
cfm
The Power of Flight
LEAP
96%
UTILIZATION
CLEAR ADVANTAGE
HIGH
RESIDUAL
VALUE
ENGINES OF
CHOICE
OPENS NEW
ROUTES
GLOBAL SUPPORT
CAPABILITY
MAXIMIZES
FLEET
AVAILABILITY
ADVANCED,
PROVEN
TECHNOLOGIES
GLOBAL SUPPORT CAPABILITY
INNOVATION
GLOBAL SUPPORT CAPABILITY
OPENS NEW
ROUTES
WORLD CLASS
RELIABILITY
5,000,000
FLIGHT HOURS
MAXIMIZES
FLEET AVAILABILITY
OPERATIONAL EFFICIENCY

LEAP
OVERVIEW

15%
REDUCTION
in fuel consumption and CO_2 emissions versus previous generation engines

MAINTENANCE COSTS
comparable to today's industry-leading **CFM56 ENGINES**

Aircraft compliance
WITH LATEST CHAPTER 14
NOISE REGULATION

UP TO
50%
MARGIN ON NOx EMISSIONS
versus CAEP/6 standard

THE LEAP ENGINE REPRESENTS THE OPTIMUM COMBINATION OF CFM INTERNATIONAL'S UNRIVALED EXPERIENCE AS THE PREFERRED ENGINE SUPPLIER FOR SINGLE-AISLE AIRCRAFT AND ITS 40+ YEAR INVESTMENT IN RESEARCH AND DEVELOPMENT.

The LEAP family of engines is designed to power commercial aircraft requiring **20,000 TO 35,000 POUNDS OF THRUST.**

The LEAP engine is a worthy successor to the CFM56 family, the best-selling engine in aviation history.
Leveraging the strengths of its parent companies, GE and Safran Aircraft Engines, the LEAP engine incorporates leading-edge technologies to meet customers' increasingly demanding economic and environmental requirements.

These technology innovations include optimized thermodynamic design, higher bypass and compression ratios, advanced 3-D aerodynamic design, and greater use of lightweight materials.

CFM COMMITMENTS:

BEST
ENGINE PERFORMANCE

BEST
EXECUTION

TECHNOLOGY
FIRSTS

COMMERCIAL SUCCESS

The
LEAP
is the fastest-selling engine
IN AVIATION HISTORY

17,500+
LEAP ENGINES
orders and commitments

BACKLOG EQUAL TO
8 YEARS
of production*

A320neo
Dual-source
(LEAP-1A)

737 MAX
Single-source
(LEAP-1B)

C919
Sole western powerplant
(LEAP-1C)

CFM HAS LEVERAGED ALL OF THIS UNRIVALED EXPERIENCE FOR THE LEAP ENGINE PROGRAM, AND THE BASIC PRINCIPLE HASN'T CHANGED: GIVE CUSTOMERS THE BEST POSSIBLE ENGINE, TODAY AND FOR YEARS TO COME.

CFM has a long history of constantly investing in its product lines to deliver greater value. This is the approach the company used to develop the LEAP engine and will continue to develop new technologies that will be incorporated into the engine throughout its service life, as well as in a new generation of engines.

