ACRP | AIRPORT COOPERATIVE RESEARCH PROGRAM

University Design Competition for Addressing Airport Needs

2022 - 2023 Design Competition Guidelines

NATIONAL ACADEMIES Sciences Engineering Medicine

TRB TRANSPORTATION RESEARCH BOARD

Introduction

The Airport Cooperative Research Program (ACRP) is sponsoring a national competition for universities that engages students in addressing issues relating to airports and the National Airspace System.

This Competition challenges individuals and teams of undergraduate and/or graduate students working with faculty advisors to consider innovative approaches related to these challenges.

Submitters should design innovative solutions that focus on addressing airport issues and constraints that would enhance the management, safety, capacity, and efficiency of the nation's airports.

Subject Areas

The Competition focuses on design solutions addressing airport needs in the following broad areas:

- **Airport Operation and Maintenance**
- **Runway Safety/Runway Incursions/ Runway Excursions Including Aprons, Ramps, and Taxiways**
- **Airport Environmental Interactions**
- **Airport Management and Planning**

Background and some specific challenge areas are defined in the Technical Design Challenges section.

Students are not limited to the suggested topic areas and are free to consider design solutions in related topic areas as long as they are consistent with the four broad challenge areas.

As part of the required literature review, participants need to explore past ACRP research reports to see what ideas have already been presented and studied.

The Competition website is the participant's source for complete and up-to-date information.

Watch the video: *"Tips For Creating a Winning Design Proposal"* at the Competition website.

Important to Note Before You Begin

Check out ACRP Studies and Reports: As you explore ideas for design proposal topics, you will want to start by reviewing recent Airport Cooperative Research Program (ACRP) studies to get a sense of what topics have attracted the interest of the airport community. Go to http://www.nap.edu/author/ACRP/transporation:research-board/airport-cooperative-research program to see links to recent studies.

Literature Review: A literature review summarizes the key resources that you have reviewed on your design topic and critically evaluates and analyzes those resources. A literature review is far more than a bibliography. It provides a summary of those resources, provides an understanding of the state-of-the-art in the subject area, and identifies existing knowledge gaps or processes where your innovative approach can contribute. Your literature review is the foundation for justifying your design and approach and for describing how it will meet an existing need or fill in a gap. The review panel will carefully consider the thoroughness and appropriateness of this section with respect to your chosen design topic. ACRP studies and reports directly address airport issues and needs and are a logical and expected first step in conducting your literature review. Cite these in your submission.

Interactions with an Airport Operator(s) who can help you understand the feasibility and practicality of your design concept is a Competition requirement. The Virginia Space Grant Consortium can help you link to airport operators with the help of the American Association of Airport Executives, a Competition partner. Contact us at acrp@odu.edu.

A description of the team's interactions with airport operators and the feedback received must be incorporated into the Problem Solving Approach section of the design proposal. Contact listings must also be included in appendix C. Airport operators are employees engaged in managing and running an airport. Pilots, FAA employees, airline employees, and air traffic controllers are considered industry experts.

Interaction with Industry Experts in your design process is also a requirement. The Competition website lists experts from many fields who have offered to be available as an advisor along with their contact information. You will need to document this interaction in your proposal. A description of the team's interaction with industry experts who are not airport operators and the feedback received must be incorporated into the Problem Solving Approach section of the design proposal. Contact listings must also be included in Appendix C. Examples of industry experts include: FAA employees (such as those that work for the Office of Airports https://www.faa.gov/airports), companies that use or provide services to airports, airline employees, pilots, and air traffic controllers.

A Safety Risk Assessment and a Cost Benefit Analysis are required elements of your design proposal. The Competition website has video tutorials to help you with developing these elements.

Evaluation Rubric: The scoring guidelines used by reviewers is available on the Competition Website and shows the weight given to each element of the design proposal.

Competition website resources:

- Competition Guidelines
- Links to ACRP and Federal Aviation Administration (FAA) Reports and Resources
- Online Design Submission Process
- Expert Advisors in Challenge Topics
- Online Notice of Intent Electronic Submission Form
- Link to Winning Designs from the 2007-2021 Competition Years
- Contact Information for Queries
- Instructional videos on the required Safety Risk Assessment and Cost/Benefit Analysis

Competition updates will be posted on the website.

Competition Goals

1. Raise awareness of the benefits of the ACRP and the importance of airports and the FAA to the National Airspace System infrastructure.

2. Increase the involvement of the academic community in the ACRP and addressing airport operations and infrastructure issues and needs.

