

APPLE IPAD USE AS A PORTABLE INSTRUCTOR OPERATING STATION FOR TRAINING DEVICES

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LiOS is a compact, user-friendly instructor station for any kind of flight simulator, ranging from procedural trainers to full mission simulators, which aims to improve the quality of training and reduce its costs by immediately providing essential information and controls; with LiOS the instructor is less dependent by a fixed workstation allowing a more direct training just by sitting aside the pilot.

1. INTRODUCTION

During the last few years, smartphones, tablets and touch devices suddenly changed the habits of our daily life: having a tool providing several of the most common needs with only few taps on it is something we always did want and finally had.

The aviation world, which historically brought countless innovations to everyday objects, this time has to give up to the consumer market and adopt one of the most prominent contemporary symbol: the tablet computer and, specifically, the **Apple iPad**.

The iPad is encountering a huge success even in the aerospace sector due to its ease of use, its sturdiness and affordability, which make it perfect for many procedures on ground and in flight, boosting efficiency and providing new possibilities.

Airlines started using it as an **EFB** (*Electronic Flight Bag*) where all the essential data has been made digital allowing the pilots to fetch the required documentation faster and easier; furthermore, this also dramatically reduced the need to constantly update, print and distribute flight manuals, procedures and other paper printings.

This way iPad lead many flight companies to replace hundreds of pages of flight documents with instantly accessible data on a single, thin, easy-to-navigate device which gives officers and cabin crew a better way to respond to emergencies, daily routine and customer needs.

Business aviation societies are also deploying iPad for passengers in order to enhance their flight

experience: third party producers developed apps which provide several information about the flight in addition to other entertainment stuff such as electronic newspapers, games and films.

This demonstrates the flexibility and the high level of customization offered by the Apple iPad to the market, making easier for companies to develop their own custom-tailored application even for a notoriously tough market as the aeronautical one.

In this regard, the iPad does not only fit in this market segment as an "aircraft-bound" device but also as a training device for flight simulators and flight trainers.

When it comes to simulation, one of the most prominent feature of the emulated environment is the possibility of completely alter the world surrounding the own vehicle, especially the weather conditions, and also setup the aircraft to reproduce behaviors that could not be reproduced in the real world such as system failures and other critical problems which the crew needs to be familiar with and act upon.

In order to do so, most of the current flight simulators feature a workstation where the instructor can change the flight conditions, the weather, schedule malfunctions and monitor the aircraft status and pilot actions; often referred also as "instructor operating station" or IOS, it is located behind the cockpit and sometimes even outside the simulation room in a separate place.

2. IPAD AS AN INSTRUCTOR STATION

The need of improving the communication between the instructor and the students and also the idea for the instructor to stay in the copilot/first officer seat to better overview the pilot actions, lead TXT e-Solutions to develop a portable instructor station for AgustaWestland flight simulators called **LiOS** which means “*Light Instructor Operating Station*”.

2.1 A mobile approach

LiOS is the **next-gen portable, lightweight, compact** instructor station which runs on the Apple iPad, it is entirely written in *Objective-C* and takes advantage of the latest iOS SDK to offer the best user-experience possible; in addition **LiOS** is backward compatible with older iPad devices equipping at least iOS 5.1.

LiOS is totally bound-free, which means that it does **not require any hardware connection** to the simulation as it uses the iPad Wi-Fi.

Data between the simulation host and the instructor station is exchanged via a **HLA** (*high-level architecture*) federation using **TCP**; **LiOS** also implements the “*QuickConnect*” algorithm, which keeps synchronized the data between the instructor station and the simulation even after a failure of the transport layer.

LiOS features a unique configuration management system which allows it to be adopted on multiple aircraft simulators at the same time just by connecting to a different wireless network. The software manages a virtually **unlimited** set of **predefined configurations** to setup the instructor station in order to fit the characteristics and the requirements of a specific simulator: this way, **LiOS** can, for example, set an appropriate range of values for the aircraft weight and fuel quantity or disable the visual system page if the simulation does not offer an image generator.

2.2 LiOS features

LiOS is subdivided in six areas-of-interest, each one to control a specific set of parameters; **Maps Management, Runway and Airport Repositioning, Environmental Control, Radio Communication, Malfunctions** and **Set&Reset** pages are immediately reachable from the main menu.

2.2.1 Maps and Positions Management

LiOS offers a complete Map page featuring the web-based **Apple Maps** service where the instructor can track in real-time the path described by the aircraft.

The Map Management System also shows a customized **detailed georeferenced map** over the base layer, which can be toggled by the user, and the **navaids** of the whole world providing the essential information for each beacon just by tapping on it.

