



*A-29 Super Tucano
Counter Insurgency*

Executive Summary

EP 001-S11





Embraer Super Tucano – The only real attack/reconnaissance turbo-prop available in the Market.

When it comes to “*Find, Fix and Finish*” on the counter insurgency scenario, a growing important task on Operational Missions, there is only one real, reliable and available solution: The Super Tucano.

Unrivaled in any application; the combat proven Super Tucano and its integrated sensors, data-link, cockpit protection and multiple weapons configurations, it is the benchmark for the market.

As the only turbo-prop platform under production that was designed from its inception for the attack/reconnaissance mission: weapons delivery, ISR, electronic warfare, close air support operations, the Super Tucano is fully equipped with five external stores intelligent hard points, capable to carry up to 1.550 kg (3.415 lb) of smart or conventional weapons, using the latest military data architectures.

A changing and evolving world challenges the 21st Century’s military air operations.

Under many aspects, probably never before in another period of our history, the military aviation has experienced such a transformation than that observed in the last decade. The improvements in areas like avionics, sensors and armament systems have directly influenced the form and method to employ a wide variety of platforms as fighters, maritime patrol aircraft and reconnaissance. As a consequence of this evolution, the pilots training process and the operational missions have been severely affected.

The warfare scenario has also changed, major combat operations (MRO) are extremely rare and illegal activities, insurgencies and guerrillas are most common challenges of many countries around the world on a irregular warfare scenario.

The irregular warfare scenario requires a much different approach. The enemy does not wear a uniform, they walk around in small groups spread among civilians on the urban environment or hidden on inhabited jungles, deserts, savannas or mountains. They are lightly armed, have high mobility and they don’t respect countries geographic borders. They use cooperation with local civilians to gain their confidence and they explore collateral damage events as much as possible to influence the opinion of the international community.

On such environment, the battle is fought in months and years, not in hours and days, the enemy explores the cost of war as a weapon against the state, a long-period-cost-effective solution is required to keep operational costs on an affordable level.

Enemy high mobility and *modus operandi* make intel very volatile, perishable. In some cases, when the enemy is identified, time to take action is counted in seconds – there is no time to call for air support, it must be available in real time, on long mission time duration on both border patrol or close air support missions. The ability to make both recon and attack missions with the same multi-mission platform is operationally efficient.

While time to take action is short, an efficient coordination between ground forces, air support and command and control leads to a successful mission completion. The use of modern data links and tactical network enable the transmission of critical intel such as enemy location, type of support required, friend forces position, etc.



The enemy might be spread among citizens on urban or rural areas. Precise weapon delivery and weapon flexibility for different attack conditions are required to avoid possible collateral damage. A stable platform capable of performing extremely precise attacks requires years of systems and airframe development.

The enemy is lightly armed, but old versions of cold war manpads are frequently found on the hands of insurgents and guerrillas, which is a considerable threat for air operations. The ability to avoid enemy fire or to be protected against it is required on recon/attack missions.

In order to fulfill these requirements in the most effective and efficient way Embraer developed the Super Tucano, a combat proven light attack, counter-insurgency aircraft that has been successfully applied by several airforces on the war against guerrillas, drugs traffic, illegal extraction of natural resources, contraband, etc.

The Super Tucano Aircraft

The Super Tucano is a low-wing monoplane, tandem-seat cockpit aircraft designed for the light-attack, counter insurgency, border patrol missions.

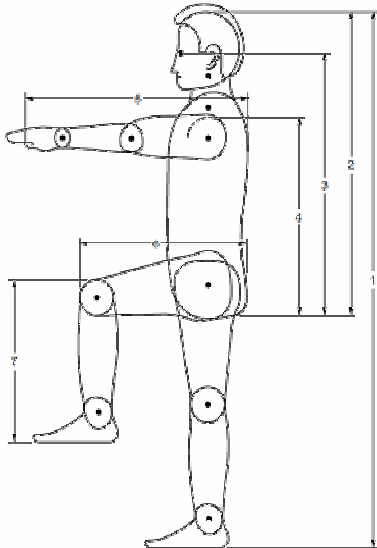


The pilot has an outstanding visibility and situational awareness from the cockpit that exceeds the requirements of MIL-STD-850B. Crew comfort for long mission duration and strenuous combat conditions is guaranteed by a fully automatic pressurized cockpit (5 Psid), an environmental system, which core is an Air Cycle Machine, is designed to provide crew thermal comfort even when operating in the hot climate in several sunlight conditions, and an anti-G system. The cockpit has been designed to



accommodate a wide anthropometrics range of pilots allowing comfortable and efficient operation for male or female pilots.

The Super Tucano is equipped with Martin-Baker MK-10LCX Ejection Seats (0 Ft altitude, 0 Kt speed – ejection seat), featuring a three modes (normal, after and single) ejection sequential command.



PILOT PHYSICAL DIMENSIONS		MINIMUM LIMIT (cm)	MAXIMUM LIMIT (cm)
1	STATURE	162.9	190.9
2	HEIGHT (SEATED)	84.4	99.1
3	EYE POSITION HEIGHT	72.5	86.9
4	SHOULDER HEIGHT (SEATED)	53.9	66.5
5	FUNCTIONAL REACH (DISTANCE FROM THUMB TO BACK)	73.1	89.7
6	DISTANCE FROM KNEE TO HIP (SEATED) (1)	56.2	68.7
7	KNEE HEIGHT (SEATED)	50.7	62.3

The windshield complies with a 4 lb (@ 300 kts) bird strike proof requirement.