3. Engage students at U.S. colleges and universities in the conceptualization of applications, systems and equipment capable of addressing related challenges in a robust, reliable and comprehensive manner.

4. Encourage undergraduate and graduate students at U.S. colleges and universities to contribute innovative ideas and solutions to issues facing airports and the National Airspace System.

5. Provide a framework and incentives for quality educational experiences for university students.

6. Develop an awareness of and interest in airports and aviation as vital and challenging areas for careers in engineering and technology.

About the ACRP

The Airport Cooperative Research Program (ACRP) carries out applied research on problems that are shared by airport operating agencies, not adequately addressed by other federal research programs. The ACRP undertakes research and other technical activities in a variety of airport subject areas involving administration, environment, legal, policy, planning, safety, human resources, design, construction, maintenance, and operations at airports. ACRP is able to draw on its targeted research to help U. S. university students be engaged in contributing innovative approaches to issues facing our nation's airports and the National Airspace System.

Airports are vital national resources. They serve key roles in the transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research continues to be necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry.

The primary parties supporting ACRP are (a) the ACRP Oversight Committee (AOC), an independent governing board appointed by the Secretary of the U.S. Department of Transportation, with representation from airport operating agencies, other stakeholders, and relevant airport associations such as the Airports Council International - North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), Airports Consultants Council (ACC) and the Airlines for America (A4A) as vital links to the airport community; (b) the Transportation Research Board (TRB), a program division of the National Academies of Sciences, Engineering, and Medicine as program manager and secretariat for the governing board; and (c) the FAA as program sponsor. The ACRP benefits from the cooperation and participation of airport professionals, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

About the FAA

The FAA is part of the Department of Transportation and is responsible for the safety of civil aviation. The activities of the FAA include:

- Regulating civil aviation, including commercial service airports, to promote safety;
- Encouraging and developing civil aeronautics, including new aviation technology;
- Developing and operating a system of air traffic control and navigation for both civil and military aircraft;
- Researching and developing the National Airspace System and civil aeronautics;
- Developing and carrying out programs to reduce aircraft noise and other environmental effects of civil aviation; and
- Regulating U.S. commercial space transportation.

The FAA provides the framework for a safe, secure, and efficient aviation system. As a leading authority in the international aviation community, the agency is responsive to the dynamic nature of customer needs, economic conditions, and environmental concerns. The FAA encourages and supports innovative research to improve airport and aviation safety, improve aviation capacity, and reduce environmental impact.

The FAA provides funds to the ACRP to support this Competition.

Competition Partners

The ACRP gratefully acknowledges the contributions of the following partnering organizations that supply expert advisors for teams, assist in dissemination of the Competition opportunity to organizational members, and participate in design reviews.

The American Association of Airport Executives (AAAE)

AAAE is the largest professional organization for airport executives in the world, representing thousands of airport management personnel at public use airports nationwide. The organization's primary goal is to assist airport executives in fulfilling its responsibilities to the airports and communities they serve.

The Airport Consultants Council (ACC)

ACC is an international trade association representing more than 240 companies that provide development and operations-related consulting and product services to airports and other aviation system stakeholders. Members offer architectural, engineering, planning, security, environmental, financial, management, economic and construction services, products and equipment.

The Airports Council International - North America (ACI-NA)

ACI-NA is a membership organization representing approximately 160 state, regional, and local governing bodies that own and operate the principal airports served by scheduled air carriers in the United States and Canada. ACI-NA member airports handle approximately more than 95 percent of the domestic and virtually all of the international air passenger traffic and cargo traffic in North America.

The National Association of State Aviation Officials (NASAO)

NASAO was founded to ensure uniformity of safety measures, to standardize airport regulations and develop a truly national air transportation system responsive to local, state, and regional needs. The organization represents the men and women in state government aviation agencies who serve the public interest in all 50 states, Guam, and Puerto Rico.

University Aviation Association (UAA)

UAA is the voice of collegiate aviation education to its members, the industry, government and the general public. Through the collective expertise of its members, this nonprofit organization plays a pivotal role in the advancement of degree-granting aviation programs that represent all segments of the aviation industry.

The Competition is managed for the ACRP by the Virginia Space Grant Consortium based in Hampton, Va. (vsgc.odu.edu).

Overall Requirements

The ACRP University Design Competition for Addressing Airport Needs is open to teams or individuals from accredited U.S. colleges and universities who are working with a faculty advisor.

