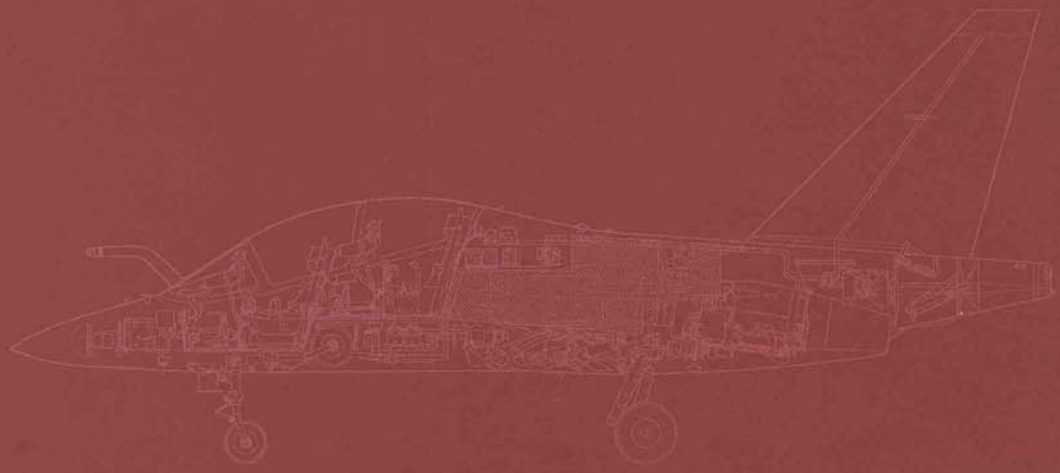
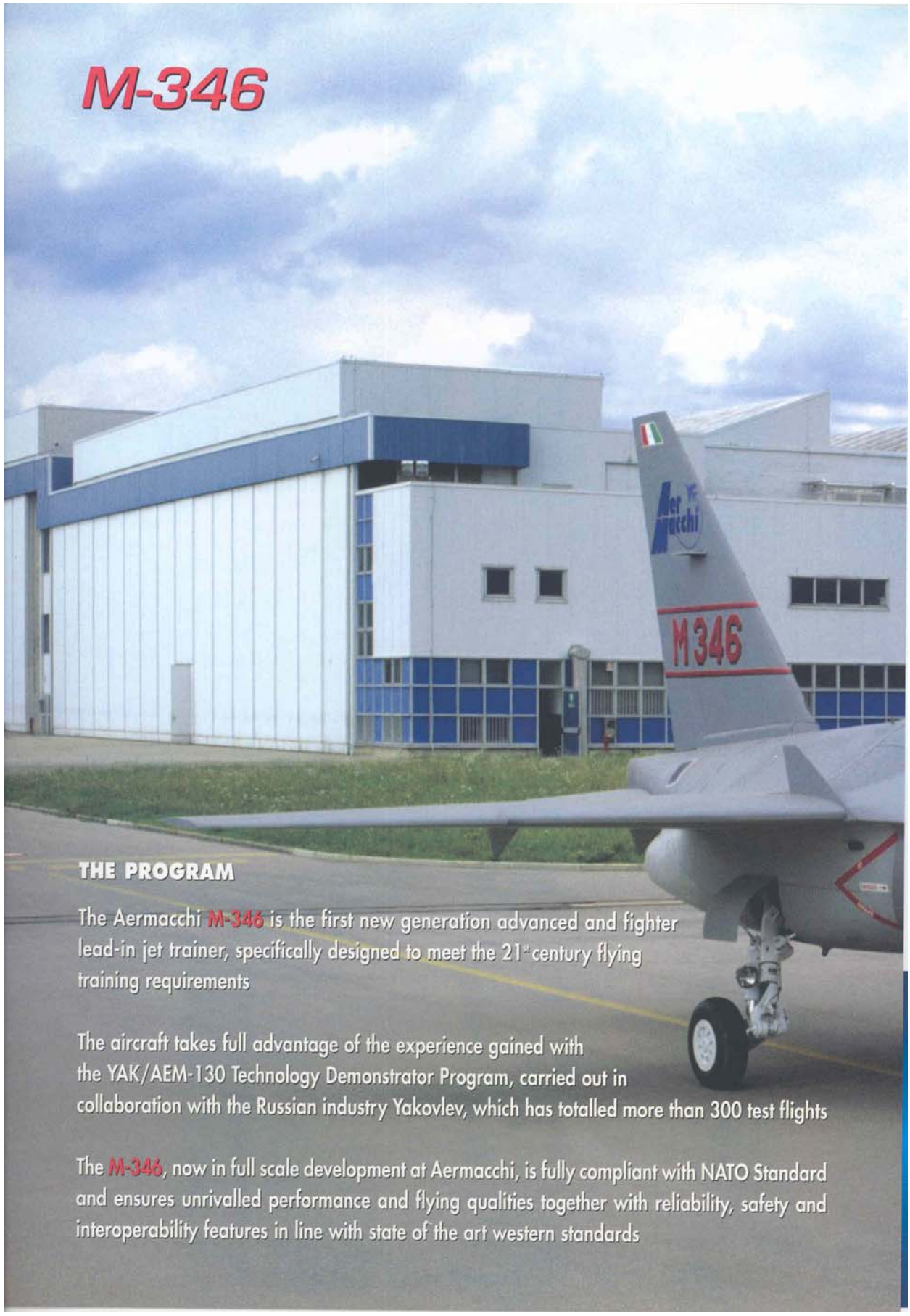
M-346