The aircraft has been developed for a very hostile environment, considering remote bases and poor infrastructure. Minimum logistic support is required. The Super Tucano can really operate without any ground support other than fuel being available for re-fueling operations in this kind of theater. Gravity refueling, engine start using the aircraft start-generator powered by the aircraft on-board main battery, engine start

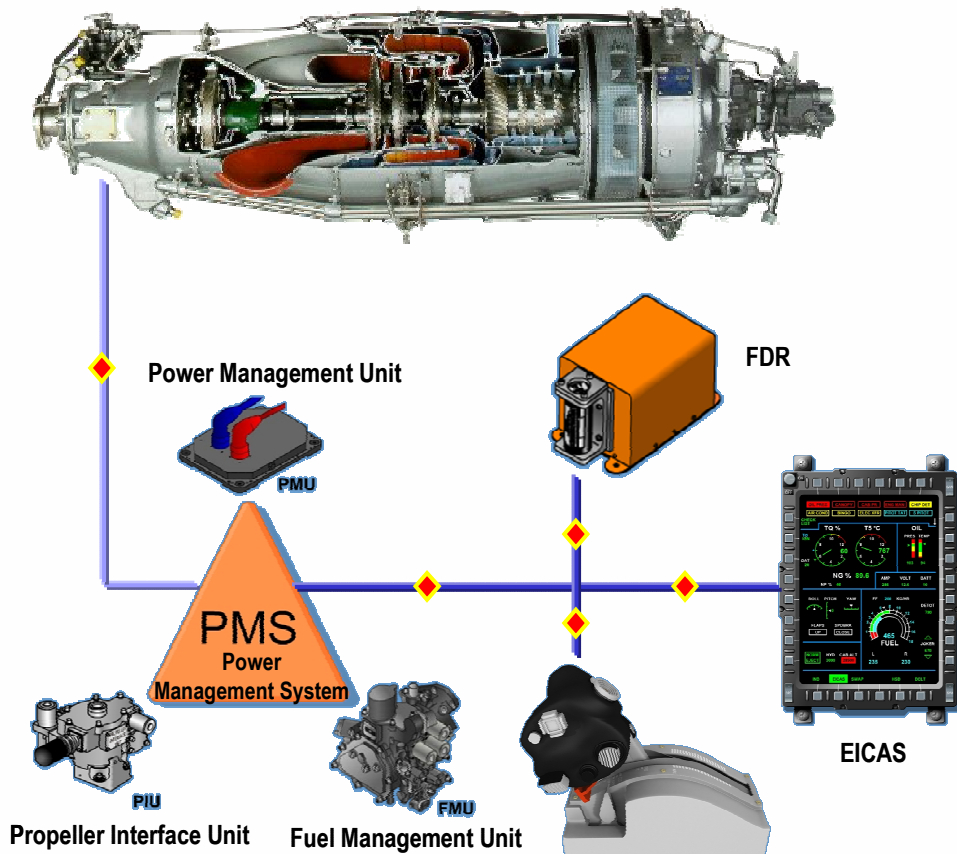


assisted whenever necessary by another Super Tucano, on-board oxygen generation system are some of the aircraft features designed to allow the operation with no ground support or infrastructure. The mission systems were also considered, most of them are “on-condition” and features a BIT (Built-In Test) capability.

To supply electrical power for the systems installed in the aircraft, the Super Tucano has an electrical system which supplies 28 VDC through a start-generator, a main battery and an emergency back-up battery.



The Super Tucano is able to start the engine employing its own main battery, and features the unique capability to start the engine in emergency conditions with the assistance of another Super Tucano.

The power plant is a Pratt & Whitney PT6A-68C (1,600 SHP) engine, incorporating a Power Management Unit that acts like a FADEC – Full Authority Digital Engine Control, avoiding pilot induced exceedances and recording engine relevant parameters for maintenance diagnosis. Integral fuel tanks (654 liters total) were designed in the wing. The Super Tucano can also carry 3 external fuel tanks of 320 liters each one.






State-of-the-Art Systems





Human-Machine Interface

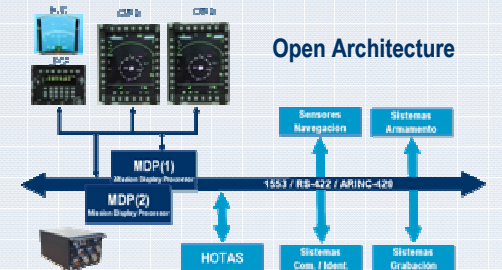
- HUD + 3 CMFD's + HOTAS
- Outstanding Situational Awareness
- Fully compatible with NVG Operations



NVG Night Vision Goggle




Connectivity
Via Data-Link (Air-Air and Air-Ground)