The Competition will be open for student participation from August 2022 through May 12, 2023, allowing participation during fall semester 2022 and/or spring semester 2023. Final due date for all submittals is May 12, 2023. All submissions will be judged after the due date.

Challenges might typically be addressed as part of a senior design class or independent study option or through other academic venues, including faculty-mentored, college-based student chapters of professional societies.

The Competition requires evidence of interaction with both airport operators **and** industry experts for feedback on the practicality of the proposed design/approach. Links to expert advisors are provided on the Competition website. The American Association of Airport Executives is offering assistance in linking students to airport operators. Participants should contact the Virginia Space Grant Consortium at acrp@odu.edu to request assistance.

A key criterion for submittal evaluation is innovation. As part of the required literature review, participants should carefully review and consider previous, related research and proposed problem solutions in formulating and supporting their submission.

The ACRP offers a wealth of research papers and other documents that students should consider in planning their submittal and proposed research approach. Links to previous and current ACRP research are available on the ACRP web site: www.nap.edu/author/ACRP/transportation-research-board/airport-cooperativeresearch-program. **Students should also review previous winning submissions of the University Design Competition for Addressing Airport Needs and its predecessor, the FAA Design Competition for Universities.** Links to these resources are provided on the Competition website.

Participants are encouraged to take an interdisciplinary approach to the selected topic and a cross-departmental approach where appropriate. Submissions must be student written and demonstrate a thorough understanding of current conditions/state-of-the-art approaches relevant to the chosen topic. Guidelines for elements of the submittal package are provided on page 11.

Note that additional information, resources, and responses to queries will be posted on the Competition website at www.trb.org/ACRP/ACRPDesignCompetition.aspx. Scoring criteria for submittal review are also posted on the Competition website. The submittal packages must be delivered both electronically and in hard copy with instructions and necessary forms provided on the website.

Notice of Intent: Though not required, participants are strongly encouraged to provide a nonbinding "Notice of Intent," which is submitted electronically through the Competition website. The purpose of the Notice of Intent is to allow Competition staff to assist as needed with providing access to Airport Operators and expert sources that can be of help to the student or student team during the design process. ACRP personnel and members of partnering organizations will serve as resources to design teams or individual participants.

A key goal of the Competition is to enhance the educational experience of participating students. The ACRP believes that by providing access to experts, the educational process can be strengthened; students gain exposure to professionals in the field; and students will be better able to assess the practicality of their designs. The Notice of Intent will also assist the ACRP with planning for the review process to include appropriate subject matter experts. Once a Notice of Intent is received, the faculty advisor will be contacted to see what assistance might be needed.

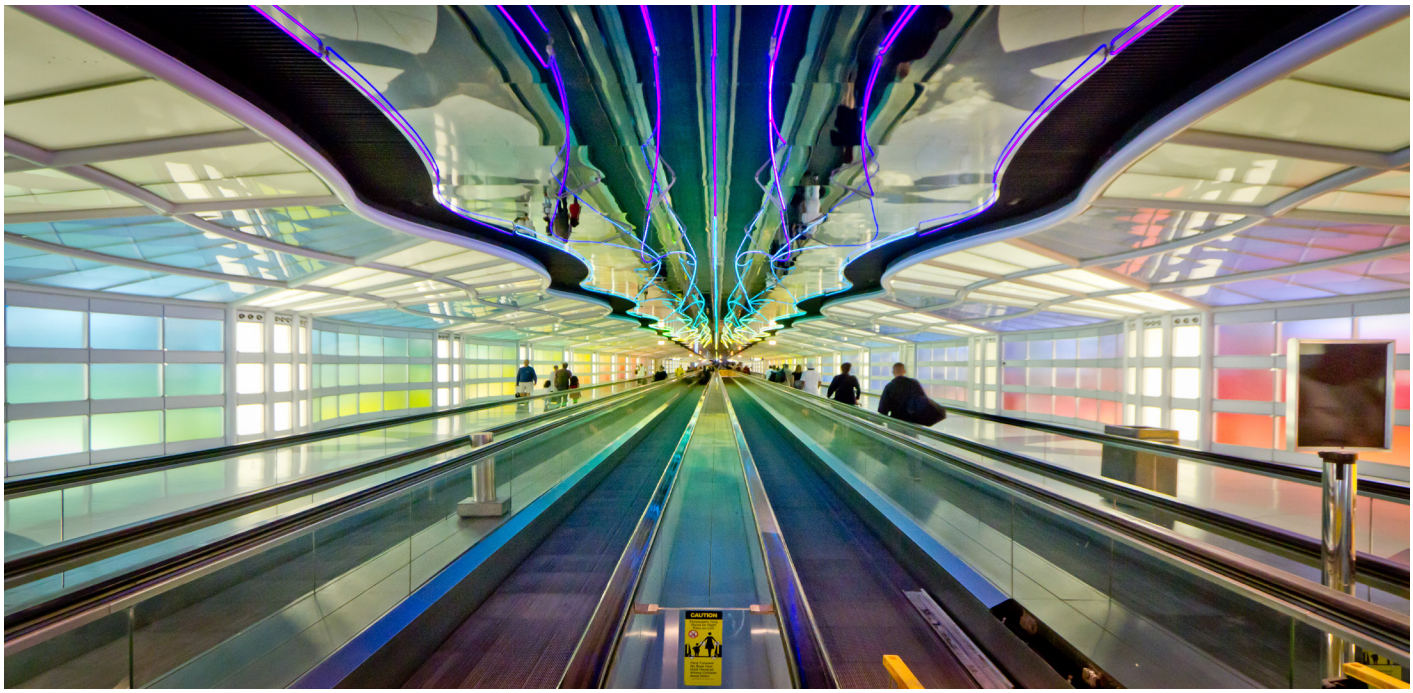
For maximum effectiveness, the Notice of Intent should be submitted in advance of beginning the design process by September 28, 2022 for projects commencing in the fall semester and January 27, 2023 for projects commencing in the spring semester. A Notice of Intent will be accepted later; however, teams are encouraged to submit by the suggested date.

