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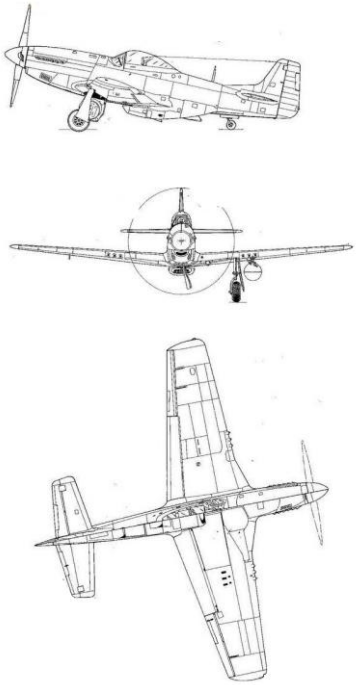
Aircraft 1:



This P-51 Mustang. In this report, you will:

1. Investigate the performance and design features of P-51.
2. Answer the following questions using the knowledge learnt from this course:

- What type of engine does it use? Please state the Pros and Cons of this type of engine
- Please describe the features of its wing.
- What kind of landing gear does it use? Please state the Pros and Cons of this type of landing gear
- Where is its aileron? What is the functionality of the aileron?
- Where is the device that controls the pitching angle of the aircraft? What's the name of this device?

Type your report here:

Aircraft 2:

This is F-35. In this report, you will:

1. Investigate the performance and design features of F-35.
2. Answer the following questions using the knowledge learnt from this course:

- What kind of air inlet does it use? Please describe the features of this type of inlet.
- It is a stealth fighter. Please describe the features that reduces the RCS.
- Why does the vertical tail sit between the wing and the horizontal stabilizer?
- What kind of engine does it use? Why?
- Does it have a LEX? Describe how the LEX works.

Type your report here:

Answer to the question no:1

The Lockheed Martin F-35 is an American family of single-seat, single-engine, all-weather stealth multirole combat aircraft that is intended to perform both air superiority and strike missions. It is also able to provide electronic warfare and intelligence, surveillance, and reconnaissance capabilities. The aircraft has three main variants: the conventional takeoff and landing (CTOL) F-35A, the short take-off and vertical-landing (STOVL) F-35B, and the carrier-based (CV/CATOBAR) F-35C. The second fifth generation fighter to enter US service and the first operational supersonic STOVL stealth fighter

Based on wind tunnel testing, Lockheed Martin slightly enlarged its X-35 design into the F-35. The forward fuselage is 5 inches longer to make room for avionics. Correspondingly, the horizontal stabilators were moved 2 inches rearward to retain balance and control. The top surface of the fuselage was raised by 1 inch along the center line. Also, it was decided to increase the size of the F-35B STOVL variant's weapons bay to be common with the other two variants. prototype airframe began in November 2003. Because the X-35 did not have weapons bays, their addition in the F-35.

The F-35B STOVL variant was in danger of missing performance requirements in 2004 because it weighed too much; reportedly, by 2,200 lb (1,000 kg) . In response, Lockheed Martin added engine thrust and thinned airframe members, reduced the size of the common weapons bay and vertical stabilizers, rerouted some thrust from

the roll-post outlets to the main nozzle, and redesigned the wing-mate joint, portions of the electrical system, and the portion of the aircraft immediately behind the cockpit.
F-35 isn't just the most survivable combat aircraft ever built, it is also the most versatile. It's onboard sensors can collect and share intelligence from diverse sources across the spectrum. Its jamming system and air-to-air munitions make it a superior escort for less survivable aircraft

F-35's advanced sensor fusion creates a single integrated picture of the battlefield that greatly enhances awareness, survivability and lethality.

2. The way to reduce RCS

- Tilting the vertical stabilizer or remove stabilizer
- Using "S" inlet duct or fine mesh screen to shield the fan
- Using rectangle/slit jet exhaust
- Applying iridium tin oxide coating on canopy
- Frequency Selective Surfaces (FSS)
- Hiding missiles into internal weapon bays
- Mounting conformal antenna
- Replacing conventional air intake by DSI air intake
- Tilting both sides of fuselage

Reduce reflection caused by creeping wave in the skin
-----Swept back/forward leading edge/trailing edge
-----Saw tooth on the edge of openings and doors
-----Limit reflection waves into a few direction
------Try to make all leading edge and trailing edge parallel to each other

------ Applying radar-absorbent material on the aircraft（Iron ball paint . Etc.)

Answer to the question no:2

Engine
It uses Pratt & Whitney F135 is an afterburning turbofan developed for the Lockheed Martin F-35 Lightning II. F-35 Joint Strike Fighter is a single-engine jet fighter designed for both air-to-air and air-to-ground combat. The F-35's engine, the F135 afterburning turbofan, produces 28,000 pounds of thrust, or 43,000 pounds of thrust with afterburn gle-engine strike fighter.

Low-bypass-ratio turbofans are more fuel efficient than the basic turbojet. A turbofan generates more thrust for nearly an equal amount of fuel used by the core because the fuel flow rate is changed by slightly when adding the fan. As a result, the turbofan offers high fuel efficiency.

Turbofans differ from turbojets in that they have an additional fan at the front of the engine, which accelerates air in a duct bypassing the core gas turbine engine. Turbofans are usually more efficient than turbojets at subsonic speeds. Low-bypass turbofans have bypass ratio of around 2:1 or less.

LEX

No.It don't have LEX.

LEX = Leading Edge Vortices, AOA> 30^0(angle of attack)

Without LEX AOA ≤ 1.8 .

With LEX angle of attack is 30^0 or more. But without LEX it is less than 1.8.

INLET

DSI inlet. Because no diverter, no bleeding, low RCS. It form a Y-duct for the engine.