Open Architecture


Auto-Rudder Trim

- To compensate engine torque effects



Surveillance and Aiming Sensors

- FLIR StarSafire III and Brite Star DP
- Laser Range Finder



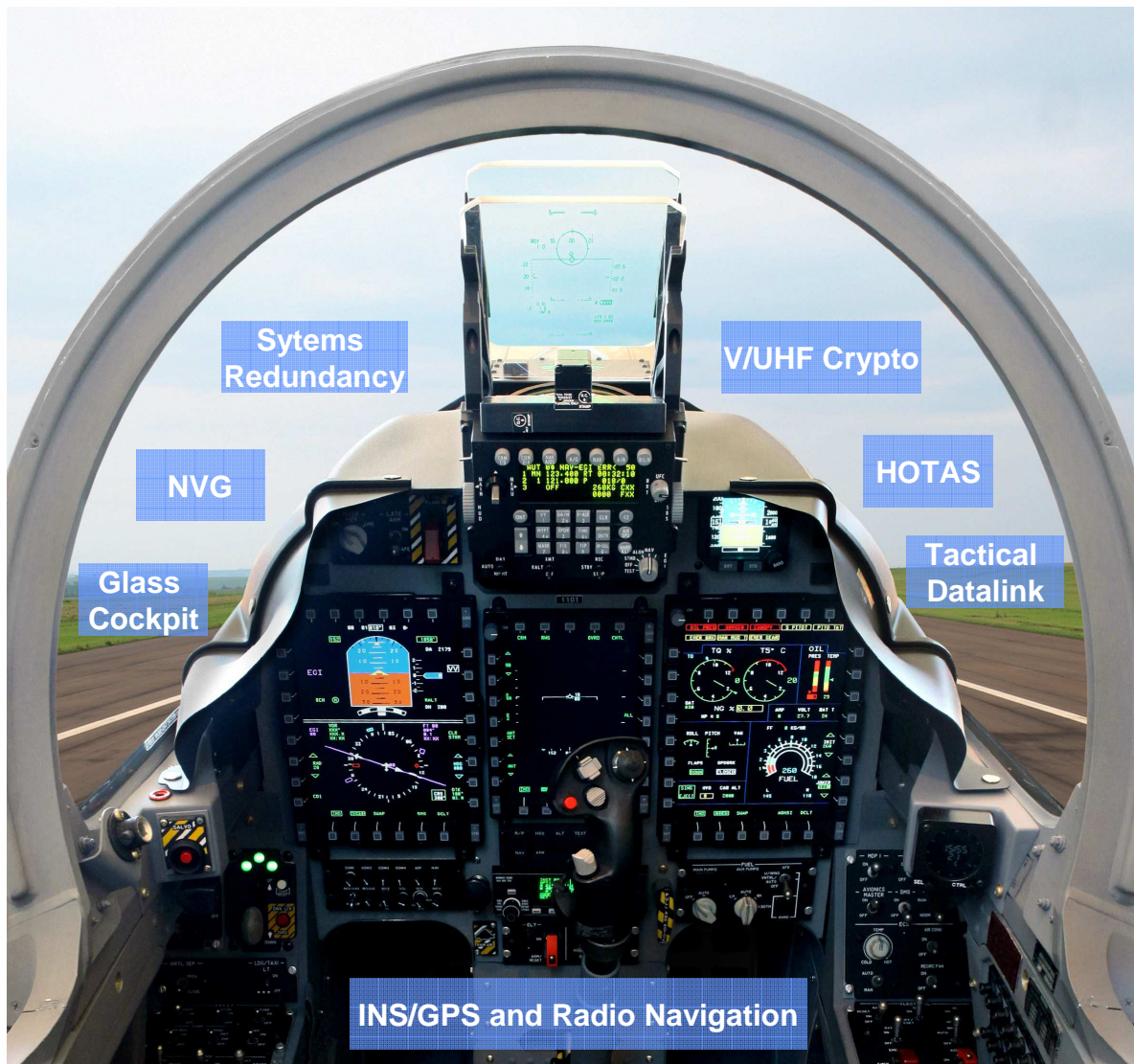
1.550 kg (3.414 lb) of External Loads

- Smart or Conventional Weapons (LGB, etc.)
- Two embedded .50 machine-guns in the wings
- A/A short-range missile (MAA-1 Piranha)



The Heart and Brain of a New Legend

The Super Tucano systems were designed for a multi-purpose aircraft. System redundancy, reversionary modes were specially designed for both safety and mission completion, considering the Amazon area where no airfields are available for hundreds of miles. This concept was also the main definition to ensure mission success probability. A single failure will not jeopardize the mission completion.



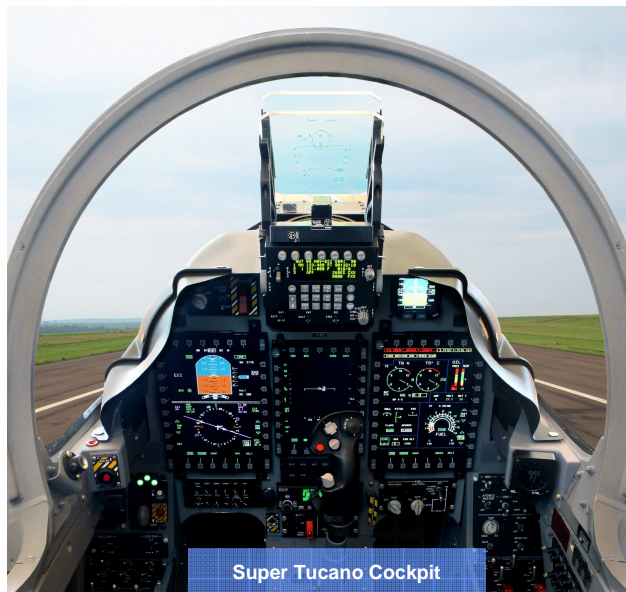
The Super Tucano's avionic system, as well as its HMI (Human-Machine Interface), is in the state-of-the-art technology according with the new operational and training scenarios and its evolution trends.

The core of the Avionics System is composed of two identical, fully redundant Mission and Display Processors (MDP), running its Operational Flight Program (OFP), on a "master/slave", hot standby architecture. This feature assures a high level of mission accomplishment, survivability and reliability, without losing system performance.

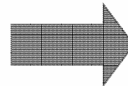


The Operational Flight Program is the MDP software responsible for aircraft subsystems management, Human Machine Interface (HMI), EICAS data processing, graphics generation, stores management, mission navigation and weapon aiming computation.

The main avionics and weapons systems controls are based on HOTAS – Hands-On Throttle and Stick – and All Glass Cockpit concepts, similar to 4th generation fighters. The main navigation, attack and communication functions are available for the pilot on shortcut buttons on the stick and throttle. The pilot can change avionics, weapons, communication or navigation systems setups with hands on flight controls and eyes on the external picture, maintaining high levels of situational awareness for immediate response for any external adverse condition. This structure includes a Head-Up Display (HUD) as the pilot main display.



Cockpit comparable to modern fighters



Three Color Multi-Function Displays (CMFD's) are available in each pilot station (front and rear cockpit) on a Full-Glass-Cockpit concept. The CMFDs present, in color, the flight parameters, navigation, mission waypoints and routes, status of the avionics and other systems, store management and weapon delivery functions. This information is presented in several types of screen formats that can be selected by both front and rear cockpit in accordance with the operational scenario.

The Navigation functions are fully integrated in the Super Tucano MDP (Mission Display Processor). The Navigation functions perform the sensor data processing to provide the Navigation information (position, velocities, attitude, steering commands, distance, heading) to the pilot through the aircraft main displays (HUD and CMFD).