Technical Design Challenges

I. Airport Operation and Maintenance

The day-to-day operation and maintenance of an airport involves many tasks. Airport operators must handle both routine matters and unusual circumstances. Their responsibilities include keeping records; hiring and training personnel; maintaining pavement; maintaining markings, signs, and lighting; providing snow and ice control, if applicable; managing emergency preparedness; overseeing handling of hazardous materials, including jet fuel; conducting airport self-inspections; overseeing procedures for operation of vehicles on the airfield; providing obstruction lighting; protecting navigational aids; protecting public safety; dealing with wildlife control; and overseeing construction projects.

Almost 20,000 airports are located throughout the United States today. Of those, approximately 8,700 feature paved runways, taxiways and ramps/aprons. Paved airport surfaces can be affected by many things: adverse weather, build-up of rubber residue from aircraft tires, and normal wear and tear. The pavement surface must also be kept free of what is referred to as foreign debris.



This debris can be in the form of such things as rocks and stones tracked onto the pavement surfaces from grass areas adjacent to the pavement, material coming off aircraft during taxiing, landing, or takeoff, and objects blown from the aircraft servicing areas. This debris can cause major damage to aircraft engines if it is ingested or affect the aerodynamics of a propeller.

Airport operators certificated under 14 Code of Federal Regulations Part 139 are required to keep these surfaces in a condition that meets requirements specified in the regulation. These surfaces are inspected visually on a regular basis so any deficiencies can be found and corrected. Some automated systems have been developed to supplement aspects of these visual inspections.

In the interest of safety, an airport surface must be closed for a pavement repair. Runway closures reduce capacity at that airport, affecting carriers that may have to juggle flights to accommodate the repair and inconveniencing non-airline (called general aviation, or simply GA) aircraft that need to use alternate airfields, especially if the closure is unplanned. Any technologies or procedures that either improve the structure/longevity of pavement, increase the speed of repairing pavement, or automatically alert the airport operator to hazardous pavement conditions will be a welcome advance for airports.

This Design category has challenges that focus on new approaches that will help airport operators increase airfield efficiency outside of the terminal and airport buildings. Terminal facilities, exclusive of security, are a secondary consideration. Designs can also consider the potential effects of NextGen on airport operations.

Airport Operation and Maintenance Challenges:

A. Exploring new methods for design and maintenance of pavement surfaces and markings. Ideas include, but are not limited to:

- Methods for innovative pavement repair.
- Innovative pavement materials, installation and maintenance techniques, including nondestructive evaluation methodologies.
- Improved approaches to rubber removal/surface restoration due to aircraft tire friction.
- New or improved techniques for ice removal from runways.
- Improved methods for ensuring the integrity of airfield markings.

