# 2025 PACE Future Innovators Awards in HMI design for single-pilot operations

## Regulation

V1.1

28/11/2024

# Contents

Changelog ..... 3
1. Motivation ..... 4
2. Vision ..... 4
3. Teams ..... 4
4. Application ..... 5
5. Project Definition ..... 6
6. Project submission ..... 8
7. Commission ..... 8
8. Evaluation ..... 8
9. Prizes ..... 8
10. Organisation ..... 9
11. Schedule ..... 9
12. Intellectual Property ..... 9
13. Fair use of software license ..... 10
14. Contacts ..... 10
15. Amendments ..... 10

# Changelog

The following modifications have been made between version V1.0 (of 07/11/2024) and the version V1.1 (of 28/11/2024):

- The number of members in a team is of four (4) or five (5)
- The notification of acceptance is on December 5th
- The confirmation of acceptance is on December 8th

# 1. Motivation

PACE Aerospace & IT, a leading aerospace engineering software development company, values innovation, quality, and passion in aviation. For more than 20 years, the company has promoted these values around the world at exhibitions, conferences, and corporate events.
PACE has also promoted these values at universities, research institutes, and government institutions. These promotional activities have been centred around the unique capabilities of the company's software solutions, which include aircraft preliminary design, aircraft interior configuration, flight profile optimization, and extended reality training.
Through these activities, PACE has realized that the future software developers and aerospace engineers of the world are a great source of inspiration not only for the company, but for the rest of the industry as well as the world. PACE would like to facilitate the empowerment of these future innovators by providing them with a stage upon which they can showcase their skills, talents, and dedication to the values they share with the company.

To that end, PACE has created the Future Innovators Awards program and is proud to herein announce the *2025 PACE Future Innovators Awards in HMI design for single-pilot operations*, organized in collaboration with EUROAVIA - the European Association of Aerospace Students.

# 2. Vision

2025 PACE Future Innovators Awards in HMI design for single-pilot operations (hereinafter PACE FIA) is a competition in which Teams composed of university students confront each other on the design of an HMI for single-pilot operations that better fulfils the requirements defined in the PACE FIA Project Topic.

Such design shall be carried out by teams using VAPS XT 5.0 part of the VAPS Product Family of PACE. VAPS XT is a software tool used to design, deploy and certify safety-critical and mission-critical display applications. A fully featured VAPS software suite will be made available to every team member for the whole duration of the contest.

# 3. Teams

## 3.1. Composition

Teams shall be composed of four(4) or five (5) students regularly enrolled in university at application time. Mixed teams of associates and non-associates of EUROAVIA are accepted.

Every team shall appoint its Team Leader and communicate their name. Team Leaders will be the responsible for the communication with the PACE FIA organisation.

## 3.2. Member substitution

Teams' composition shall not change throughout the duration of the competition. If any issue were to arise in the participation of a member, the team shall contact the organisation promptly.

## 3.3. Maximum number of participating teams

A maximum number of ten (10) participating teams is established.

## 3.4. Software and hardware requirements

To participate in the competition, the team members ensure the device on which they will install the software meets these minimum system requirements.

| Component | Minimum Configuration |
|---|---|
| OS version | Microsoft Windows 10 |
| CPU | x86 or x64 Intel architecture |
| RAM | 2 GB (4 GB recommended) |
| Hard disk space | VAPS XT 5.0: 6.33 GB |
| For Developers | |
| Compiler (only VAPS XT 5.0) | **Editor:**<br>Microsoft Visual Studio 2017 is required to build coded Object plugins for the Editor.<br>**Code-generated application:**<br>Microsoft Visual Studio 2017, Microsoft Visual Studio 2015, Microsoft Visual Studio 2019, Microsoft Visual Studio 2022, or the MingW/G++ 8.1.0 compiler can be used on a Microsoft Windows OS to:<br>• Build code-generated applications.<br>• Build coded Objects to be linked into code-generated applications. |
| Adobe Acrobat Reader | Required to view documents provided in PDF format. |

# 4. Application

## 4.1. How to apply

To learn more about the application procedure, the participation fee, and the deadlines for the application, please refer to the Application&Cancellation Rules. Please contact the organisation if further clarification were needed.

## 4.2. Acceptance policy

Within the application form, teams are asked to state their motivation for participating in the competition, which will be taken in due consideration.

Additionally, variety of participating universities will be privileged, so the available places will first be assigned to the first applying team of every university. Should any place remain available, it will be granted to the second team(s) from already accepted university(ies), and so forth.

Teams will be notified whether they have been accepted by email.