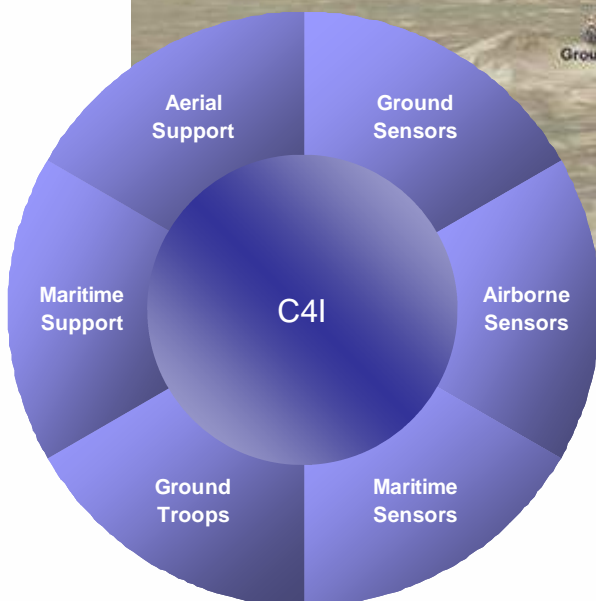
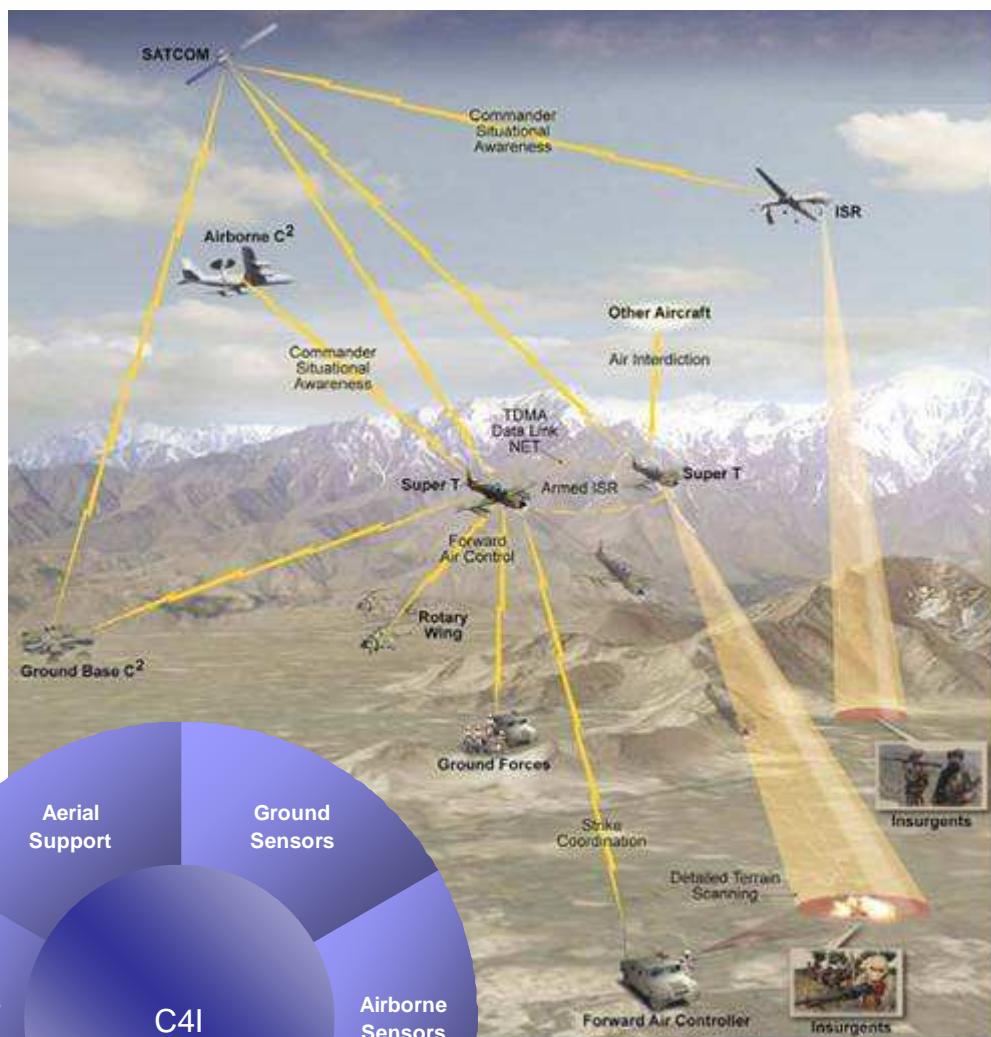
The main navigation sensors are the EGIR (INS/GPS sensor) and the ADC (Anemometric Data Computer). Radio navigation (VOR/ILS, DME and ADF) is also available. Navigation sensor backup is provided by the BFI (Basic Flight Instrument) and a stand alone GPS.

In order to reduce the pilot's workload during long endurance missions the Super Tucano features a two axes military autopilot.



For tactical communications, the aircraft has a digital V/UHF radio with both crypto and anti-jamming functions. This radio also provides a data link capability.

The data link represents one of the most powerful features of the Super Tucano. The data link is based on a TDMA network with up to 32 participants. Mission information such as target location, squadron location, points of interest, threats location, weapon and fuel status and text messages can be exchanged among the network participants in secure data link mode without voice communication. Ground stations can also be included in the network transmitting information from ground sensors such as target location informed by ground troops or intercept vector for illegal flights informed by surveillance radars. Integration with C4I systems is also based on the data link and closes the loop for armed forces joint operations and interoperability through a tactical network.





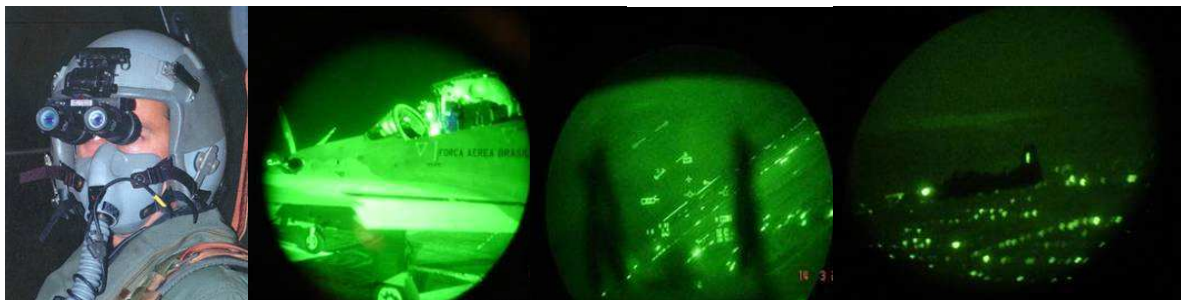
The aircraft is optionally equipped with an Electro-Optics / Infrared Sensor by FLIR Systems (EO / IR).

The EO / IR systems are fully stabilized, multipurpose thermal imaging systems designed for maritime patrol, search & rescue, law enforcement, border security, surveillance, reconnaissance and laser targeting missions. Two FLIR Systems EO/IR sensors are fully integrated to the Super Tucano, the Star Safire III and the Brite Star DP, the last one with Laser Designator capability.

The Super Tucano is also fully compatible with the current state-of-the-art Night Vision Goggles – NVG – Gen III.



