewers can easily follow the material.

Based on PDR reviews, up to five (5) teams will be selected to move to the final phase of the competition, where selected teams will be asked to submit a CDR package that addresses the PDR feedback and documents their final solution, and then present and demonstrate their concepts at the FAA FAA TFM-AID Challenge Forum in June 2023.

Deliverables for Finalist Teams

Teams selected as finalists in the Challenge and invited to attend the FAA TFM-AID Challenge Forum will be responsible for the following additional submission elements:

1. Critical Design Review Package, including:
   a. A 15 – 20-page technical paper
   b. An interactive design / Graphical User Interface (GUI)
   c. A "How-To" CDR video explaining the interactive design / GUI

2. A student-led 25-minute presentation to the Judging Panel followed by a 30-minute Q&A Session at the FAA TFM-AID Challenge Forum
   a. Presentations should be considered the teams' opportunity to "pitch" their meticulously developed solutions to the judges. It is expected that the presentations will include the Interactive Design / GUI via a live presentation, video, or other demonstration methods.
   b. The team's faculty advisor may participate in the presentation for up to to 3 minutes (e.g. for introduction and/or closing).

Critical Design Review (CDR) Package

CDR SUBMISSION DEADLINE: 11:59PM EST ON JUNE 7, 2023

CDR Package Expectations

- CDR packages should be 15-20 pages in length.

- CDR packages should include everything that was requested in the PDR package, with updates clearly articulating how the team has addressed the judges' feedback and open actions from their PDR. CDR packages should also include an updated video explaining how to use the interactive design/UI
    - Include an updated quad chart (using the Quad Chart Template).
    - List all actions/recommendations from PDR and their resolutions. Clearly articulate how PDR feedback was addressed.
    - Summarize any additional updates made since the PDR submission.
    - Include wireframe and mock-up illustrations.
    - Include a link or file to the developed prototype. Demonstrate that the prototyped UI design can be used for the required tasks.
        - A prototype is defined as a high-fidelity representation of the UI that simulates user interface interaction. Teams may use tools and programs such as Figma, Whimsical, or Sketch to build and demonstrate their prototype.
    - Include an updated CDR "How-To" video link, explaining how to use the Interactive Design/UI.
    - Teams should refer to the same rules as the PDR submission: *If needed, appendices are to be used for additional images, and evaluation details ONLY. Appendices do not count toward the maximum page limitations, however, please limit them to 5 pages. References must be formatted uniformly and correctly. Only listing a link to the source is not acceptable. Judges are not obligated to look at the appendices. Include important details in the body of your paper to ensure they are reviewed.*

Instructions to Submit CDR (Technical Paper, Video, and Interactive Design / UI)

To upload your CDR package (PDF file), please use the online submission form. No revisions can be accepted after the submission deadline, so please proofread your CDR and video files very carefully before submission. If there are any technical problems with the content of your PDF package or video (for example, your file was corrupted or a URL link was broken), we will try to contact you immediately, so it is very important that you provide us with up-to-date contact information on the submission form. **Late submissions will not be accepted**, and the submission form will close promptly at midnight.

The following information will be requested on the CDR Submission Form:

- Name of U.S.-based lead academic institution
- Partnering universities (if any)
- Project title
- Name and contact information of faculty advisor from lead institution
- Name and contact information for student team lead
- Name and contact information of each additional faculty advisor (if applicable)
- An updated two-to-three sentence synopsis of the proposed project that briefly highlights key features and innovations (max 600 characters).
- File upload for CDR package Technical Paper (PDF; max 95 MB).

- PDF file upload for Faculty Advisor Approval Attestation using the provided template
  - Note: Submissions without a valid Faculty Advisor Approval Attestation will be deemed noncompliant and will not be reviewed.
- URL link for team YouTube video
  - Videos must be "unlisted" or "public." Private videos are not publicly viewable and may result in disqualification.
  - Videos should be titled as follows: "TFM-AID CDR Video: University Name" Abbreviations are allowable if necessary for YouTube character limits.

The National Institute of Aerospace (NIA) will acknowledge receipt of submissions and may request supplemental information, including supporting documents, more detailed contact information, and statements of authenticity to guarantee the originality of the work. NIA and the Federal Government assume no responsibility for lost or untimely submissions for any reason.

Presentation Guidelines

PRESENTATION SUBMISSION DEADLINE: 11:59 PM EDT ON JUNE 24, 2023

Teams will present their work (with accompanying chart deck) to the TFM-AID Judging Panel, Program Staff, and other competing teams during their designated time slot at the 2023 FAA TFM-AID Challenge Forum. Presentations should be no less than 20 minutes and no longer than 25 minutes, and are followed by a 30-minute Q&A session. Teams may choose who speaks and who doesn't speak during the presentation. However, we encourage all team members to stand together at the front of the room during the presentation and Q&A session, to be available to answer questions even if they do not present.