Aermacchi
A Finmeccanica Company

M-346



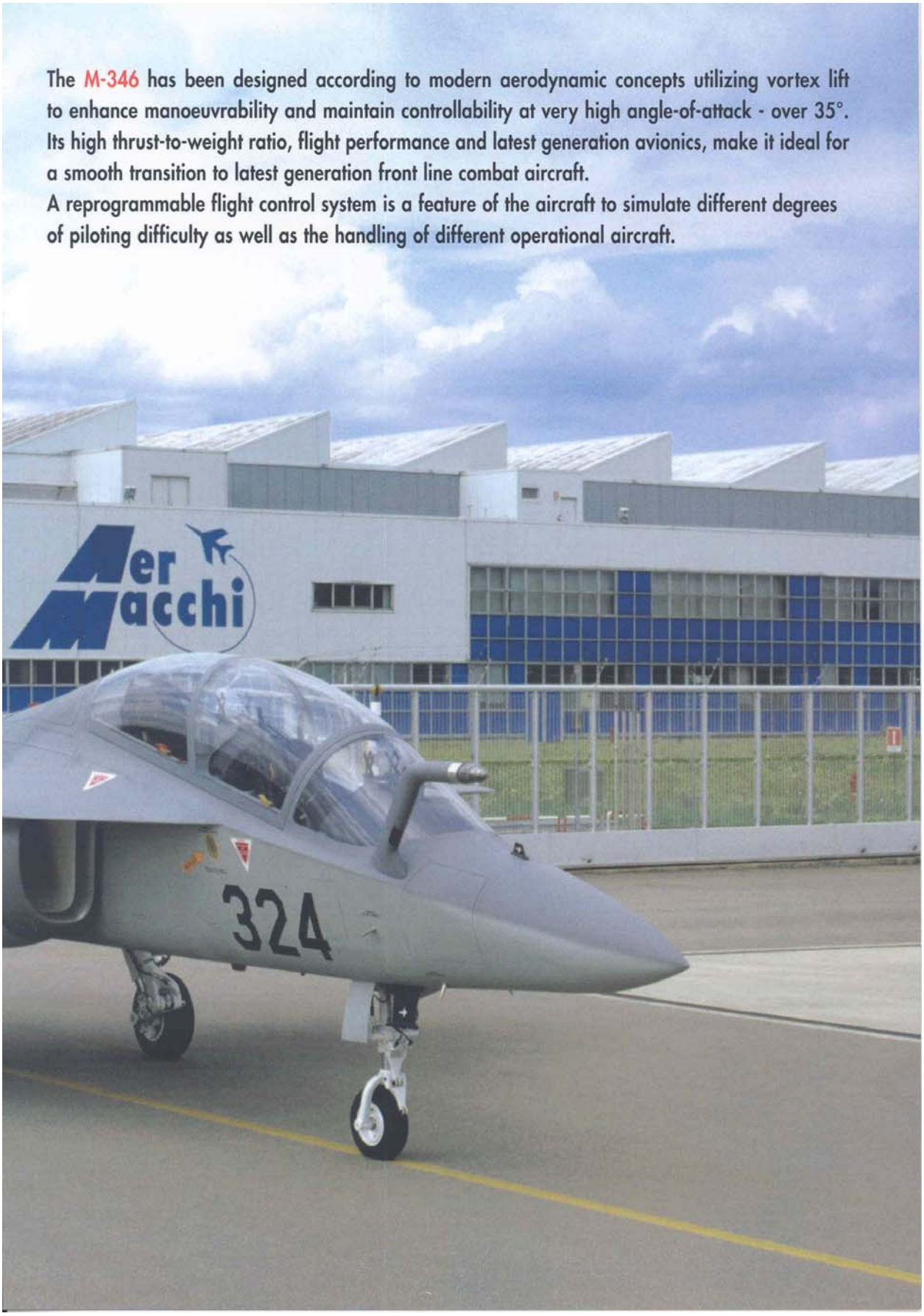
THE PROGRAM

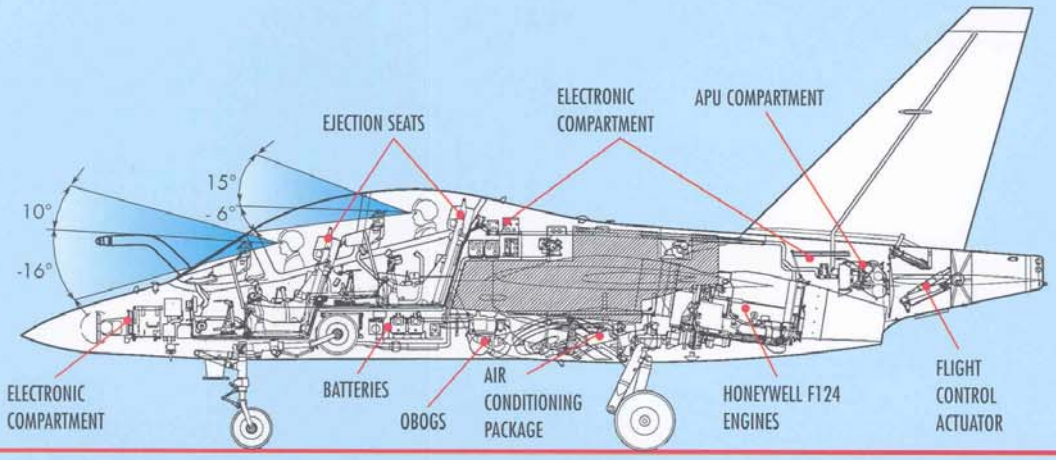
The Aermacchi M-346 is the first new generation advanced and fighter lead-in jet trainer, specifically designed to meet the 21st century flying training requirements

The aircraft takes full advantage of the experience gained with the YAK/AEM-130 Technology Demonstrator Program, carried out in collaboration with the Russian industry Yakovlev, which has totalled more than 300 test flights

The M-346, now in full scale development at Aermacchi, is fully compliant with NATO Standard and ensures unrivalled performance and flying qualities together with reliability, safety and interoperability features in line with state of the art western standards

The M-346 has been designed according to modern aerodynamic concepts utilizing vortex lift to enhance manoeuvrability and maintain controllability at very high angle-of-attack - over 35°. Its high thrust-to-weight ratio, flight performance and latest generation avionics, make it ideal for a smooth transition to latest generation front line combat aircraft.
A reprogrammable flight control system is a feature of the aircraft to simulate different degrees of piloting difficulty as well as the handling of different operational aircraft.





Flight Control System

The FCS is a Multiple Redundant, Re-Configurable, Full Authority Full Time Digital Fly-By-Wire System.

The FCS provides the aircraft both manual *(three axis stability and Command Augmentation, High Level of Self Monitoring and Redundancy Management, Carefree Handling Capabilities with Pilot Selectable different limits)* and Automatic *(Flight Director and Auto-Pilot)* capability.

The FCS also provides data exchange interface between Avionics System, Back-up instruments and Engine FADECS through MIL-STD-1553B Data Busses.

Structure mainly built of light alloys, carbon fiber-based composites are used for most of the control surfaces. Damage tolerance concepts are used throughout the airframe design. Corrosion protection follows the most advanced aeronautical practices.