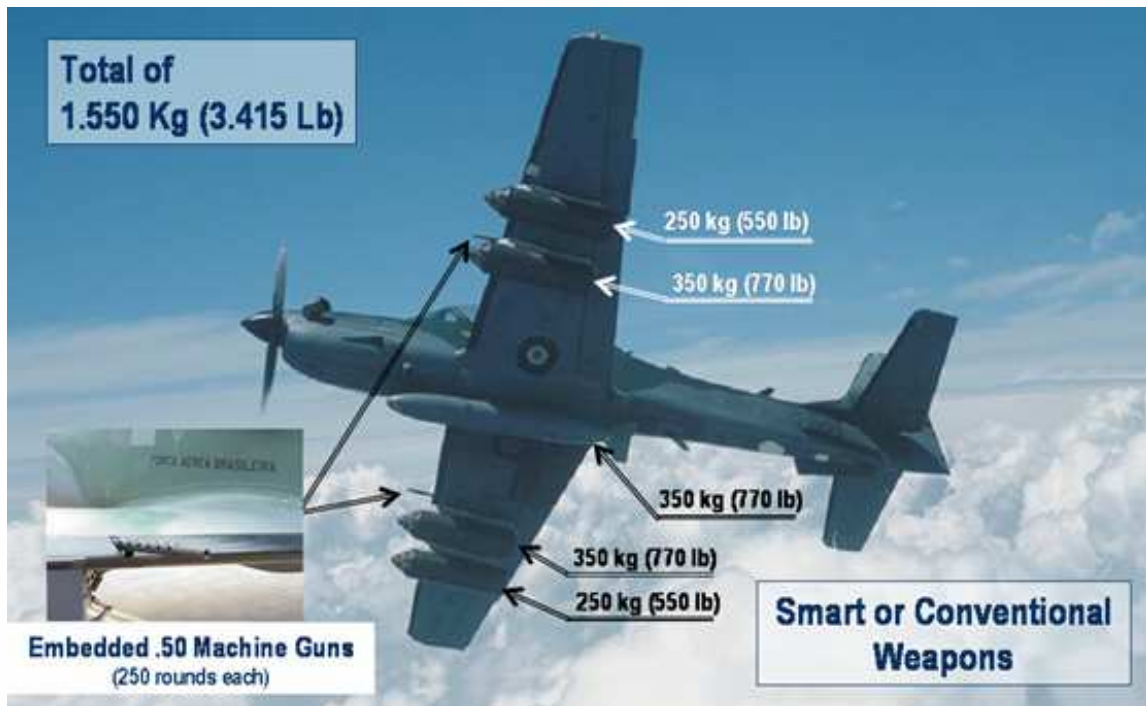
BRITE Star DP(Targeting)





The Super Tucano in the Counter Insurgency Role

The Super Tucano can be employed throughout a large variety of operational missions, unsurpassed by any other aircraft of its class. Its versatility is derived from the excellent characteristics to be operated with a minimum ground support and with limited navigation and communication aids.



The Super Tucano can carry a wide range of stores in eight hard points distributed under the wings and fuselage.

There are five 14" lugs NATO standard pylons (MIL-STD-8591) with flexibility to carry bombs, rockets, missiles, fuel tanks and other ordinances. Two wing internal machine guns hard points and one special EO/IR sensor hard point.

All the five NATO standard hard points are provided with MIL-STD-1553B MUX bus among other features required for smart weapons and POD's integration. The Super Tucano employs a wide array of ordnance and a wide range of stores from Laser Guided Bombs (LGB) to General Purpose munitions including 250, 500 and 750 lb bombs, and 2.75" rockets. A laser range finder installed under the engine air intake is capable of measuring ranges up to 10km (depending on visibility), improving weapon aiming calculation on irregular terrain.

The two inboard pylons and the ventral one are "wet" for the use of under wing jettisoning fuel tanks.

The Super Tucano is equipped with two caliber .50", wing-mounted in dedicated hard points inside each semi-wing of the aircraft. This weapon is an automatic recoil-operated, link-belt fed, and air-cooled machine gun. Ammunition is belted fed to the machine gun from an ammunition box also fitted inside each semi wing. Each ammunition box has capacity of 250 rounds.

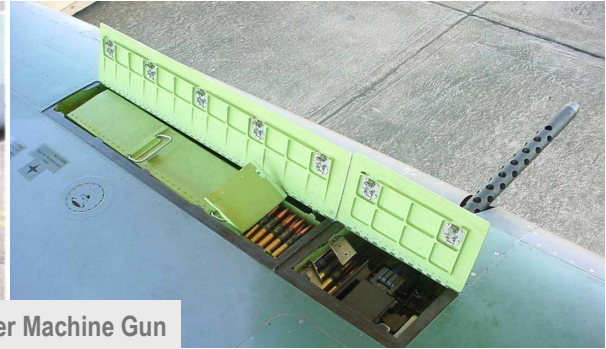


Moreover, the outboard pylons allows to load and fire of short-range air-air missiles MAA-1A (Brazilian AIM-9L class missile).

The Super Tucano can optionally be equipped with Chaff & Flare Dispensers.