Cover Slide:

Each presentation must have a cover slide that includes:

- Project title
- University name and any partnering universities, if applicable
- Faculty advisor's name(s)

Slide readability:

The presentation room is very large. Please ensure the font on your power point is large enough for those to see from the back of the room. Take advantage of high contrast options and avoid black screen backgrounds. Emphasize slide readability, especially for significant figures.

Dark videos/animations and black backgrounds typically do not show well in the presentation room and should be avoided when possible.

SPECIAL NOTES ABOUT THE PRESENTATIONS

Presentations should reflect the information found in the CDRs. If errors were discovered after the CDR package was submitted, teams should take this time to address them. **Significant information discussed during the presentation that was not included in the CDR may be penalized for scoring.**

The interactive design / UI's functions should be demonstrated within the team's final presentation, either via a live demonstration, video, or other interactional methods.

SUBMITTING THE PRESENTATION FILE

To upload your team's Presentation file, please visit the FAA TFM-AID Challenge website to access the online presentation submission form. Presentation files must be submitted by the deadline using the online form. ***Revisions to these files will not be accepted after the deadline – no exceptions.***

Teams that do not submit a presentation by the deadline will be barred from presenting and may not receive reimbursement for travel costs to the FAA TFM-AID Challenge Forum. Teams are encouraged to submit their final presentation files prior to travel. **Late submissions will not be accepted**, and the submission form will close promptly at noon EDT.

The following information will be required or requested on the Presentation Submission Form:

- University name
- University partners, if any
- Project title
- Primary faculty advisor and student team lead contact information
- File upload for Chart Deck (.ppt, .ppx, .pptx; Max 95 MB)

Final Evaluation Criteria

The TFM-AID Challenge Scoring Matrix outlines how the final technical paper, CDR video, and interactive design / UI will be evaluated. The Judging Panel will evaluate and score the final deliverables based on adherence to the following, with a maximum of 100 points earned:

CDR Technical Paper Evaluation Criteria (70% of total score):

Technical Papers will be scored out of 120 and multiplied by .7 to make up 70% of the team's final score.

- **Description of how the team's design will accomplish required tasks** (max – 20 points)
  - How well does the proposed prototype align with Challenge goals and objectives?
  - How compelling are the proposed prototype's goals and objectives?
  - Could the prototyped design help to minimize user training requirements?
- **Description of team's UI design** (max 20 points)
  - How well does the team describe their prototyped design?
  - Does the design account for all aspects of AFP modeling, implementation, and management for ATCSCC traffic managers?
  - How well does the prototype communicate the design?

    - Does the integrated UI design support streamlined workflows?
- **Technical merit and feasibility of proposed design** (max – 20 points)
    - Does the prototyped design provide a viable user interaction approach?
    - Is the prototype intuitive for ATCSCC traffic managers?
- **Innovation** (max - 20 points)
    - How innovative is the proposed solution?
    - How innovative is the UI design approach?
    - How well does the prototyped design improve the user experience?
- **Updates** (max - 20 points)
    - Are all the actions/recommendations from the PDR addressed?
    - Have any additional updates been appropriately applied (i.e., have they improved the design and/or user experience?)
- **Project plan completion– degree to which team has accomplished tasks** (max – 10 points)
    - Has the proposed project plan been completed?
    - Has an evaluation activity taken place?
    - Has the team developed a functioning, working prototype (high-fidelity representation of the UI that simulates user interface interaction)
- **Compliance and review** (max – 10 points)
    - Has the team adhered to appropriate design constraints?
    - Has the team submitted a package that has been thoroughly proof-read?

Presentation Evaluation Criteria (20% of total score):

- **Visual Presentation & Delivery:** Quality of presentation slides (e.g.: visuals, structure, appropriate use of slides for information, easy to follow), communication delivery, and presence of integration and teamwork (max - 10 points)
- **Q&A Response:** Quality of responses to questions from the judges (max 5 points)
- **Consistency with Final Technical Report:** Presentation is representative of the work in the Technical Report (max - 5 points)

CDR How-To Video Evaluation Criteria (10% of total score):

- **Aesthetics, Creativity, & Organization:** Video is visually compelling and clearly demonstrates the UI's purpose and how to use it (max - 5 Points)
- **Technical Simplification**: Language and information are easily understood by people from different technical fields and non-technical fields (max - 5 Points)

The National Institute of Aerospace (NIA) will acknowledge receipt of submissions and may request supplemental information, including supporting documents, more detailed contact information, and statements of authenticity to guarantee the originality of the work. NIA and the Federal Government assume no responsibility for lost or untimely submissions for any reason.