# 5. Project Definition

## 5.1. Background

Single Pilot Operation (SPO) refers to an aircraft configuration and operational model that allows a single pilot to manage the flight of the aircraft instead of the traditional two-pilot system. This concept, once primarily associated with smaller, general aviation aircraft, is being explored for larger commercial jets as a way to reduce operating costs, alleviate pilot shortages, and improve efficiency.

**Key Aspects of Single Pilot Operation**

1. **Technology and Automation**: For single-pilot operations to be feasible in commercial aviation, highly advanced automation systems are required. These systems assist in monitoring, navigation, and decision-making tasks, helping the solo pilot manage the workload that two pilots would typically share.
2. **Safety Considerations**: SPO presents unique safety challenges. Emergency scenarios or complex flight situations often benefit from the combined expertise and shared responsibilities of two pilots. Mitigating this requires robust automation, remote support from ground-based co-pilots, and other safety redundancies.
3. **Remote Co-Pilot Support**: In SPO, a "remote co-pilot" concept is often discussed, where a second pilot (or crew) on the ground provides support and oversight. This would involve secure, real-time communication channels and would allow ground-based personnel to assist with decision-making if necessary.
4. **Regulatory Approvals and Trials**: Aviation authorities like the FAA and EASA are conducting research and regulatory assessments to determine the safety, viability, and economic impact of SPO. Full approval would require rigorous testing and proven safeguards, and any regulatory changes are likely to be gradual.
5. **Cost and Operational Efficiency**: Reducing cockpit crew to one pilot could decrease personnel costs, reduce scheduling complexity, and make operations more flexible. However, it requires high upfront investment in technology and infrastructure, as well as extensive pilot training.
6. **Potential Challenges**: Human factors such as pilot fatigue, workload management, and response to emergencies are critical concerns. In a single-pilot setup, the remaining pilot would need enhanced training, real-time monitoring for fatigue, and support systems to manage high-stress situations independently.

## 5.2. Project Topic definition

The topic of the project to be developed by the teams is the design a reconfigurable HMI of a Large Area Display glass cockpit, with the aim of reducing the workload of a pilot performing single-pilot operations. Thus, teams must consider the impact of the HMI on the pilot, and the scenario in which their HMI enables single-pilot operations.

The scope of the project is limited to commercial airplanes. No restrictions are imposed with regard of the kind of operations performed by the pilots, the phase of the flight, or the environment (e.g. wind shear, turbulence, night or day), but a variety of scenarios shall be explored.

## 5.3. Project requirements for evaluation

Human-Machine Interface (HMI) requirements for Single Pilot Operations (SPO) in commercial aviation are critical, as they must enable a single pilot to operate safely, efficiently, and comfortably without the support of a second pilot. These requirements focus on enhancing situational awareness, managing workload, supporting decision-making, and ensuring rapid access to information in both normal and abnormal scenarios.

## 5.3.1. Technical Requirements for the project

- Using VAPS XT as primary platform for developing the solution
- The designed HMI fits for LAD (Large Area Display)
- All critical flight information, including navigation, weather, terrain, and air traffic, should be displayed in a clear, integrated format, minimizing the need to switch between screens.
- Instruments and controls should be within easy reach, enabling a single pilot to manage the entire cockpit without having to move excessively.
- Displays that can be customized according to pilot preferences and the phase of flight (e.g., takeoff, cruise, landing) allow the pilot to focus on relevant information, minimizing cognitive load.
- The prototype includes simulated input data
- Generate Windows OS executable to run the simulation of the prototyped HMI

## 5.3.2. Realism and Accuracy

- Strive for a high level of realism in replicating systems and procedures
- Adhere to real-world aviation regulations, safety standards, and best practices.

## 5.3.3. Innovation and Creativity

- Showcase innovation and creativity in design and user experience.
- The interface should be intuitive enough to minimize training time and enable single pilots to use it effectively under various scenarios
- Simple interfaces with minimal button presses and clear visual hierarchies are essential to prevent errors in high-stress situations

## 5.3.4. Applicability

- The solution shall be applicable to one or more scenarios (e.g. different phases of flight, different environmental conditions) that involve SPO

## 5.3.5. Quality of the deliveries

**VAPS XT PROJECT**
The VAPS XT project folder and all resources shall be provided.
The simulation of the HMI can be played inside the editor and the executable can be generated without issues on Windows OS.

**REPORT**

Provide detailed documentation that explains:

- Context and scope of the project
- Description of the architecture of the HMI
- Assumptions made (e.g. digression from the existing regulation, safety standards and best practices)
- Traceability of the design choices
- Justification and rationale of the design choices
- Techniques used with the design software
- Critical view on the project
- Bibliography of the resources used

**PRESENTATION**

The presentation shall be tailored to the previous deliveries and shall not introduce new concepts or information.