0.50" Caliber Machine Gun



MAA-1 missile

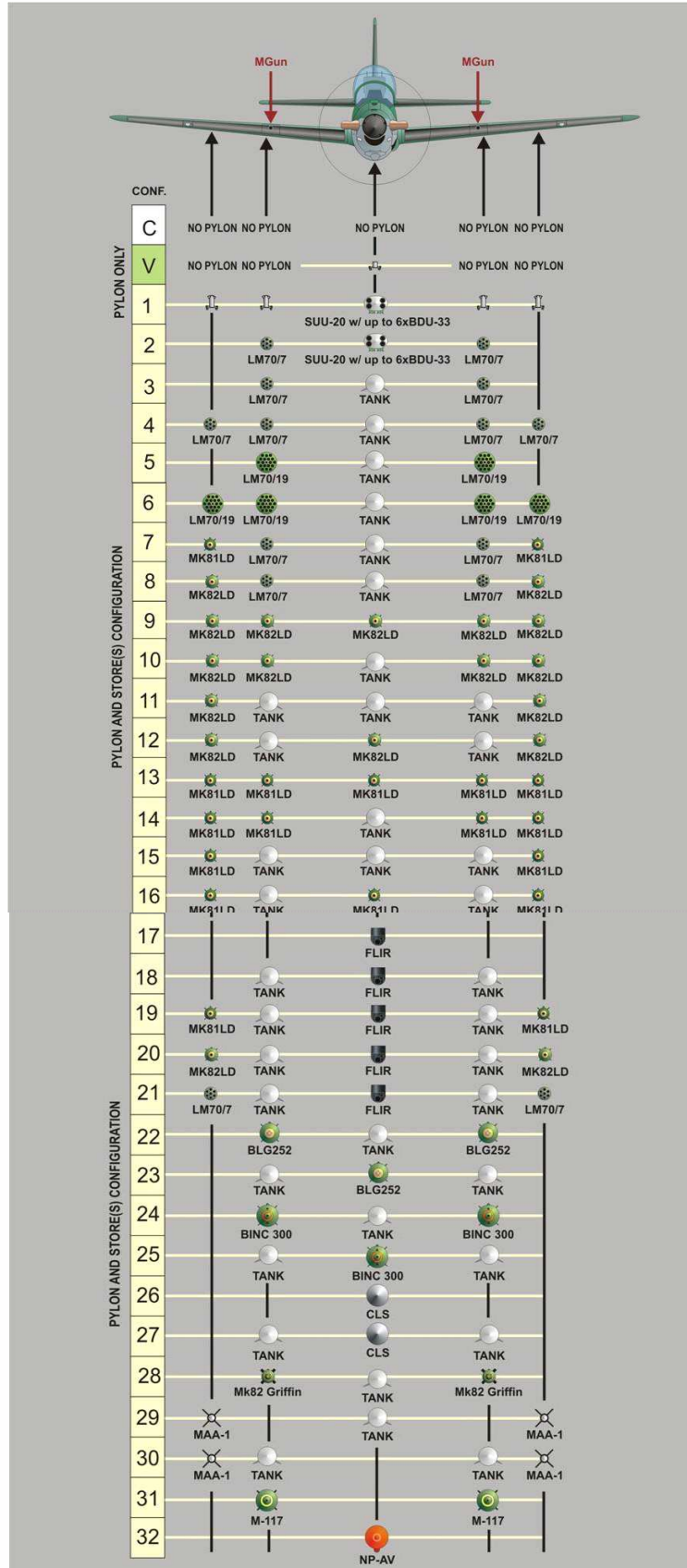


Chaff & Flare Dispenser



133 different external stores configurations are already cleared for flight with several combinations of weapons, guns, EO/IR, fuel tanks and POD's.

Find below some of the already cleared external stores configurations:





The Super Tucano, in the air-ground attack mode, supports unguided and guided weapon delivery and is optimized for effective performance in visual and blind air-to-ground attack, providing aiming symbology on the HUD.

The system performs the Continuously Computed Impact Point (CCIP), Continuously Computed Release Point (CCRP), Dive Toss (DTOS), Strafe and Manual weapon aiming computations and release.

In the air-to-air attack mode, supports gunnery and missile launch. The system provides Hot Line, also called Continuously Computed Impact Line (CCIL or Snap Shot) and Lead Computing Optical Sight (LCOS) computations symbology on the HUD.

The weapons system is at the same level of the 4th generation front line fighters.

The capability to operate from remote bases with poor infrastructure makes the Super Tucano able to follow the troops close to the frontline. This unique feature and the capability to perform long time station (over target) missions enables the Super Tucano to provide very efficient close air support.



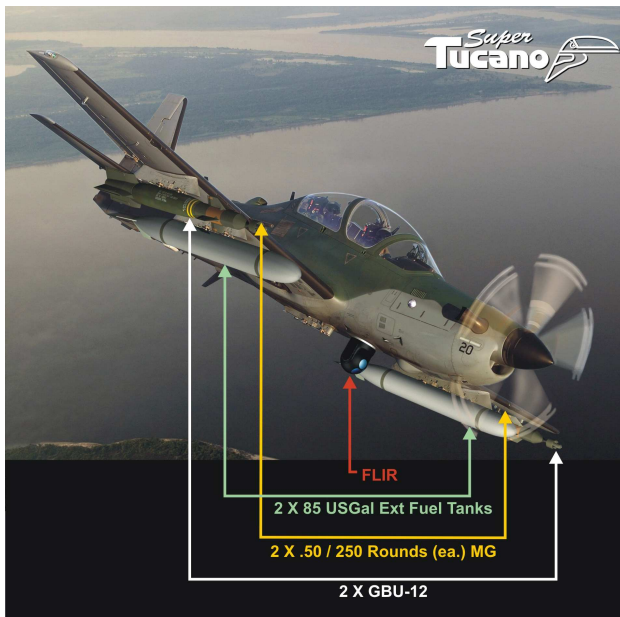
Flight combat tactics, for training and operational purposes, can be recorded in the Super Tucano for flight analysis. Data recording is an integral system connected to the aircraft avionics suite. It gathers information during flight and keeps it in the aircraft Net Centric Data Recorder (NCDC).

This data, synchronized on the ground to a complete flight and mission review, provides a dramatically improved and cost effective solution for training and operational flight analysis and debriefing needs. It is a proven tool for honing the skills of squadron pilots.



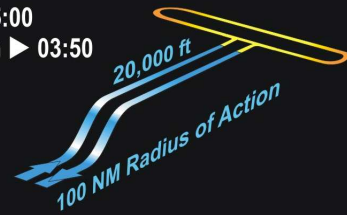
Typical Mission Performance

Some of the typical mission performance are presented on the following graphs in both long time on station and long distance attack missions.

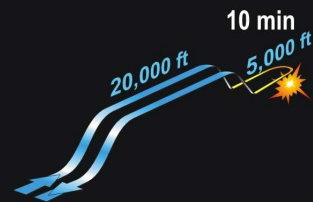


LONG TIME ON-STATION MISSION

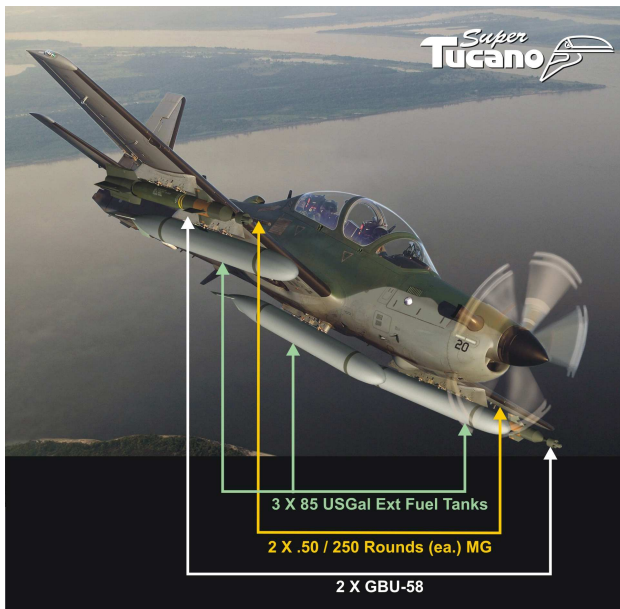
Total Time ▶ 05:00
Time On Station ▶ 03:50



