GENERAL

airbus system a319 a320

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When it comes to modern commercial aviation, few aircraft families have achieved the same blend of reliability, efficiency, and versatility as the Airbus A319 and A320. These twin jet, narrow body airliners form the backbone of many airlines around the world, powering everything from short haul regional routes to high density trans Atlantic flights. At the heart of their success lies an integrated suite of systems that work in harmony to deliver safe, comfortable, and cost effective travel.

In this comprehensive guide we dive deep into the **Airbus system A319 A320**—examining every major component, from the wing structure to the flight deck avionics, and exploring how these systems interconnect to create a world class aircraft. Whether you're a pilot, engineer, aviation enthusiast, or simply curious about the technology that keeps the skies busy, this article offers a clear, engaging look at the inner workings of two of the most popular planes in the skies today.

1. Overview of the Airbus A319/A320 Family

The Airbus A319 and A320 are part of the A320 family, which also includes the larger A321 and the extended range A330 200. The A319 is a shortened version of the A320, designed to accommodate 124–156 passengers, while the A320 typically seats 140–170 passengers in a standard two class configuration. Both aircraft share a common airframe, engines, and systems, allowing airlines to operate mixed fleets with minimal training and maintenance differences.

First introduced in the early 1990s, the A320 family was a response to the need for more fuel efficient, high capacity aircraft that could serve both short haul and medium haul routes. Over the years, the family has evolved through several major updates—most notably the A320neo (New Engine Option) and the A320ceo (Current Engine Option). These updates brought significant improvements in fuel burn, noise reduction, and cabin comfort.

Key Design Objectives

- High passenger capacity with efficient fuel consumption
- Modular systems architecture to simplify maintenance
- Advanced fly by wire flight control for precise handling
- Low operating costs through reduced crew requirements
- Scalable cabin layout for airlines of all sizes

2. Airframe and Structural Systems

The A319 and A320 share a lightweight, aluminum composite hybrid airframe. The primary structure—fuselage, wings, and tail—uses a combination of aluminum alloys and composite materials to achieve a high strength to weight ratio.

Wing Design and High Lift Devices

The wings feature a high aspect ratio and incorporate a leading edge slat and a trailing edge flap system. These high lift devices extend during takeoff and landing, increasing wing area and reducing stall speed. The wing's internal structure includes a network of spars and ribs that distribute aerodynamic loads while keeping weight low.

Composite Materials

Composite panels are used extensively in the fuselage and wing sections. These panels are lighter than traditional aluminum and offer superior resistance to corrosion and fatigue. The use of composites also allows for more complex aerodynamic shapes, enhancing overall performance.

3. Propulsion & Powerplant

The A319 and A320 typically use either the **CFM International CFM56 5B** or the **Pratt & Whitney PW1100G CE** turbofan engines. The choice of engine depends on airline preference, performance requirements, and environmental regulations.

CFM56 5B Series

- Thrust range: 27,000–35,000 /lb (12–16 /kN)
- High bypass ratio for fuel efficiency
- Advanced fan blades made of titanium and aluminum
- Low noise signature due to optimized fan geometry

PW1100G CE Series

- Geared turbofan architecture for improved fan efficiency
- Up to 12 /% fuel burn reduction compared to older engines
- Reduced maintenance costs thanks to fewer moving parts
- Compliance with Stage /3 and Stage /4 noise regulations

Engine Integration

Both engines are mounted on pylons that incorporate thrust reversers and bleed air systems. The bleed air is used to pressurize the cabin, operate environmental control units, and power the aircraft's electrical systems.

4. Flight Control Systems

The A319/A320 family introduced fly by wire (FBW) flight controls, a revolutionary technology that replaces traditional mechanical linkages with electronic signals. This system allows for precise control inputs, reduced pilot workload, and enhanced safety features.