The system allows the **repositioning** directly on the map itself just by long-pressing on the point the user desires to position the vehicle; afterwards, before applying changes, flight parameters such as *airspeed*, *AMSL altitude* and *heading*.

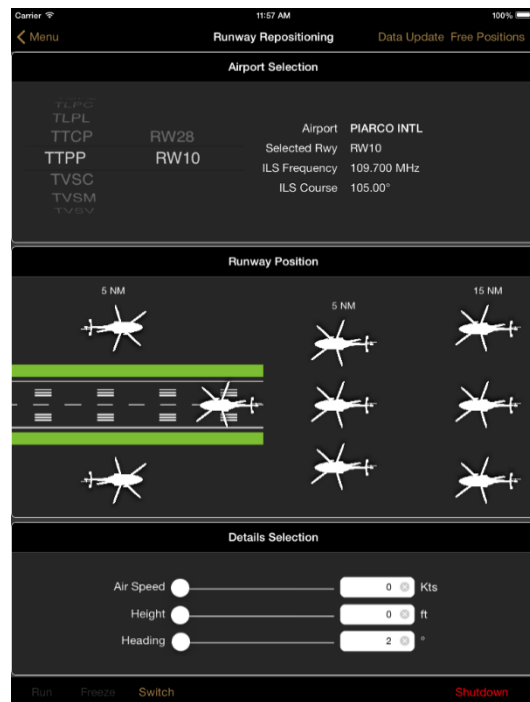


Figure 1 - LiOS Runway Repositioning page

Furthermore **LiOS** grants the user the possibility to save as a “*free position*” the actual aircraft placement in order to be recalled later in the lesson or during another training session; free positions can be accessed through a separate page or directly by the map. This kind of data is **configuration-specific** so using the same instructor station on other simulation devices does not interfere with the saved data.

2.2.2 Runway and Airport Repositioning

Besides the Map page, **LiOS** provides another way to reposition the simulated aircraft near an airport: the Runway and Airport view allows the user to choose a **runway** of an airport and place the ownship in one of the nine predefined positions (as shown in **Fig.1**) which are dynamically calculated taking in account the **ILS beam**, if present.

The Airport section of the page also provides the user additional airport-specific information such as the ILS frequency and course, if an ILS system is detected on the selected runway.

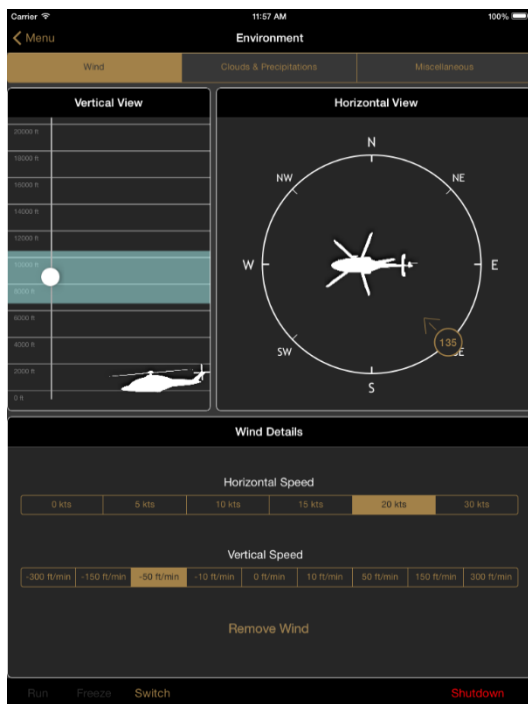


Figure 2 - LiOS Wind control page

2.2.3 ARINC-424 Data Processing

Nav aids and airport data can be periodically updated through an **ARINC-424 NSDB**¹ containing the customer data; once the update procedure is started, LiOS awaits, within a timeout, for a system-defined number of standard communication packets containing data about the world navigation database.

LiOS can be customized to require to the Simulation Engine the whole world database or a subset of beacons given a range from a defined point.

Also this information is configuration-specific, that means that different simulators can have each a specific set of nav aids and airport without any issue.

2.2.4 Weather and Environment Control

One key feature of almost each instructor station is the ability to edit in real-time the weather; this is often quite a painful experience for the instructor which faces pages of unintuitive settings which implies investing time to master the software and even more time to plan the lesson.

LiOS tries to bring a breath of fresh air providing a light and user-friendly interface with a “direct-to-the-point” selection of settings, being easy to use and complete at the same time.

As shown in **Fig.2**, LiOS is provided with a clean interface where each element has been designed with a touch perspective; this means the user can actively interact with any element of the page in order to setup the simulator weather.

In the example above is represented the wind control page which allows the instructor to move the wind layer vertically and on the horizontal plane having as reference the icon of the helicopter which is moved accordingly with the simulation data received from the host.