B. Improved methods for foreign object detection and removal from runway surfaces.

C. Innovative approaches to address wildlife issues at airports including bird strikes.

D. Innovative applications, including web-based solutions, for airport operations and maintenance.

E. Improved methods for ground traffic flow scheduling.

F. Innovative ways to collect, verify, distribute or use geospatial data to benefit safety or efficiency impacting airport operations. Note: The FAA Office of Airports has developed an Airports GIS program to collect authoritative geospatial data for airport infrastructure and surveys. The NAV Lean Program has developed authoritative databases for sharing geospatial data for airports, obstacles, airspace and navigation aid.

G. New and improved techniques for communicating status and impact of service disruptions such as weather, equipment, accidents or other occurrences, flight delays, air

traffic disturbances, and computer system breakdowns.

H. Operation and maintenance procedures to enhance sustainability and resilience at airports.

I. Strategies for safe and effective integration of automated and connected vehicles into the complex airport operations environment.

J. Innovative ways for airports to respond to future demand for alternative powered aircraft including electric and biofuels.

K. Innovative approaches to aircraft rescue and firefighting including environmentally safe and effective alternatives for fire suppression.

L. Utilization of UAV technology to enhance safety in the airport environment. NEW

While students will need to undertake a thorough literature search, some key documents and resource links to begin the process are listed on the Competition website.

II. Runway Safety/Runway Incursions/ Runway Excursions Including Aprons, Ramps, and Taxiways

The United States National Airspace System (NAS) has over 500 FAA/contract towered airports that handle more than 135,000 aircraft operations—takeoffs and landings—a day, averaging approximately 50 million airport operations per year. A runway incursion is any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft. According to the FAA Runway Safety Office, 25,551 Runway incursions have been reported over the past 20 years, with 1761 reported in 2019. Of the approximately 150 million takeoffs and landings at United States towered airports from FY 2011 through FY 2013, there were 3,326 reported runway incursions. This performance record means that there were approximately 22 runway incursions for every one million operations and just under one serious runway incursion for every five million operations. The National Transportation Safety Board (NTSB) continues to list "Airport Surface Operations" on their Most Wanted List, which "is designed to increase awareness of, and support for, the most critical changes needed to reduce transportation accidents and save lives."

One of the FAA's top priorities is to reduce the frequency of runway incursions and the risk of a runway collision. The FAA aims to reduce the severity, number, and rate of runway incursions by implementing a combination of technology, infrastructure, procedural and training interventions to decrease the prevalence of human errors and increase the error tolerance of airport surface movement operations.

The FAA is developing airport design concepts and surface movement procedures, such as the use of perimeter taxiways, to decrease the number of runway crossings and thereby reduce the risk of runway incursions. Related efforts address the errors committed by pilots, air traffic controllers, and airport-authorized vehicle operators and pedestrians.

Also of great concern are runway excursions. A runway excursion occurs when an aircraft departs the runway in use during the take-off or landing run or during taxiing. The excursion may be intentional or unintentional. Runway excursions are mainly of three types—overrun, undershoot and veer-off. Examples of runway excursions include: (1) a landing aircraft is unable to stop before the end of the designated runway is reached leading to a overrun; (2) an aircraft taking off or rejecting takeoff or landing departs the side of the designated runway leading to a veer-off; (3) an aircraft attempting a landing touches down in the undershoot area of the designated landing runway within the aerodrome perimeter; or (4) a runway or taxiway other than the designated one is used for a takeoff or a landing.

Runway excursions are the most frequent accident category worldwide. Between 2009 and 2013, there were 432 total commercial aviation accidents. Of these, 98 were runway/taxi excursions of which 7 involved a total of 191 passenger and crew fatalities (Source IATA). Studies of runway excursions have called for appropriate measures to be taken to address this problem.

Runway Safety/Runway Incursions/ Runway Excursions Including Aprons, Ramps, and Taxiways Challenges:

A. Methods for improving runway safety during airport construction and reconstruction.

B. Optimizing safety through improvements and redesign of existing runways and taxi ways.

C. Safety considerations for drones operating in or near the airport environment—issues and constraints as well as benefits and costs.

D. Innovative concepts for virtual/remote towers at non-towered airports.

E. Optimizing NextGen technology to improve runway safety in particular and airport safety in general.

F. Expanding situational awareness of pilots and ground operators on the airfield. Ideas include, but are not limited to:

- Mobile tools for pilots, pedestrians and vehicle operators that aid in situational awareness.
- Direct warning systems to alert pilots that they are approaching a runway and if the runway is occupied.
- Direct warning systems to alert air traffic controllers for situations leading to runway incursion.
- Direct warning systems to alert airfield drivers that they are approaching a runway they are not authorized to cross.
- Development of innovative techniques to record, analyze and display annotated spatial data for improved situational awareness of ground operations.
- Methods for aircraft/runway interface that address issues caused by new energy efficient lighting not being visible to heat sensing, enhanced flight vision systems.