Structural design is in accordance with the criteria specified in MIL-STD-1530A and MIL-A-8860A series specifications.

Easy accessibility to equipment is provided by quick access doors. Service life is 10,000 flight hours, an extension up to 15,000 flight hours is planned.

Maintenance

analysis was performed in accordance with MIL-STD-470B as the basis to develop a maintainability program.

The aircraft is designed to operate as a self-sufficient unit: autonomous engine start, OBOGS, Built-In Test Equipment, APU providing ground power and cooling, independent cockpit access, no specific GSE required to operate the aircraft. Technical publications are in accordance with all applicable MIL Standard.

Fuel System

is based on one fuselage and two wing integral tanks. The fuselage tank front section acts as a engines feeding tank. Two auxiliary droppable tanks, 580 l capacity each, can be carried underwing, one conformal auxiliary tank carried underfuselage. Fuel is supplied to the engines from the feeding tank via two redundant AC electrical pumps. The feeding tank is maintained always full thus to provide fuel also during negative G flights.

Fuel transfer is by gravity from the wing to the fuselage tank, by jet pumps from the rear fuselage to the feeding tank, by AC electrical pumps from the auxiliary to the fuselage tank.

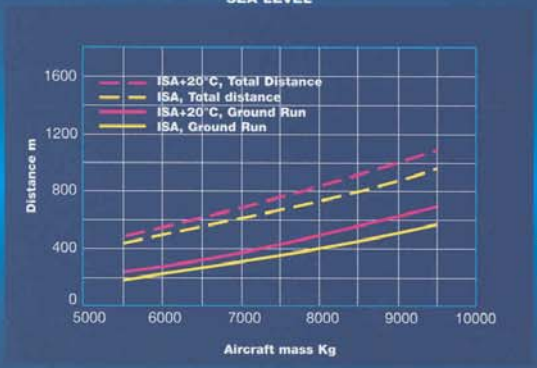
All tanks are single point pressure refuelled through NATO STANAG coupling.

Gravity refuelling is by NATO STANAG orifices. The optional air-to-air refuelling system, night operations-compatible, includes a removable (30 minutes required) probe.

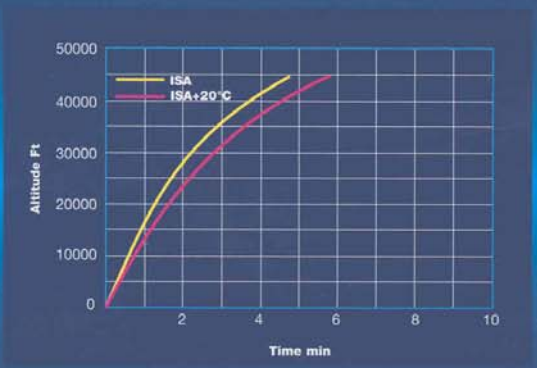
Landing Gear with single wheels mounted on levered suspension, in the main elements and telescopic in the nose element. Brakes are fitted with anti-skid system. Nose wheel steering system is designed according to MIL-S-8812 class A specification, engaged by switches on each control stick grip.

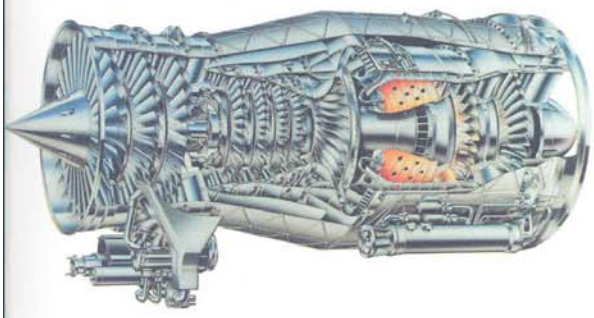
TAKE-OFF PERFORMANCE

SEA LEVEL



CLIMB PERFORMANCE





- **Thrust, max, s.l.s. ISA** 2835 Kg
- **Pressure ratio** 19.4 : 1
- **Bypass ratio** 0.47
- **Specific fuel consumption** 0.81 Kg/h/Kg st
- **Air mass flow** 42.6 Kg/sec

Power Plant

Two Honeywell F124 twin-shaft turbofans. Features: low bypass ratio for high performance in the high subsonic regime; high efficiency fan; HP compressor variable inlet guide vanes for flexible and surge-free operations in a wide envelope; closed-circuit self-contained aerobatics lubrication system; modular design, fully interchangeable modules; dual-channel Full Authority Digital Engine Control (FADEC).