Resources

Please visit the *Resources section* on the FAA TFM-AID website to find resources and information for developing your TFM-AID Concept. A preliminary list of suggested resources is below.

1. TFM Learning Website – Provides tutorials on how TFM is conducted in the NAS, including how the existing TFMS is used.
    a. Document overview of AFP strategy
    b. Video providing more background on AFP planning
    c. Documented best practices for AFPs
    d. Document describing considerations for creating an FCA
2. TFMS Storyboard: TFMS | Traffic Flow Management System (faa.gov)
3. Traffic Flow Management Background
4. Airspace Flow Program (AFP) scenario
5. Traffic Flow Management Concept of Operations for Flow Management Data and Services (FMDS)
6. Traffic Flow Management in the National Airspace System booklet
7. Overview: Air Traffic Control System Command Center (ATCSCC) | Federal Aviation Administration
8. Collaborative Decision-Making Home Page | Federal Aviation Administration
9. Suggested Prototyping Tools: Figma, Whimsical, Sketch
    a. Note: These tools are provided as a reference and suggestion, and are not sponsored or endorsed by the FAA or NIA. Teams should carefully review all options before selecting a prototyping tool.
    b. For an example of the differences between a Mock-up, Wireframe, and Prototype, please visit Springboard.com and/or Mockplus.com.
10. FAA TFM-AID Challenge Documents & Templates:
    a. The FAA TFM-AID Challenge Details Document (this document)
    b. The FAA TFM-AID Challenge Evaluation Criteria
    c. The TFM-AID Quad Chart Template
    d. The FAA TFM-AID CDR Advisor Attestation Form Template

Rules, Terms, and Conditions

The following rules, terms and conditions apply to all submissions and teams that do not comply with the rules, terms and conditions may be disqualified:

1. Team is defined as all participants in the submission, including all academic institutions, faculty advisors, students, organizations and industry partners;
2. The Prize Administrator will administer the award of a single dollar amount to the designated lead academic institution of the winning team. The lead academic institution is solely responsible for allocating any prize funds among its team members as they deem appropriate;

3. Submission must include a robust Preliminary Design Review (PDR) to enter the competition under the rules declared and published by the FAA;
4. Submission must be in English and in a format readable by Microsoft Office applications or Adobe PDF. Scanned hand-written submissions will be disqualified. Additional format requirements may be listed on the FAA TFM-AID Challenge website;
5. The team and/or team members may not be a Federal entity or Federal employee acting within the scope of employment (this includes co-op students with civil servant status);
6. Team members may not be an employee of the DOT, including but not limited to the FAA; however, Federal Co-Op Interns may participate in the FAA TFM-AID Challenge anytime when they are on Leave Without Pay (LWOP).
7. Teams will not be deemed ineligible because a team member used Federal facilities or consulted with Federal employees during a competition if the facilities and employees are made available to all teams participating in the competition on an equitable basis;
8. Proposing team members are not permitted to consult with the judges or any of its committee members other than the invitation to participate in a scheduled Question and Answer (Q&A) Session and the follow-up technical question opportunities set forth in paragraph 9. These opportunities are offered to the teams that submit expression of interest by the deadline;
9. After the (Q&A) Session with the SC, should the students and faculty have follow-up technical questions, those questions should be submitted to NIA by email to Victoria.oleary@nianet.org. NIA will forward the question to the SC. After receiving a response from the SC, NIA will post follow-up questions and answers on the FAA TFM-AID Challenge website;
10. The FAA TFM-AID Challenge is subject to all applicable Federal laws and regulations. Participation constitutes the team's full and unconditional agreement to these rules, terms and conditions and to the final decisions of the FAA, which are final and binding in all matters related to this competition;
11. Each team represents and warrants that the team is the sole author and owner of the submission, that the submission is wholly original and authored by the team, that it does not infringe on any copyright or any other rights of any third party of which the team is aware, and, if submitted in electronic form, is free of malware. All submissions remain the property of the team;
12. By submitting an entry, teams agree to assume any and all risks and waive any claims against the Federal Government and its officers, employees and related entities (except in the case of willful misconduct) for any and all injury, death, damage, or loss of property, revenue or profits, whether direct, indirect, or consequential, arising from their participation in the FFAA TFM-AID Challenge, whether the claim or cause of action arises under contract or tort;
13. By submitting an entry, teams agree to indemnify the Federal Government against third party claims for damages arising from or related to the FAA TFM-AID Challenge activities;
14. The SC has the right to request additional information and access to supporting materials from the team;
15. The submission cannot have been submitted in the same or substantially similar form in any previous Federally-sponsored contest;
16. Each team grants to the DOT, the FAA, as well as other Federal agencies and organizations with which it partners, the right to use names, likeness, application and submission materials not marked with protective markings, photographs, voices, opinions, and/or hometown and state for FAA promotional purposes in any media, in perpetuity, worldwide, without further payment or consideration;