G. Enhancing airport visual aids
- Improved lighting, marking, and signage for runways, taxiways and the airport apron.
- Lighting other than traditional incandescent.
- Providing surface navigation guidance to pilots in the cockpit via electronic alternatives in limited visibility conditions (in lieu of outside visual cues).

H. Runway excursions
- Identification of major causal/contributory/contextual factors leading to runway excursions.
- Risk analysis of runway excursions due to overrun/undershoot/veer-offs.
- Innovative approaches to reducing runway excursions and associated risks.

I. Safety assessment tools
- Mobile tools to support assessments conducted by runway safety action teams that aid in compliance evaluation as well as hazard identification and correction.
- Systems analysis to determine areas of greatest risk for runway incursions and excursions in the National Airspace and proposing corrective action plans.
- Innovative processes to identify the hazards that present the greatest risk to air carrier operations within the runway environment and strategies to mitigate those hazards and improve safety of airport surface operations.

J. Safely integrating emerging technologies into apron, ramp, taxiway, and runway environments.

K. Enhancing airfield safety through application of emerging technologies.

While students will need to undertake a thorough literature search, some key documents and resource links to begin the process are listed on the Competition website.

III. Airport Environmental Interactions

As the FAA carries out its mission, it must comply with regulations protecting the environment. All airport operations must be carried out with consideration for how the environment could be adversely affected. Airport environmental concerns may include many things: noise; land use; social impacts; air quality; endangered and threatened species; energy supply and natural resources; light emissions; solid waste impacts; or construction impacts.

This Design category has challenges that focus on improvements in snow and ice removal, containment and cleanup of fuel spills, storm water management, noise reduction and energy efficiency that will help airports carry out their mission in a way that will be environmentally sound and energy efficient.

As mentioned in Section I, Airport Operation and Maintenance, one of the airport operator responsibilities is snow and ice control on paved surfaces. Air carriers/pilots must ensure their aircraft are free of ice/snow to enable a safe takeoff. In many cases, this involves application of a chemical agent, which for both aircraft and airport pavements must meet strict corrosivity requirements. After the aircraft is treated, the airport operator is left with the problem of how to dispose of these chemicals or other cleanup required. Any improvements in aircraft and/or pavement anti-icing and/or de-icing agents themselves, new methodologies or procedural improvement would be welcome.

Another environmental hazard is fuel spills. While a hazard on the airfield itself, airport operators must also ensure the spilled fuel does not enter the water supply where it can do even more damage. Storm water management at airports is important to prevent contaminants such as chemicals and fuels from entering the water table. Air quality around airports is also a factor.

Energy efficiency is another factor of environmental responsibility at airports. Energy is required for all airfield buildings, vehicles, and the airfield itself. It can be a challenge, especially at remote airports that may not have an independent power source, to keep the airfield properly lit.

Airport Environmental Interactions Challenges:

A. Making snow and ice removal more environmentally friendly. Both chemical and nonchemical options can be considered. The ACRP is seeking designs that offer:
- Improved means and methods of complying with aircraft and airfield anti- and de-icing requirements.
- Environmentally safe aircraft and airfield anti- and de-icing products that are compatible with both aircraft structures and airport pavements.
- Improved containment and cleanup of anti- and de-icing products.

B. Improving methods for containment and cleanup of fuel spills.
- Bioremediation techniques for fuel spill cleanup.
- Techniques/substances for neutralization of toxic components of fuel.
- Techniques/substances that delay the biological and chemical breakdown of fuel, allowing cleanup to occur without causing rapid decreases in dissolved oxygen in receiving waters that result from biological and chemical degrading of the fuel.
- Techniques for prevention of percolation of fuel into ground water.

C. Increasing energy efficiency in the management of airfields, the terminal area and other airport buildings. Topics that might be considered include:
- Alternative energy/energy efficient airport equipment such as tow vehicles, emergency generators, power units, heating systems, etc. for use in airfield areas.
- Alternate energy sources and approaches to providing lighting at remote airports that don't have access to electrical power.
- Innovative approaches to solid waste reduction at airports.
- Integration of alternative energy-producing and energy-saving technology into the airport environment.