Auxiliary Power Unit

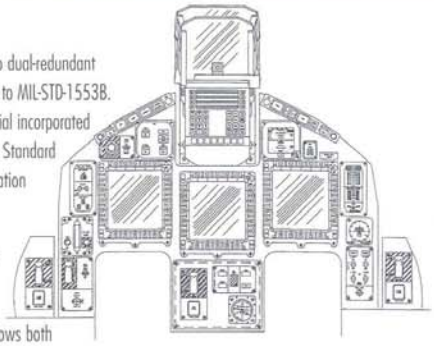
Provides autonomous engine starting and ground operations as well as electrical/hydraulic/pneumatic power for normal operations and emergency needs.

OBOGS (On Board **Oxygen** Generating **System**) with individual seat-mounted regulator, oxygen analyser and status indication system. OBOGS reduces logistic support and maintenance needs.
Emergency oxygen system consists of a bottle of gaseous oxygen, located on each ejection seat.

Avionics

Architecture based on two dual-redundant digital data buses conform to MIL-STD-1553B. Significant growth potential incorporated to cater for future needs. Standard Communication/Identification subsystem includes:

- VHF/UHF transceivers
- IFF transponder



Navigation subsystem allows both autonomous and radionav modes:

- IN/GPS, based on a laser gyro inertial platform with embedded GPS receiver
- TACAN and VOR/ILS/MB.
- Embedded training capability

Ejection Seats

Martin Baker Mk. IT 16 D zero-zero

Fire detection and **Fire Suppression** system in the engine bays and the APU bay.

Man - Machine Interface

representative of latest generation combat aircraft cockpit environment, each crew position including:

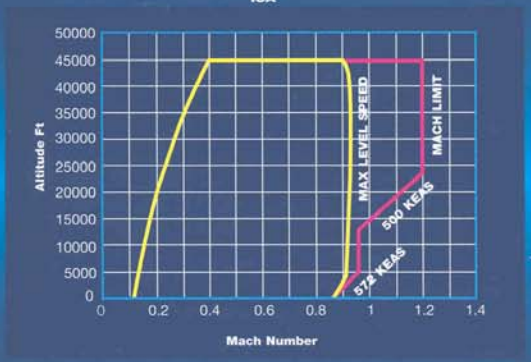
- Head-Up Display, raster/stroke type
- Multi Function Display, (three for each pilot), color, liquid crystal type
- Helmet-Mounted Display
- Night Vision Goggle compatible instrumentation
- Hands On Throttle And Stick (HOTAS) controls.

Environmental Control System

(ECS) provides air conditioning and pressurization of cabin, ventilation and cooling of avionics compartments and equipment. Automatic electronic control maintains temperature according to pilot selection. ECS operation by engines bleed air or APU, the latter in particular for avionics ventilation/cooling on ground (engines shut down). Cockpit pressurization nominal differential pressure: 3.7 psi.

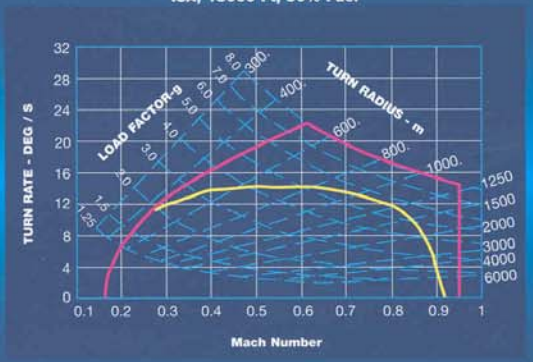
FLIGHT ENVELOPE

ISA



TURN PERFORMANCE

ISA, 15000 Ft, 50% Fuel



Embedded Simulation

In-flight simulation is a key feature of the M-346.
The Embedded Simulation reduces the need for additional aircraft in training missions typically requiring the presence of a leader or opponent aircraft. It also enables the simulation of the operational environment with no need for actual deployment of various threats and for installation of on-board expensive sensors like multimode radar and active/passive electronic countermeasures, thus greatly reducing the operational and logistics costs.