The PACE FIA encourages students to explore the groundbreaking potential of innovative HMI designs in the aerospace field. By focusing on the project, the students will contribute to the advancement of flight operations, showcasing their skills and spirit of innovation.

# 6. Project submission

The projects shall be delivered within the submission deadlines, specified in the following sections.

## 6.1. Procedure

The project should be sent by the Team Leader to the official address of the organisation of the context, provided in the following sections. A confirmation email will be received by the team within 24h from the submission.

## 6.2. Submission content

Teams' submission shall contain the following items:

- The VAPS project files.
- A pdf report file.
- A ppt presentation of their report, for a presentation of maximum fifteen (15) minutes, to be showcased at the PACE Days in the case the team wins.

Detailed instructions on what to upload and report/ppt templates will be provided after the kick-off of the competition.

# 7. Commission

The evaluation commission will be nominated by PACE. The members of the commission will be selected from the HMI & Embedded Graphics department of PACE Aerospace&IT. A Commission observer member will be designated by EUROAVIA.

# 8. Evaluation

Teams' projects will be graded by the commission with respect to the following criteria:

- Requirements capture – 25%
- Technological feasibility and applicability – 25%
- Innovation introduced – 30%
- Quality of the deliveries – 20%

Only the VAPS project file and the report will be considered in the scope of the evaluation.

# 9. Prizes

The winning team will be granted the following benefits:

- Free entry to the PACE Days, the Annual PACE Conference, taking place on May 13-14, 2025 in Berlin
- A winning prize of the approximate value of 500€
- The full coverage of travel and accommodation expenses, for the duration of the PACE Days event.

# 10. Organisation

All participating team members will receive a time-limited license for VAPS Product Family that will unlock the fully featured development environment that shall be used for the project development.

For the entire duration of the project development phase, technical support from PACE will be available via:

- A Kick-off meeting, held via Microsoft Teams, during which teams will receive an initial training on the installation of VAPS XT Product.
- A mandatory 3h webinar (divided in a morning and afternoon sections), on December 12th, held via Microsoft Teams
- Email exchange with the experts from PACE Aerospace&IT, mediated by EUROAVIA
- Q&A Sessions on request, based on the availability of the experts.

# 11. Schedule

| DATE | MILESTONE |
|---|---|
| **05/12/2024** | NOTIFICATION OF ACCEPTANCE |
| **08/12/2024** | CONFIRMATION OF ACCEPTANCE |
| **09/12/2024** | KICK–OFF EVENT |
| **12/12/2024** | MANDATORY WEBINAR* |
| **28/02/2024** | OPENING OF SUBMISSION WINDOW |
| **07/03/2024** | CLOSING OF SUBMISSION WINDOW |
| **21/03/2024** | NOTIFICATION OF WINNING TEAM |
| **13/05/2024** | FINAL EVENT |

*The webinar will be held in the following time slots: 9:00-11:00(CET), 15:00-17:00(CET)

# 12. Intellectual Property

By participating in the competition, each team guarantees that the project developed is original and entirely conceived and studied by the team during the competition, is not protected by industrial property rights or copyright owned by third parties, does not violate applicable laws and rights of third parties, is not the subject of a contract with third parties and releases PACE Aerospace Engineering and Information Technology GmbH ("PACE") from any and all responsibility, liability or request for compensations, damages that could be made by any third party.

At termination of the event, PACE shall be the exclusive owner of all transferrable intellectual property rights or industrial property rights relating to, underlying and/or in any way connected with the competition and the projects submitted and/or developed during such competition. As the exclusive owner of the mentioned intellectual property rights, PACE shall be free to enjoy them, directly or indirectly, as well as to use, exploit or dispose of them in any and all ways.

The aforesaid rights, as well as any other rights of use and economic exploitation relating to the activity rendered within the competition, shall therefore be automatically acquired definitively and exclusively by PACE, without any participant being entitled to claim any further compensation, payment, remuneration, indemnification, fee from the company in connection therewith, other than the prize (in case of award according to this Regulation).

The participants undertake to provide all the cooperation requested by PACE in order to obtain the registration, protection, assignment, access, maintenance and consolidation of the intellectual property rights, as well as to protect such right against third-party disputes of anynature whatsoever before any competent authority, including the courts.

Should any patent be deposited, teams' contribution will be rewarded recognising them as inventors.

Should any part of the teams' projects be included in any of the PACE products, authors' names will be explicitly recognised within the software's accompanying documentation.

## 13. Fair use of software license

Every team will receive a license that will unlock a fully featured version of VAPS XT product. Such license will be time-limited until the end of the contest/final event.

## 14. Contacts

The organisers may be contacted at the email address pace-organisers@euroavia.eu.

## 15. Amendments

The present regulation may be subject to amendments, that will be promptly notified to all participants.