D. New tools and approaches to storm water management methods, water use at airports, and dealing with negative impacts of standing water.

E. New tools and approaches to noise reduction at airports.

F. System level methodologies for strategic assessment of environmental interactions beginning at the airport planning phase.

G. Enhanced methods for improving air quality around airports.

H. Innovative strategies for management of natural environments to minimize negative impacts on, and to enhance compatibility with, Airport Operations.

I. Enhancing potential for resilience and sustainability of airport improvement projects in response to climate change effects or other naturally occurring catastrophic events such as hurricanes and other extreme weather events, sea level rise and changing weather patterns.

J. Managing potential environmental impacts from Spaceport activities such as fuel management, access and egress, noise, and safety issues among others.

K. Enhancing resilience and sustainability of airport operations and associated improvement projects in response to potential climate change effects or other naturally occurring catastrophic events:

- Risks to terminal operations
- Risks to flight control procedures
- Risks to operation of other on-airport facilities
- Risks to fuel supply
- Effects on freight and passenger access/logistics

L. Methods of reducing carbon emissions from ground equipment at large hub airports. NEW

While students will need to undertake a thorough literature search, some key documents and resource links to begin the process are listed on the Competition website.

IV. Airport Management and Planning

In today's airport environment, especially at the busier airports, any change in "normal" operations affects that particular airport and also may ripple across the NAS and affect many other airports and passengers. To meet this challenge, the FAA, airport operators, and airport users must work together to develop action plans that provide the best solutions for local and regional areas, as well as the nation. An integrated approach is preferred which includes improving technology, air traffic control procedures, and expanding airport and airfield infrastructure.

Airport Management and Planning Challenges:

This Design Category has challenges that focus on airfield management and planning that will help airport operators optimize the use of existing airport resources and plan for upcoming functional needs.

A. Maximizing airport capability

- Strategies for accommodating aircraft that experience extended delays on the tarmac and in line for takeoff, including dealing with human needs as well as airport and airline capabilities.
- Innovative approaches to demand forecasting and management for airports.
- Innovative strategies for reducing airline fuel consumption, such as new ways to reduce gate-to-gate time or revise procedures.
- Effective alternatives to current ramp and gate controls.
- Creative approaches to airport revenue generation for general aviation airports.
- Models for collaborative decision making and data sharing at airports.
- Improved aircraft and airport design factors affecting aircraft compatibility to decrease the risk of aircraft wing tip collisions in the non-movement apron areas.
- Improved strategies for airport asset management, including land use.
- Innovations to accommodate the aging passenger demographic at airports.
- Effective uses of social media in airport planning, marketing, development and customer service.
- Planning for the integration and mitigation of possible impacts of drones into the airport environment.
- Enhanced management approaches to landside functions to include parking and ground transportation.
- Innovative approaches to building and maintaining workforce capacity at airports in response to changing demographics, influence of emerging technologies, institutional changes, and other relevant factors.
- Strategies for mitigating potential cybersecurity challenges at airports.

B. Identifying, collecting, and managing data from new technologies such as artificial intelligence and machine learning to improve airport planning and operations.

C. Planning and preparing airport infrastructure for the integration of advanced air mobility transportation systems. How do airports plan now for this upcoming new transportation venue? NEW

D. Planning and preparing airport infrastructure for the integration of commercial space operations. NEW

E. Approaches to addressing cybersecurity issues with respect to integrity of aircraft and airport systems. NEW

While students will need to undertake a thorough literature search, some key documents and resource links to begin the process are listed on the Competition website as well as instructional videos on completing a Safety Risk Assesssment and Guidance for Preparing Benefit Cost Analyses.

Guidelines for Design Submission

It is strongly recommended that participants review the Tips for Proposers section of the Competition website. Each of the following should be identified as a separate section of the design.

Design Package Components:

1. **Main Body of the Design Submission**
The main body of the report must contain the following sections. There is a limit of 40 pages. Only required appendices are allowed. See format below. Use the bolded section headings noted below in formatting your design package.

- **Cover Page** to include: Title of Design; team member(s) name(s) and status (undergraduates or graduates); advisor(s) name(s) and university attending.

- **Executive Summary** – 1 page. This section must include a statement of the problem being solved, brief background information on the topic, a short explanation of the process undertaken to arrive at the solution and the solution itself.

- **Table of Contents** with page numbers referenced for each section and appendix.

- **Problem Statement and Background** on the Design Challenge being addressed. This section should demonstrate that the individual or team has a clear understanding of the issues surrounding the design challenge as well as current conditions and state-of-the-art approaches. See additional background on page 2.