17. Personal information submitted by teams to Challenge.gov is subject to the privacy policy located at http://www.challenge.gov;
18. Personal information submitted by teams as part of the Expression of Interest and/or Submission through the FAA TFM-AID Challenge website will be transmitted to the FAA and may be kept in a system of records. Teams understand that the FAA TFM-AID Challenge website is hosted by a private entity, the Prize Administrator (NIA), and is not a service of the FAA or the Federal Government. The collection of personal and individually identifiable information on the FAA TFM-AID Challenge website is subject to the Prize Administrator's privacy and security policies. Teams agree not to hold the FAA or the Federal Government liable for the protection, use, or retention of any personal information submitted through the FAA TFM-AID Challenge website and/or in the team's Expression of Interest or Submissions;
19. Submission Marking and Freedom of Information Act (FOIA), 5 U.S.C.§552: All materials submitted to FAA as part of a submission become FAA records and are subject to release under the FOIA. Any confidential commercial information contained in a submission should be designated in writing at the time of submission.
    i. Teams are required to use protective markings as follows:
        a. The cover sheet of the submission must be marked as follows and must identify the specific pages containing trade secrets or commercial or financial information that is privileged or confidential:
    ii. Notice of Restriction on Disclosure and Use of Data: Pages [list applicable pages] of this document may contain trade secrets or commercial or financial information that is privileged or confidential and is exempt from public disclosure. Such information must be used or disclosed only for evaluation purposes. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. [End of Notice]
    iii. The header and footer of every page that contains trade secrets or commercial or financial information that is privileged must be marked as follows: "May contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure."
20. In addition, each line or paragraph containing trade secrets or commercial or financial information that is privileged or confidential must be enclosed in brackets.
21. If the team's submission has been marked as set forth above, the team will be notified of any FOIA requests for their submissions. Teams may then have the opportunity to review materials and work with a FAA FOIA Coordinator prior to the release of materials;
22. The Prize Administrator is the National Institute of Aerospace (NIA). The Department of Transportation (DOT), Federal Aviation Administration (FAA), is the Federal Agency sponsor of the prize;
23. Federal grantees may not use Federal funds to develop submissions;
24. Federal contractors may not use Federal funds from a contract to develop submissions or to fund efforts in support of a submission; and
25. Teams must include all the required submission elements. The Prize Administrator reserves the right to disqualify submissions after an initial screening if all required submission elements are not provided and/or if eligibility requirements are not met. The Prize Administrator may give teams an opportunity to fix non-substantive mistakes or errors in their submission packages.
26. The FAA retains sole discretion to select the winning team. The FAA reserves the right not to award the prize if the Steering Committee believes that no submission demonstrates sufficient innovation, potential and/or achievement.

Media Release

The recipients of monetary awards under the FAA TFM-AID Challenge ("Teams") agree to give permission to be recorded, photographed and/or videotaped by or for NIA, the FAA or their representatives or designees for the purpose of announcements and other outreach or informational purposes, including public announcements, concerning the Challenge.

The Teams further give permission to NIA, the FAA or their representatives or designees to use, reproduce, prepare derivative works, publish, distribute to the public, perform publicly, and/or publicly display all deliverables, including excerpts and any ancillary material, which may include each team participants' names, affiliations (schools), images, voice, and/or likenesses. NIA or the FAA may distribute the materials, including excerpts therefrom, and any ancillary material through a variety of media in existence now or in the future, including but not limited to print, television, websites, radio, or any other means. The FAA may also permit a third party to exercise the FAA's rights, including but not limited to the right to display or distribute the recording, including excerpts therefrom, and any ancillary material, in any manner the FAA deems appropriate. The teams also understand that this permission to use each participant's name, image, voice and/ or likeness in such materials is not limited in time and team participant will not receive compensation for granting this permission. Teams acknowledge that the FAA has no obligation to use any participant's name, affiliation, image, voice, and/or likeness in any materials produced by the FAA, but if the FAA so decides to use them, each participant waives the right to inspect or approve any such use. Teams hereby unconditionally release the FAA and its representatives from any and all claims and demands arising out of the activities authorized under this Media Release.