Once the Embedded Simulation is activated, the actions undertaken by the pilots and the actual aircraft flight data interact in real time with the virtual scenario generating specific symbologies.

A set of different operating modes and options can be selected by the instructor through HOTAS controls and MFD soft-key selections. Simulated scenarios data are presented on the MFDs and HUD
in both cockpits.

Three areas of embedded simulation have been included in the design of the aircraft:

• Variable Flight Characteristics

The M-346 Fly-by-wire FCS is designed to make its flying qualities representative of next generation fighters.

The FCS allows also a progressive approach to the front line fighter characteristics. Different levels of difficulty can be selected by the instructor to adapt the aircraft handling qualities to the student pilot skills.

• In-flight sensors and scenario simulation

Embedded Simulation of Radar and Electronic Counter Measures (ECM) is also a feature of the aircraft.
The system can simulate a variety of tactical scenarios:
- Aerial engagements with use of a multy-mode Fire Control Radar.
- Situational awareness and consequent performance of actions and/or manoeuvres in presence of hostile Electronic Warfare (EW) threat warnings.

• In-flight simulation of weapons

This mode allows to perform weapons training without actually employing real or training weapons. The student pilot performs simulated attacks, both in air-to-air and air-to-ground weapons delivery modes, using representative symbologies and weapons delivery parameters.
On-board systems provide the pilot scoring, both in real-time or for on ground mission de-briefing.

The simulated scenarios can be created on ground through a PC-Based Mission Planning Debriefing Station (MPDS) and loaded into the aircraft avionics system via a removable and re-programmable cassette. At the end of the mission, for debriefing purpose, the same mission can be completely reconstructed and played back on the MPDS utilising video, audio and flight data recorded on the cassette.

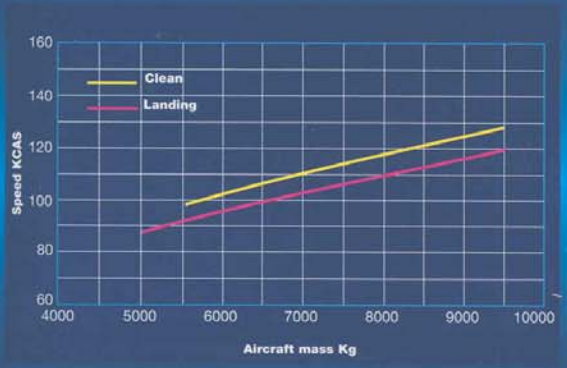
Electrical System provides AC and DC power by two indipendent 20 KVA main generators (one driven by each engine), two 9 KW transformer-rectifier units (TRU), one emergency APU-driven generator and two batteries.
In case of failure of one main generator or one transformer-rectifier unit, the remaining one supplies the complete AC or DC electrical load of the airplane.

Emergency generator (5 KW, 28 V DC) is driven by the APU for ground operations and for emergency flight essential loads supply.
Two ULM NiCd batteries are included for ground and in flight APU starting and emergency prower for operation of flight essential DC loads.
A standard receptacle for external electrical power connection is also provided.

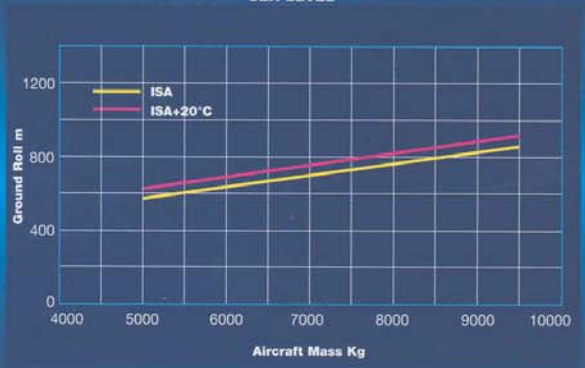
Two totally independent **Hydraulic Systems** (21 Mpa/3000 psi pressure), ensure aircraft operation also in case of failure of either system. Each system is fed by a separate engine driven pump.
Hydraulic systems actuate:

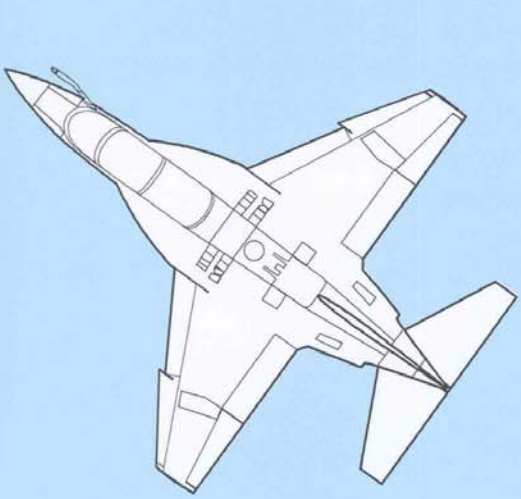
all primary and secondary flight control surfaces, landing gear (emrgency extension accomplished by an indipendent circuit), nose wheel steering, wheel brakes (actuated by both systems, one providing the emergency braking function).

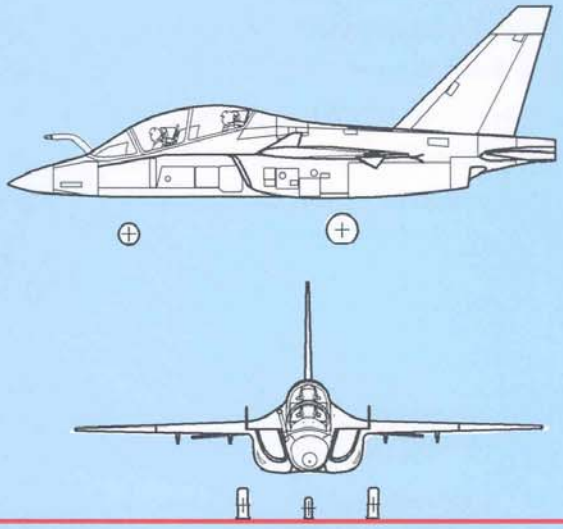
STALL SPEED



LANDING PERFORMANCE
SEA LEVEL







TECHNICAL DATA

Dimensions

Span	9.72 m	(31.89 ft)
Length	11.49 m	(37.70 ft)
Height	4.76 m	(15.62 ft)
Wing area	23.52 sq m	(253.2 sq ft)

Weights

Empty	4610 Kg (10163 lb)
T. O. (trainer)	6700 Kg (14770 lb)
Weapon load (max)	3000 Kg (6615 lb)
T. O. Max (armed)	9500 Kg (20945 lb)

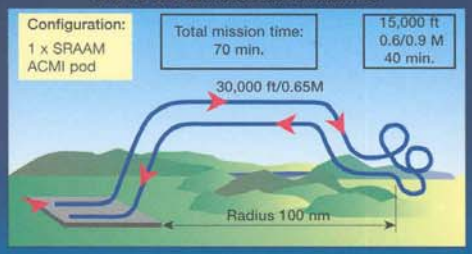
Power Plant

Honeywell	2 x F124-GA-200
Thrust, max, s.l.s. ISA	2 x 2835 Kg (2 x 6250 lb)
Internal fuel, usable	2000 Kg (4409 lb)

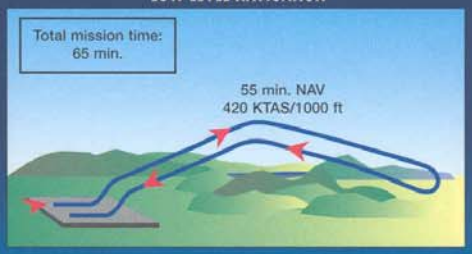
Performance
(Clean, ISA)

Max level speed (5000 ft)	590 KTAS
Limit speed	572 KEAS/1.2 MN
Rate of climb	20,000 ft/min
Stall speed (landing, 100% fuel)	103 KCAS
Service ceiling	45,000 ft
Range Clean/3 Ext. tanks (10% reserve)	1100/1500 nm
Limit Load factor	+8/-3 g
Max sustained load factor (15000 ft)	5.6 g
Max sustained turn rate (15000 ft)	14.5 deg/sec
Take off ground run (s.l.)	290 m (951 ft)
Landing ground roll, 10% inter. fuel (s.l.)	550 m (1804 ft)

AIR-TO-AIR MANOEUVERING TRAINING



LOW LEVEL NAVIGATION



GENERAL HANDLING & CIRCUITS

FERRY FLIGHT

AEM-FINMEC 05/04

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