*Assuming a steady production rate of 2000 engines per year

LOW RISK BEST EXECUTION

GE and Safran Aircraft Engines
together since 1974,
PARTNERS THROUGH
2040+

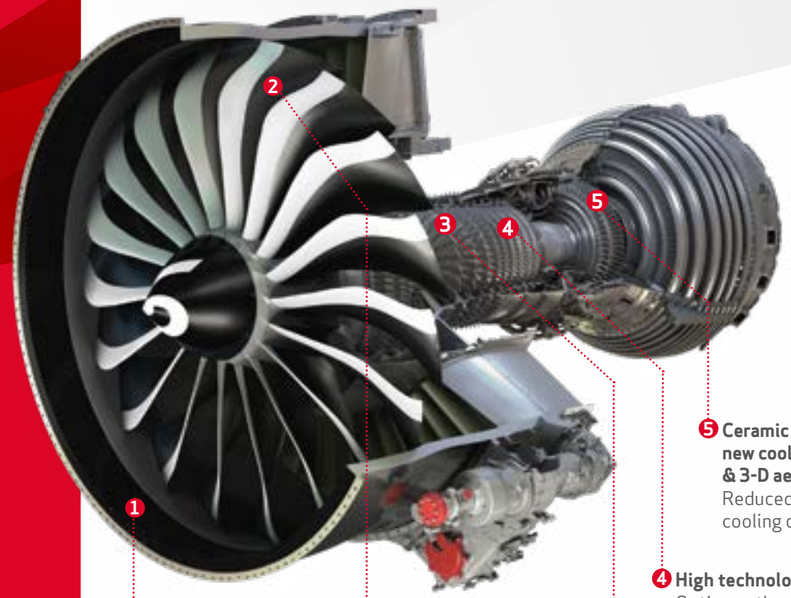
5,000,000+
LEAP ENGINE
flight-hours

100+
OPERATORS
have ordered the LEAP
as of May 2019

TECHNOLOGY FIRSTS

500 LBS
the weight reduction per engine enabled by 3-D RTM material

20% BETTER THERMAL RESISTANCE
of CMC materials vs metallic alloys



1 **High bypass ratio**
Optimum propulsive efficiency

2 **3-D woven carbon fiber composites**
Lightweight, increased durability

3 **Debris rejection system**
Airfoils protection against erosion

4 **High technology compressor**
Optimum thermal efficiency

5 **Ceramic composites, new cooling & 3-D aerodynamics**
Reduced weight, cooling optimization

CFM'S LEAP ENGINE IS AN IMPRESSIVE PACKAGE OF INNOVATIVE TECHNOLOGIES. IT SETS A NEW STANDARD IN ENGINES FOR SINGLE-AISLE COMMERCIAL JETS, PROVIDING A 15% REDUCTION IN FUEL CONSUMPTION AND CO_2 EMISSIONS VERSUS PREVIOUS GENERATION ENGINES.

3-D WOVEN CARBON FIBER COMPOSITES

- The 3-D woven RTM (Resin Transfer Molding) carbon fiber composites used for the fan blades and fan case on the LEAP engine are revolutionizing the single-aisle market.
- This material helps reduce engine weight by 500 lbs per engine. The 3-D RTM technology is highly impact resistant and, thus, reduces maintenance requirements.

CERAMIC MATRIX COMPOSITES (CMCs)

- Composite materials, such as CMCs, are made from separate materials that are joined together. CMCs are produced from silicon carbide fibers 5 times as thin as human hair embedded in a silicon carbide matrix and coated in a proprietary coating creating a part that is stronger than metal.
- CMCs are incorporated in the LEAP engines in the high-pressure turbine shroud, one of the hottest sections of the engine. CMC materials have a 20% better thermal resistance (reducing cooling needs), two times the material strengths and are 2/3 lighter vs the metallic alloys they replace (contributing to engine weight reduction), all of those contributing to better fuel efficiency.

LEAP
IN OPERATION

Flying an average of
10 HOURS
a day and up to
11 FLIGHT CYCLES,
every day.

96%
FLOWN DAYS

It is highly gratifying to see the continued confidence our customers have in our products. Everyday, the LEAP product is delivering world-class fuel efficiency and utilization, fulfilling the commitment we made to customers more than a decade ago.

Gaël Méheust, President and CEO of CFM International

THE LEAP ENGINE HAS DEMONSTRATED AN UNRIVALED UTILIZATION SINCE IT STARTED REVENUE SERVICE IN AUGUST 2016. ITS FOOTPRINT IS NOW GLOBAL AND HAS DELIVERED PERFORMANCE IN LINE WITH THE COMMITMENT MADE BY SAFRAN AND GE.

As of June 2019, more than 1,650 LEAP engines were in service on six continents, flying in various environments, logging more than 5,000,000 flight-hours.

Designed for reliability, the engine's proven architecture has enabled the highest utilization rate in its thrust class! LEAP engines have demonstrated longer time spent in the air versus previous generation engines, flying an average of 10 hours a day and up to 11 flight cycles, every day.