LONG DISTANCE ATTACK MISSION



Radius Of Action ▶ 460 NM

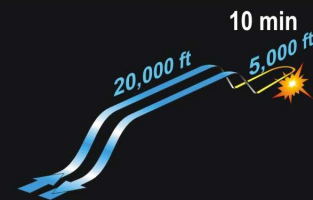


LONG TIME ON-STATION MISSION

Total Time ▶ 06:28
Time On Station ▶ 05:22



LONG DISTANCE ATTACK MISSION



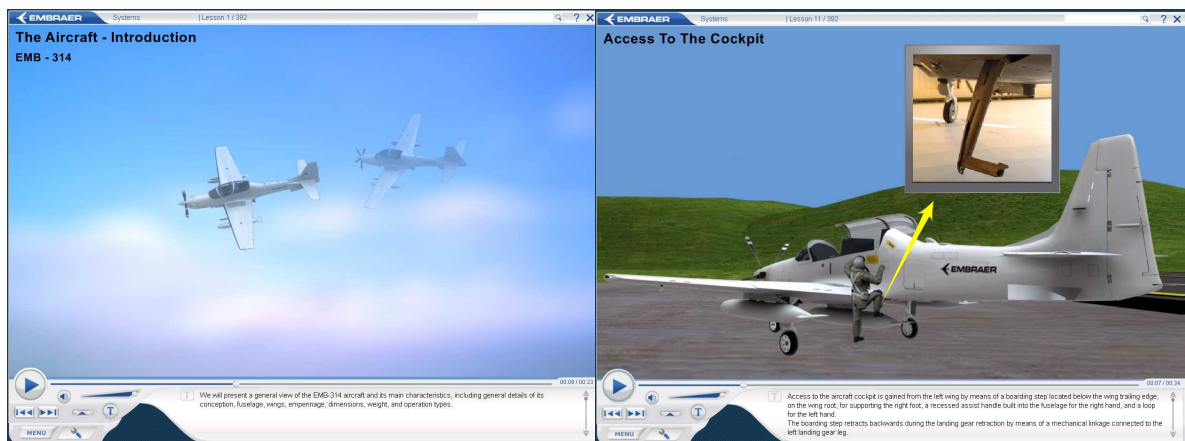
Radius Of Action ▶ 620 NM



Training and Operational Support System (TOSS)

The TOSS is composed of powerful tools, which assure continuous training and operational mission preparation and assessment support giving to pilots and technicians the ability to operate and maintain the aircraft. The system is composed of:

- **Computer Based Training (ST-CBT):** Installed in a dedicated network, the CBT provides theoretical classes for pilots and technicians, teaching on aircraft systems and avionics management. The ST-CBT is available at classroom networks allowing the customer to control the training of all pilots in a centralized database



The ST-CBT is a training aid designed to supply pilot and technician students with the necessary information to develop the knowledge and understanding of specific aircraft system, in order to have complete domain of the aircraft operation and maintenance.

The ST-CBT can be configured for stand-alone (single computer) or network (multiple computers) operation. The stand-alone mode, normally in laptop, has no course management and can be deployed in any place, including the student's home. In the network mode, the stations are connected to a network to run the courseware and the student frequency and performance are managed by specific software termed "Learning Management System" (LMS) providing course management.

- **Freeplay (ST-Freeplay):** Allows a pilot to exercise all the cockpit procedures using emulated displays in an avionic environment similar to the real aircraft. The ST-Freeplay is installed in the CBT computers.





The Super Tucano Freeplay is software intended to familiarize the pilots with the operation of cockpit avionics controls (“switchology”). Its purpose is to fix the knowledge acquired during the CBT course program reducing the necessary time to practice in the Flight Simulator.

The ST-Freeplay emulates the cockpit lateral consoles, switches and displays controls used to train the pilot in checks and drills.

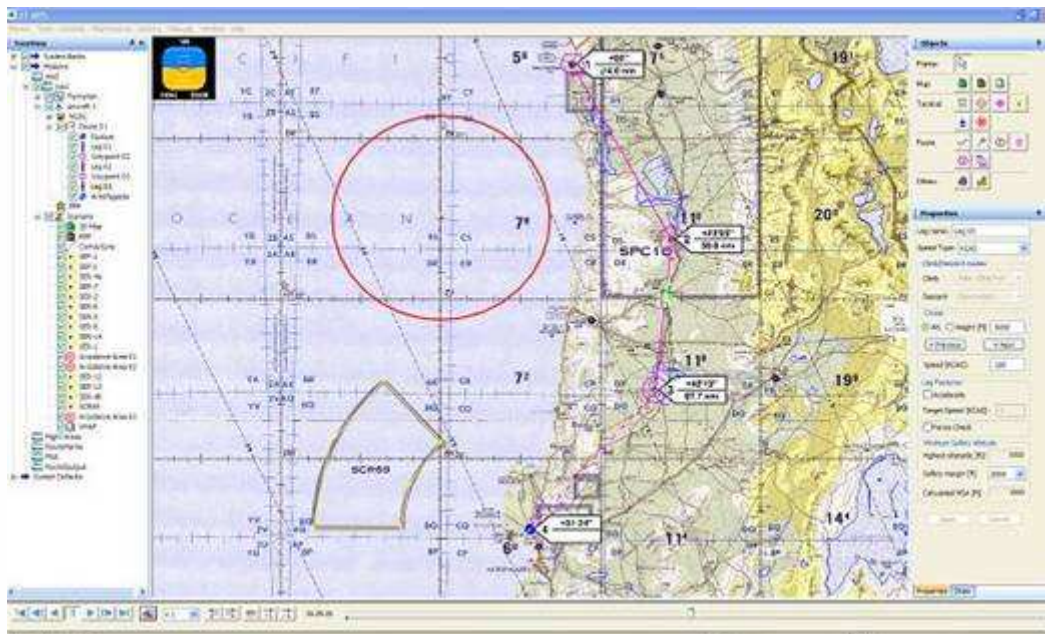
All components are integrated with the same embedded software used in the real aircraft mission computer.

This gives great realism and flexibility, since all the display formats can be presented without any loss of information compared to the real one. Besides, it is possible to update the ST-Freeplay replacing only the software part related to the aircraft mission computer without reinstalling it again.