- **Summary of Literature Review**. This is an overview of what was gleaned from the literature review with a discussion of primary sources and their influence on the design. Include a description of the ACRP reports reviewed. If no ACRP report was found to address your problem statement, be sure to note this. See page 2. Specific reference citations are to be provided in Appendix F.

- **Individual or Team's Problem Solving Approach to the Design Challenge**. This section should include a thorough description of individual's or team's work including a description of both interdisciplinary and systems engineering approaches as appropriate to solving the problem. Incorporate details of your interaction with airport operators and industry experts and the feedback you received. (See page 2 for more background.) A separate listing of these contacts is required in appendix C. This section should include a description of how the technical aspects of the Design Challenge are addressed through drawings, mockups, computer codes, etc. as appropriate to provide evidence of a thorough design process.

- **Safety Risk Assessment**: The FAA promotes a culture of safety throughout all its operations. Examine existing FAA safety management system guidance as it relates to your proposed design solution. Consider inherent risks and describe how these risks should be addressed to ensure safe operations. Be sure to reference Introduction to Safety Management Systems for Airport Operators (FAA Advisory Circular 150/5200-37) and FAA Safety Management System Manual available under the Resources section of the Competition website. See video with additional guidance on this section at the Competition website.

- Description of the **Projected Impacts of the Team's Design and Findings** with a thorough discussion of how the design/solution meets ACRP goals. This section should address commercial potential for the design, including a description of processes that would need to be undertaken to bring the design to the product/implementation state. Emphasis should be on increased affordability and utility. This section should provide a financial analysis that reflects a realistic approach to projected cost/benefit determination and for the team's design. Guidance for acceptable cost/benefit analyses for the purpose of the Competition is provided on the Competition website.

2. **Appendices A-F** as described below are required but not included in the 40-page limit. No other material may be included as an appendix.
- **Appendix A.** List of complete contact information (use permanent addresses) for all advisors and team members. Include email, fax and phone numbers. This information is crucial as student participants may have graduated prior to receiving an award and all award checks are mailed directly to the participants.
- **Appendix B.** Description (approximately one page) of the university or college.
- **Appendix C.** List of industry experts contacted by the team. Detail on your interactions must be provided in the Problem-Solving Approach.
- **Appendix D.** Sign-off form for faculty advisor(s) and department chair(s). Sign-off form is available at the Competition website.
- **Appendix E.** Evaluation of the educational experience provided by the project. Evaluation questions for both student and faculty are provided on the Competition website.
- **Appendix F.** Reference list with full citations using APA, IEEE, or other standard format. APA reference format is available at http://writing.wisc.edu/Handbook/Documentation.html. IEEE format is available at IEEE Citation Reference Guide

Format:

Double-spaced, single-sided, minimum 12-point type, Times New Roman or Helvetica font. Captions and charts may be at a minimum of 10-point type. Pages, including appendices, must be numbered and referenced in Table of Contents.

Due Date: May 12, 2023

The design package shall be submitted electronically following guidelines provided at the Competition website. Be sure to include the sign-off form which is available on the Competition website.

All electronic submissions must meet the 5 p.m. (Eastern Daylight Time) deadline on May 12, 2023. The faculty advisor will receive a submission acknowledgement via email.

By submission of the design package, Competition participants are agreeing that their design may be publicly shared.

Awards and Key Dates

A cash award will be given to the student or shared equally among the student team members in each of the four technical design challenge areas as follows:

First Place - $3,000
Second Place - $2,000
Third Place - $1,000

First place award-winning team representatives will be invited to accept their award and present their design at a ceremony at the National Academies of Sciences, Engineering, and Medicine in summer 2023, date to be determined.

A travel allowance will be provided for at least two individuals (two students or one faculty advisor and one student) from each first place winning team.

First place teams will also be invited to present their design at an appropriate Competition partner workshop or conference. Travel costs will be covered.

• Competition announcement August 2022.

• Notice of Intent (NOI) is strongly encouraged but not required. The NOI allows Competition staff to facilitate connections with airport operators and industry experts. Fall semester NOI deadline is September 28, 2022. Spring semester NOI deadline is January 27, 2023.

• Design submissions will be accepted from November 2, 2022 through May 12, 2023.

Note: Students may work on their designs at any time throughout the Competition period.

• Winners will be announced in June 2023.

Contact:
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www.trb.org/ACRP/ACRPDesignCompetition.aspx