To operators, this means more flights and more flexibility to meet their economic objectives, with the opportunity of opening up new routes and supporting longer flight legs.

Delivering 15% fuel efficiency, the LEAP meets its environmental challenge by reaching the rate of 90 miles per gallon per passenger. A fuel saving of more than 60% compared to an average car drive.

CLOSE TO OUR CUSTOMERS

ON-SITE SUPPORT

A PROVEN GLOBAL SUPPORT NETWORK

CFM also provides 24-hour support for Aircraft on Ground (AOG) issues, spare parts and spare engine requirements, and technical assistance, while our Technical Training facilities in the U.S., France, China and India provide comprehensive, hands-on and digital maintenance training for all engine models. CFM provides also a dedicated worldwide LEAP experts network to support new operators.

INITIATIVES:

- Dedicated LEAP experts network supporting new LEAP operators
- Entry into Service Road Map customized for each airline
- New LEAP Customer Support Center (CSC), (Available 24/7)
- LEAP Maintenance Training Centers
- Flight Ops dedicated to airline pilots LEAP training

4 TRAINING CENTERS
on 3 continents

3 CUSTOMER SUPPORT
and **DIAGNOSTICS CENTERS**

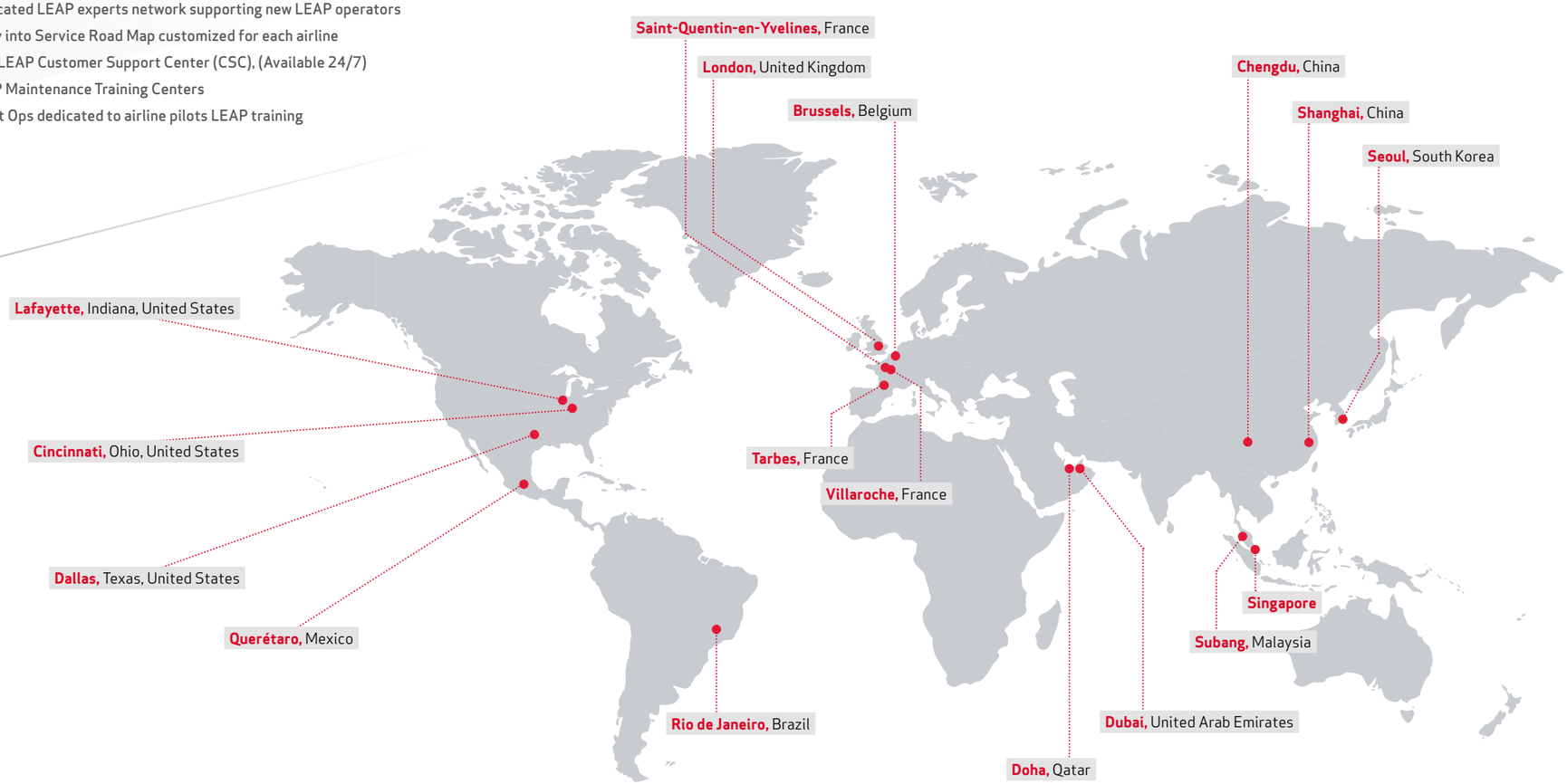
17 ON-SITE
SUPPORT CENTERS

WORLDWIDE COVERAGE FOR A NEW STANDARD OF EXCELLENCE

WORLDWIDE NETWORK

MAXIMIZED RESPONSIVENESS

STANDARDIZED PRACTICES



STRONG EXECUTION

assures unparalleled success

2018 MARKED THE PRODUCTION TRANSITION from CFM56 engines to the LEAP product line.

CFM HAS PRODUCED AND DELIVERED THE WORLD'S LARGEST FLEET OF JET ENGINES IN THE SINGLE-AISLE MARKET.

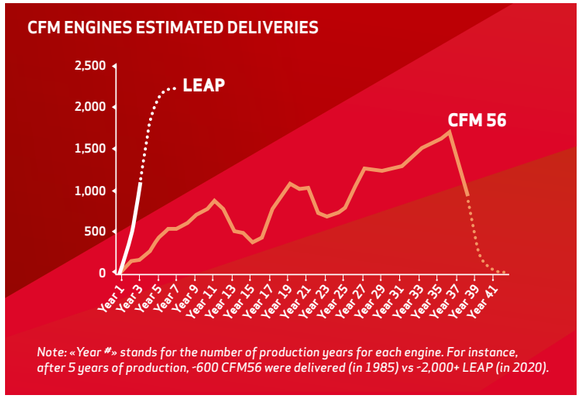