This view offers controls to many weather parameters such as *wind*, *clouds*, *precipitations*, *storms*, *time of day* and *sea state* and it also allows to toggle the *power status* of the projectors and of the IG system.

2.2.5 Radio Communication

A sound and radio communication page is also offered by LiOS in which the instructor can easily emulate the aircraft intercom or a radio transmission. This page also gives the instructor the possibility to operate on the various levels involved in the sound environment such as pilots listening volume or the engines volume.

2.2.6 Malfunctions and Failures

One of the most important parts of a pilot training regards the exercise on various **emergencies** and abnormal situations that could happen on the real aircraft.

To school the trainee reacting upon those critical conditions, flight simulators provide the opportunity to inject **malfunctions** and cause **plants and systems failures** that could be dangerous and difficult to reproduce in the real world.

Which malfunction to induce and when is a choice operated by the instructor by the instructor station; LiOS makes this task even simpler providing an **easy-to-browse** set of customizable malfunctions and a handy tool to **preselect** the set of malfunctions that the user wants to trigger during the training session.

The system is able to host custom documentation and procedures manuals which can be referenced directly for each malfunction in order to reach with only one tap the sequences needed to get rid of a specific failure.

¹ ARINC-424 database must be processed by an external tool before being submitted to LiOS

2.2.7 Balance, Tools and Resets

LiOS allows the user to intervene on various **aircraft parameters** to satisfy any need; *dry weight*, *fuel quantity*, *center-of-gravity* position are only a subset of the settings that the instructor station can provide and that can be chosen by the customer basing on the aircraft type.

Additionally, **kits** (and consequently their influence on the weight, CoG, etc.) such as *hoist* system or *weapons* can be enabled or disabled through this page.

Ground equipment (*GPU*, *hydraulic bench*) can also be activated by the controls on this page; furthermore the instructor can **recover** several

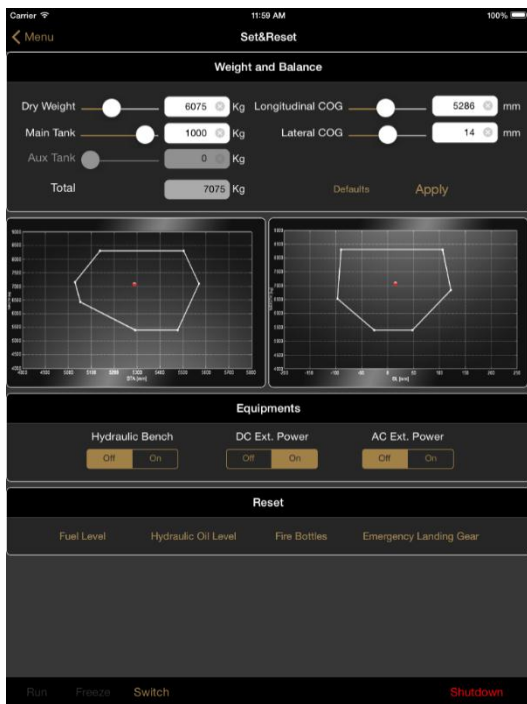


Figure 3 - Balance page

critical situations that could happen in various cases, for instance restoring the hydraulics or fuel levels after a leakage.

2.2.8 Hardware and System control

LiOS uses ranges from procedural trainers through full flight simulators and to fit the various requirements of such different systems it offers a configurable page monitoring the status of many hardware systems and allowing the chance to enable, disable or launch a test on those.

To date, LiOS supports the modules managing **motion**, **control loading**, **vibrating platform** or **seat shaker** and **hardware interlocks**.

For all systems, the bottom bar hosts the "Shutdown" button which requests the simulation engine to shut down the entire hardware.

3. LIOS BENEFITS

Easy. LiOS is a complete instructor platform which aims to bring to the aeronautic world the benefits that touch devices brought to the consumer market which means more flexibility for the instructor to move through the pages and provides a quick way to activate the needed features on the simulator.

Time-saver. LiOS also saves time allowing the instructor to set up a lesson sit in its office and then playing it in the simulated environment, saving precious time within a mostly expensive flight simulator.

Customizable but unique. When it comes to LiOS, the "glace on the cake" is represented from its integration easiness: LiOS is able to **fit into** almost **any environment**, it is **platform-independent** and is **customizable** enough to meet the requirements of each different aircraft in order to satisfy multiple needs with an unique piece of software; this way, the instructors that are used to work on many different targets can have a single workstation to use on every flight training device, reducing the companies needs to organize and keep updated their personnel on multiple software and getting a more profitable use of the training sessions.

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