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

AIRCRAFT COMPLIANCE WITH FUTURE CHAPTER 14 NOISE REGULATION

MAINTENANCE COSTS COMPARABLE TO TODAY’S INDUSTRY-LEADING CFM56 ENGINES
15% REDUCTION IN FUEL CONSUMPTION AND CO₂ EMISSIONS VERSUS PREVIOUS GENERATION ENGINES

UP TO 50% MARGIN ON NOₓ EMISSIONS VERSUS CAEP/6 STANDARD
TO DATE, CFM HAS RECEIVED MORE THAN 12,200 LEAP ENGINES ORDERS AND COMMITMENTS ACROSS ALL THREE MODELS.

A320neo
Dual-source (LEAP-1A)

737 MAX
Single-source (LEAP-1B)

C919
Sole western powerplant (LEAP-1C)

THE LEAP IS THE FASTEST-SELLING ENGINE IN AVIATION HISTORY

-100,000 LEAP ENGINE FLIGHT-HOURS IN LESS THAN A YEAR

OPERATING WORLDWIDE

Commercial success
CFM EXPERIENCE:

- **31,000+** CFM ENGINES DELIVERED
- **22 SUCCESSFUL ENTRIES INTO SERVICE**
- **EVERY 2 SECONDS** A CFM POWERED AIRCRAFT TAKES OFF SOMEWHERE IN THE WORLD

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.
Technology **firsts**

**Technology firsts**

**MULTIPLE PROVEN CUTTING-EDGE TECHNOLOGIES**

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. **New-generation combustor**
   Lean burn, low temperature

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

7. **Lightweight materials & 3-D aerodynamics**
   Reduced weight, increased efficiency
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 CO₂ 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.

ADDITIVE MANUFACTURING
Additive manufacturing is transforming the way engines are built. This technology “grows” engine parts directly from a CAD* file using layers of fine metal powder and a laser. This results in complex, fully dense, lighter parts, manufactured in a fraction of the time it would take using traditional subtractive methods. Each LEAP engine contains metal 3-D-printed fuel nozzles, which are up to 25% lighter than traditional nozzles.

* Computer Assisted Design.
2016 has been an incredible year for the LEAP program. It has been marked by the entry into service of the first model of the family and ended with the certification of the third version of this family.

"Everyone, from the project and engineering teams to manufacturing and our suppliers, has done an incredible job. They kept this program on schedule and built an engine that is delivering everything that we have promised."
The LEAP engine started revenue service in August 2016. Its footprint is now global, it has delivered performance in line with the commitment made by Safran and GE.

As of June 2017, more than 100 LEAP engines were in service on four continents, flying in various environments, logging a total of 100,000 flight-hours. Within the first five years, CFM will have support 50 entries into service, which has never been done in aviation history.
CFM HAS IMPLEMENTED THE MOST COMPREHENSIVE READINESS PLAN EVER TO ENSURE A SMOOTH, SUCCESSFUL ENTRY INTO SERVICE FOR ALL LEAP 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
• Customer web portal (myCFMportal.com)
• Flight Ops dedicated to airline pilots LEAP training

A PROVEN GLOBAL SUPPORT NETWORK IS ALREADY IN PLACE:

DEDICATED LEAP EXPERTS SUPPORTING NEW LEAP OPERATORS

Closer to our customers
On-Site Support
WORLDWIDE COVERAGE FOR A NEW STANDARD OF EXCELLENCE

- WORLDWIDE NETWORK
- MAXIMIZED RESPONSIVENESS
  AND MINIMIZED COSTS FOR CUSTOMERS
- STANDARDIZED PRACTICES
  AND DELIVERABLES BASED ON CFM56
Strong execution assures unparalleled success
The Power Of The Future

The transition is expected to be completed by 2020 with an anticipated production rate of more than 2,000 engines per year. CFM will continue to build CFM56 spare engines for several years to support the in-service fleet.

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.

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 U.S.
CFM commitments

- **BEST ENGINE PERFORMANCE**
  Fuel consumption, maintenance cost, reliability, minimal environmental footprint.

- **BEST EXECUTION**
  22+ successful service entries

- **TECHNOLOGY FIRSTS**
  Proven architecture, multiple proven and new technologies.
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

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.
LEAP-1A
Airbus A320neo
The LEAP® family of engines is designed to power commercial aircraft requiring 20,000 to 35,000 pounds of thrust. These new-generation engines will set the standard in terms of fuel efficiency and total cost of ownership.