This achievement is anchored in the development and continuous improvement of world-class facilities on both sides of the Atlantic, with each partner responsible for half the workshare.

GE develops and builds the core, comprising the high-pressure compressor, high-pressure turbine, and the combustor, while Safran Aircraft Engines designs and builds the fan, the accessory gearbox, and the low-pressure compressor and turbine. Final assembly of CFM engines is performed at both GE and Safran Aircraft Engines facilities.

INDUSTRY'S HIGHEST PRODUCTION RATE

CFM maintains the highest production rate in the industry and the company is modernizing and expanding its facilities to ensure the successful ramp-up in production for the new LEAP engine. Both GE and Safran Aircraft Engines have added new manufacturing capability worldwide, making a combined capital investment of more than $1 billion.

As the ramp-up continues, CFM is on track to deliver 1,800+ LEAP engines in 2019 and will reach more than 2,000 engines per year by 2020. CFM will continue to build CFM56 spare engines for several years to support the in-service fleet.



Note: «Year #» stands for the number of production years for each engine. For instance, after 5 years of production, ~600 CFM56 were delivered (in 1985) vs ~2,000+ LEAP (in 2020).

CFM
COMMITMENTS

BEST
ENGINE PERFORMANCE
fuel consumption,
maintenance cost, reliability,
minimal environmental
footprint.

BEST
EXECUTION
35,500+ CFM engines
delivered, unprecedented ramp-up.

TECHNOLOGY
FIRSTS
proven architecture,
multiple proven
and new technologies.

The Power of Flight

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www.cfmaeroengines.com