The ST-Freeplay is available in single or twin seat configuration. All the controls are independent and, in twin seat version, is possible to interact with front and rear cockpit controls simultaneously.

- **Mission Planning Stations (ST-MPS):** Installed in personal computers connected in a dedicated network, the MPS provides way to plan a mission and upload it in the aircraft avionic system

The ST-MPS is a system developed to give more accuracy and reduce pilot’s workload on navigation and attack missions planning as well as to eliminate the task of programming the aircraft avionic system in the internal inspection. As a result, the pilot has much more time to dedicate on mission rehearsal, target analysis and other more relevant tasks.



The information generated during the planning is always kept synchronized with the relevant Net Centric Data Cartridge (NCDC) files, which ensures that only consistent mission data is transferred to the aircraft.



- **Mission Debriefing Stations (ST-MDS):** Installed in personal computers with four monitors connected in a dedicated network, the MDS gives the necessary instruments to reconstitute and assess integrated missions performed by up to 4 participants simultaneously.

The ST-MDS is a system developed to enhance pilot situation awareness through a detailed assessment of a performed mission. This tool shows exactly what was done in all maneuvers and the instructor has in his hand all conditions to teach, during the debriefing, the right procedure in case of student's failure to perform a particular maneuver.

The ST-MDS desktop configuration uses four LCD monitors to display 2D scenario with God's view of the participants, 3D synthetic scenario or video sources recorded by the participants during the flight. The projector is configured as a repeater of the first display.



The laptop configuration can present 2D scenario with the God's view of the participants, 3D synthetic scenario and up to four video sources on its LCD screen.



- **Flight Simulator (ST-FS):** Allows the pilots to exercise a flight with the same dynamics of a Super Tucano flight in a cost-effective state-of-the-art system.



The Super Tucano Flight Simulator is a complete training system (hardware, software and control feedback) designed to deliver a realistic environment for pilots' procedure training and flight exercises.



The Flight Simulator main benefits are the improvement on flight safety as the pilot can train emergencies that can not be performed on the aircraft, the reduction in training cost training the pilot on the systems switchology before performing the flight training, and operational planning while the pilot can rehearsal most of the missions in the simulator before performing the real mission in the aircraft.



- **Maintenance Support Station (ST-MSS):**
Intended to be used by the ground personnel to support aircraft maintenance activities

It provides means to download/receive and present information related to faults occurred during the mission; perform the troubleshooting analysis; register the maintenance activities performed on the fleet and present historical reports of the occurred faults and performed maintenance activities.



Customer Support

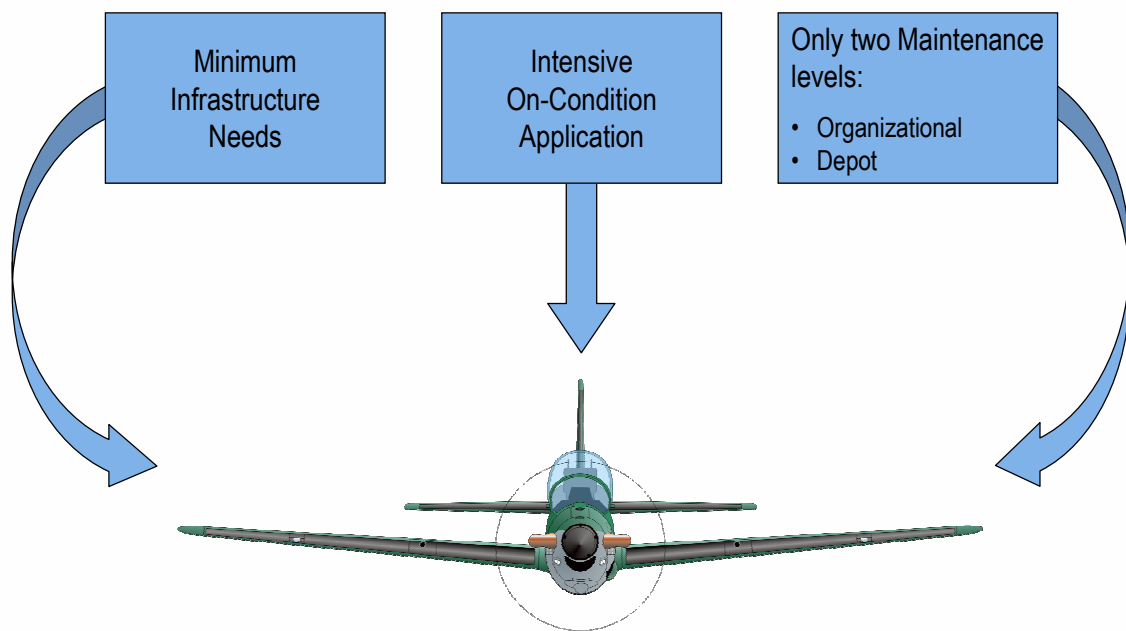
Embraer, a world-class aircraft manufacturer, has been producing and supporting military and commercial aircraft in different continents, for more than 42 years.

During this period, a support network capable of satisfying the more stringent requirements was established and improved. Embraer is able to solve Customer's issues on-time, taking ownership of them and providing customized solutions

Besides the facilities located in Brazil (São José dos Campos, Gavião Peixoto and Botucatu), this network includes subsidiaries, maintenance centers and / or offices around the world: Singapore, USA (Fort Lauderdale and Nashville), Europe (France at Paris, and Portugal at Alverca/Lisboa – OGMA), and China (Beijing and Harbin).

Embraer customer support and the aircraft maintenance concept were developed taking benefit of the lessons learned supporting military and commercial operators around the world. It is a proven system that integrates all logistics support elements.

The Logistic Support Commitment begins at the first step in the aircraft design, and any new aircraft is developed taken into consideration three main premises, as depicted in the next figure.





Embraer Super Tucano – The Solution for the Counter Insurgency Mission

Designed, built and serviced by one of the world's top aircraft manufacturer, the Super Tucano is an unrivaled counter insurgency aircraft. And it is the only one truly available now.

This high-performance turboprop aircraft is consistently chosen by those with the highest requirements and expectations. With more than 180 aircraft ordered, more than 150 delivered, and already 7 different customers on a growing portfolio, the Super Tucano is the only combat proven counter insurgency turbo-prop in the market.



Brazil



Chile



Undisclosed



Dominican Republic



Ecuador



Colombia



Indonesia