Primary Flight Control Laws

- Normal Law: Provides full flight envelope protection
- Alternate Law: Maintains basic flight control with reduced protections
- Direct Law: Gives the pilot direct control in case of system failure

Redundant Architecture

The FBW system is triply redundant, meaning there are three independent flight control computers that cross check each other. If one fails, the remaining two continue to provide control, ensuring the aircraft remains safe.

Fly by Wire Flight Deck

The flight deck features a glass cockpit with large multi function displays (MFDs) and a primary flight display (PFD). These screens provide real time flight data, engine parameters, and navigation information. The pilot interacts with the system via side stick controllers, which send electronic signals to the flight control computers.

5. Avionics Suite

The avionics suite in the A319/A320 is a modern, integrated platform that includes navigation, communication, surveillance, and aircraft management systems. The core of the avionics package is the **Airbus Common Avionics Architecture (CAA)**, which unifies data across all subsystems.

Navigation Systems

- Global Positioning System (GPS) with WAAS support
- Inertial Reference System (IRS) for precise navigation
- Enhanced Ground Proximity Warning System (EGPWS)
- Automatic Dependent Surveillance–Broadcast (ADS B) for traffic awareness

Communication Systems

The aircraft uses a combination of VHF radios, SATCOM for long range communication, and an integrated data link for flight plan updates. The cockpit displays provide continuous monitoring of communication status.

Flight Management System (FMS)

The FMS integrates flight planning, navigation, and performance calculations. It interfaces with the engine control system to optimize thrust settings, fuel burn, and flight paths. Advanced features include automatic flight following and real time performance monitoring.

Electronic Flight Instrument System (EFIS)

The EFIS provides the pilot with all necessary flight data in a clear, intuitive format. The system displays attitude, altitude, airspeed, heading, and navigation information, along with alerts for system malfunctions or abnormal conditions.

6. Electrical & Power Distribution

The A319/A320 employs a dual bus electrical system to ensure reliability and redundancy. Each bus supplies power to critical systems, including avionics, environmental control, and flight controls.

Bus Architecture

- Bus A: 115 /V AC, 200 /A, for primary systems
- Bus B: 115 /V AC, 200 /A, for backup systems

Power Generation

In addition to engine driven generators, the aircraft features a **Variable Frequency Generator (VFG)** that provides stable power to the avionics during engine failure scenarios. The VFG is powered by a dedicated battery pack and can sustain critical systems for up to 30 minutes.

Battery Systems

The aircraft is equipped with two 24 V lead acid batteries, each capable of providing power for 5–10 minutes in case of generator failure. Modern variants may use lithium ion battery packs for improved weight savings and longer life cycles.

7. Fuel Management

Fuel management is a critical aspect of aircraft operations, affecting range, payload, and safety. The A319/A320 features an advanced fuel management system that monitors fuel quantity, balance, and consumption in real time.

Fuel Quantity and Balance

Fuel gauges and sensors located in each wing tank provide continuous data to the FMS. The system calculates fuel balance and ensures that the center of gravity remains within acceptable limits throughout the flight.

Fuel Efficiency Features

- Optimized flight profiles for cruise speed and altitude
- Automatic engine power adjustments during climb and descent
- Option to use wing tip devices for reduced drag

Fuel Safety Systems

Fire detection and suppression systems are installed in both fuel tanks. In the event of a fuel leak or fire, the system automatically shuts off the fuel flow and activates the suppression system.

8. Environmental Control & Cabin Systems

The cabin environment is regulated by a sophisticated environmental control system (ECS) that manages temperature, pressure, and airflow. The ECS is powered by bleed air from the engines and supplemented by electric compressors in newer models.

Pressurization

The aircraft maintains cabin pressure at an equivalent altitude of 6,000 ft, even when cruising at 35,000 ft. The ECS uses variable area valves to adjust cabin pressure during takeoff, climb, cruise, and descent.

Air Conditioning

Heat exchanger units cool and condition the bleed air before it enters the cabin. Fans circulate the conditioned air, ensuring a comfortable temperature for passengers and crew.

Cabin Comfort Features

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