### CHARACTERISTICS

<table>
<thead>
<tr>
<th>A/C application</th>
<th>A320neo family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takeoff thrust</td>
<td>Up to 35,000 lbf *</td>
</tr>
<tr>
<td>Bypass ratio (CR)</td>
<td>11:1 class</td>
</tr>
<tr>
<td>Overall pressure ratio (T/O)</td>
<td>40:1 class</td>
</tr>
<tr>
<td>Fan diameter</td>
<td>78”</td>
</tr>
<tr>
<td>Compressor Stages (fan / booster / HPC)</td>
<td>1+3+10</td>
</tr>
<tr>
<td>Turbine Stages (HP / LP)</td>
<td>2+7</td>
</tr>
<tr>
<td>Combustor</td>
<td>TAPS II</td>
</tr>
<tr>
<td>Control</td>
<td>FADEC IV</td>
</tr>
</tbody>
</table>

* 32,900 lbf at Sea Level – Increased thrust at altitude

### TIMETABLE

- **2017**
  - LEAP POWERED A321neo ENTRY INTO SERVICE
- **2016**
  - LEAP POWERED A320neo ENTRY INTO SERVICE
- **2015**
  - LEAP-1A CERTIFICATION
- **2014**
  - FLIGHT TESTS
- **2013**
  - FIRST ENGINE TO TEST
- **2010**
  - A320neo LAUNCH

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**LEAP INCORPORATES IMPROVEMENTS DEVELOPED THROUGH ADVANCED RESEARCH & TECHNOLOGY TO OFFER:**

- **15%** REDUCTION IN FUEL CONSUMPTION AND CO₂ EMISSIONS VERSUS PREVIOUS GENERATION ENGINES
- **AIRCRAFT COMPLIANCE WITH FUTURE CHAPTER 14 NOISE REGULATION**
- **UP TO 50% MARGIN ON NOₓ EMISSIONS VERSUS CAEP/6 STANDARD**
- **MAINTENANCE COSTS COMPARABLE TO TODAY’S INDUSTRY-LEADING CFM56 ENGINES**

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LEAP-1B
Boeing 737 MAX
The LEAP® family of engines is designed to power commercial aircraft requiring 20,000 to 35,000 pounds of thrust. These new-generation engines will set the standard in terms of fuel efficiency and total cost of ownership.

**CHARACTERISTICS**

- **A/C application**: 737 MAX family
- **Takeoff thrust**: Up to 28 K
- **Bypass ratio (CR)**: 9:1 class
- **Overall pressure ratio (T/O)**: 40:1 class
- **Fan diameter**: 69”
- **Compressor Stages** (fan / booster / HPC): 1+3+10
- **Turbine Stages (HP / LP)**: 2+5
- **Combustor**: TAPS II
- **Control**: FADEC IV

**LEAP INCORPORATES IMPROVEMENTS DEVELOPED THROUGH ADVANCED RESEARCH & TECHNOLOGY TO OFFER:**

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- **MAINTENANCE COSTS COMPARABLE TO TODAY’S INDUSTRY-LEADING CFM56 ENGINES**

**TIMETABLE**

- **2011**: 737 MAX LAUNCH
- **2014**: FIRST ENGINE TO TEST
- **2015**: FLIGHT TESTS
- **2016**: LEAP-1B CERTIFICATION
- **2017**: 737 MAX 9 FIRST FLIGHT
- **2017**: 737 MAX 8 ENTRY INTO SERVICE

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LEAP-1C
Comac C919
The LEAP® family of engines is designed to power commercial aircraft requiring 20,000 to 35,000 pounds of thrust. These new-generation engines will set the standard in terms of fuel efficiency and total cost of ownership.

**CHARACTERISTICS**

<table>
<thead>
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<th>A/C application</th>
<th>C919 family</th>
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<tbody>
<tr>
<td>Takeoff thrust</td>
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<tr>
<td>Bypass ratio (CR)</td>
<td>11:1 class</td>
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**TIMETABLE**

- **2019**: C919 ENTRY INTO SERVICE
- **2017**: FIRST FLIGHT
- **2016**: LEAP-1C CERTIFICATION
- **2014**: FLIGHT TESTS
- **2013**: FIRST ENGINE TO TEST
- **2009**: C919 LAUNCH

**LEAP INCORPORATES IMPROVEMENTS DEVELOPED THROUGH ADVANCED RESEARCH & TECHNOLOGY TO OFFER:**

- **15%**: REDUCTION IN FUEL CONSUMPTION AND CO₂ EMISSIONS VERSUS PREVIOUS GENERATION ENGINES
- **MAINTENANCE COSTS**: COMPARABLE TO TODAY’S INDUSTRY-LEADING CFM56 ENGINES
- **AIRCRAFT COMPLIANCE WITH FUTURE CHAPTER 14 NOISE REGULATION**
- **UP TO 50%**: MARGIN ON NOₓ EMISSIONS VERSUS CAEP/6 STANDARD

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