Prize Administrator Contact Info (National Institute of Aerospace)

For questions, please contact the FAA TFM-AID Challenge Project Lead, Victoria O'Leary (Victoria.oleary@nianet.org).

VICTORIA (TORI) O'LEARY	STACY DEES	SHELLEY SPEARS
		

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NATIONAL INSTITUTE OF AEROSPACE

Appendix A: Definitions

Airspace Flow Program (AFP) is a Traffic Management Initiative (TMI) that identifies constraints in the airspace, develops a real-time list of flights that are planned to fly through the constrained area, and assigns departure times to flights to meter the demand through that defined piece of airspace.

Air Traffic Control System Command Center (ATCSCC): An FAA facility in Warrenton, Virginia dedicated to balancing the nation's air traffic demand with system capacity.

AvSTEM: The study areas / fields of Aviation Science, Technology, Engineering, and Math.

Collaborative Trajectory Options Program (CTOP) is a TMI that manages demand through constrained airspace and considers operator preferences regarding route and delay as defined in a Trajectory Options Set (TOS).

Expect Departure Clearance Time (EDCT) is the runway release time ("wheels up") assigned to an aircraft in a GDP, AFP, or CTOP. All aircraft are expected to depart within +/- 5 minutes of the EDCT.

FAA: The Federal Aviation Administration; part of the Department of Transportation.

Fixes are geographical positions defined by a visual reference on the ground, reference to one or more radio NAVAIDs, celestial plotting, or another navigational device, used by aircraft to determine their route. Fixes may also be referred to as waypoints, intersections, or reporting points.

Flow Evaluation Areas (FEAs) and Flow Constrained Areas (FCAs) are three-dimensional volumes of airspace, along with flight filters and a time interval, used to identify flights. They are typically drawn graphically, such as around weather, and are used to evaluate demand on a NAS resource. An FEA is a region of airspace under study while an FCA requires action to address a particular situation. Note that an FEA/FCA can be drawn as a line applicable to specific altitudes.

Ground Delay Program (GDP) is a TMI where aircraft are assigned delayed departure times at their departure airport to manage demand and capacity at their arrival airport. GDPs are normally implemented for airports where capacity is reduced because of weather—such as low ceilings, thunderstorms, or wind—or when demand exceeds capacity for a sustained period. GDPs ensure the arrival demand at an airport is kept at a manageable level to prevent extensive airborne holding, and/or prevent aircraft from having to divert to other airports due to low fuel.

Graphical User Interface (GUI) is a form of user interface that allows users to interact with electronic devices through graphical icons and audio indicator such as primary notation, instead of text-based UIs, typed command labels or text navigation.

Miles-in-Trail (MIT) is a required distance between two aircraft on the same route of flight going to the same destination. A MIT restriction requires more than the minimum separation criteria, typically 5 nm in en route airspace, typically requiring 10 nm or more between aircraft.

National Airspace System (NAS) Users are individuals and organizations, such as pilots, airlines, and general aviation or military users, who operate aircraft in the NAS, and who currently use TFMS applications and data to maintain awareness of TMIs and other constraints.

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Navigational Aids (NAVAIDS) - Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight.

Route - A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth.

Traffic Flow Management System (TFMS) is a data exchange system for supporting the management and monitoring of national air traffic flow. TFMS processes all available data sources such as flight plan messages, flight plan amendment messages, and departure and arrival messages. The FAA is actively developing future requirements for the new ***Flow Management Data and Services (FDMS)*** to replace the current Traffic Flow Management System (TFMS) in support of air traffic flow management (TFM) across the National Airspace System (NAS).

Traffic Management Initiatives (TMIs) are techniques used to manage demand relative to capacity in the NAS. Types of TMIs include miles-in-trail (MIT), minutes-in-trail (MINIT), reroutes, time-based management (TBM) including time-based flow management (TBFM) metering, departure scheduling, Ground Delay Program (GDP), Airspace Flow Program (AFP), and Ground Stop (GS).

Traffic managers consider the impact of potential TMIs to the NAS and implement only those initiatives necessary to maintain system integrity. They utilize a variety of tools and NAS performance information to implement TMIs that are carried out by air traffic controllers and flight operators to ensure safe and efficient NAS operations.

Trajectory Options Set (TOS) is a set of routes submitted by the NAS user, ranked according to the NAS user's preference and the amount of delay they are willing to accept to use each route.