Vertical Tail

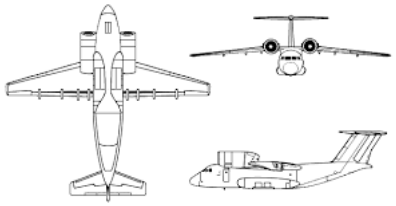
The F-35 has a wing-tail configuration with two vertical stabilizers canted for stealth.. It has a fixed wing section whose work is to provide stability for the aircraft to keep it flying straight. It prevents up and down, pitching motion of aircraft nose.

Aircraft 3:

This An-74. In this report, you will:

1. Investigate the performance and design features of An-74.
2. Answer the following questions using the knowledge learnt from this course:

- Where are its engines? Why do the engineers put engines there?
- Where is its main gear? Why do the engineers put the main gears there?



- What type of engine does it use? Why does it use this type of engine?
- How can it travel at Ma0.8?
- Where are the flaps? How does flaps work?

Type your report here:

Answer to the question no:1

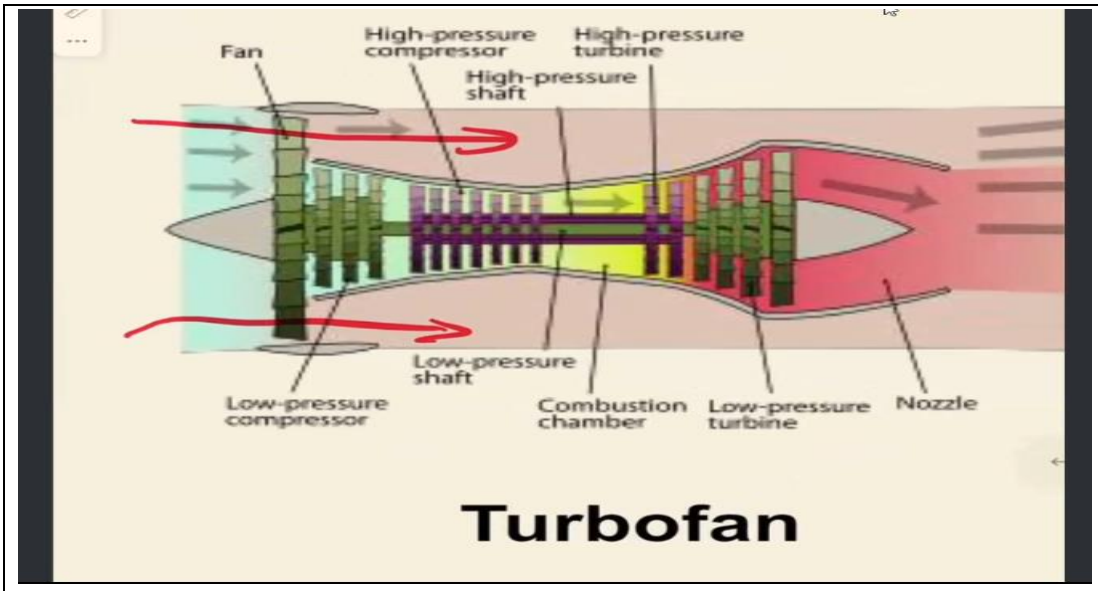
An-74 aka Cheburashka is a soviet/ukrainian transport aircraft manufactured by Antonov. There are two Lotarev D-36 turbofan engines used as a main power source and can generate 63.9 kN of thrust each which are also capable of generating reverse thrust during landing.
The engines are placed on top of the wings to boost lift which is known as Coandă effect which helps the aircraft to take off and landing in a short runway.
The landing gear can be upgradable with numerous ways like wheel-ski landing gear, de-icing equipment etc so that it can operate on arctic environment.

The maximum payload of An-74 is 7.5ton (up to 52 passengers) and it is able to reach speed 378 to 435 mph which makes it suitable for highly specialized operation.
An-74 has a wingspan of 31.89 m and it is able to reach 4,325 km in single fuel.

Ans to the question no 2:

Where are its engines?Why do the engineers put engines there?

Its Lotarev D-36 turbofan engines are put over the wings. The main reason engineers put them there is to boostlift. It blows the exhaust air on top of the wings to generate extra lift. This phenomenon is known as Coandă effect.



Where is its main gear? Why do the engineers put the main gears there?

The type of landing gear is used in An-74 is multi-bogey type and placed under the fuselage for smooth landing.

What type of engine does it use? Why does it use this type of engine?

An-74 uses two Lotarev D-36 engines. Which are turbofan engines. Engineeres used this type of engines because it reduces fuel flow and can generate reverse thrust.So overall very fuel efficient

#How can it travel at Ma0.8?

An-74 is a turbofan engine we can see from the figure .Most of the air won't enter the engine.

*M=u/c

where:

M is the local Mach number,
u is the local flow velocity with respect to the boundaries (either internal, such as an object immersed in the flow, or external, like a channel), and
c is the speed of sound in the medium, which in air varies with the square root of the thermodynamic temperature.

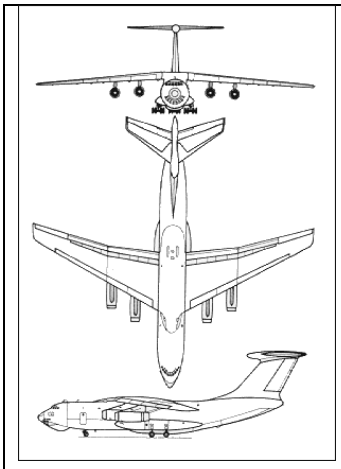
It's subsonic so it can go Ma0.8

Most often propeller-driven and commercial turbofan aircraft with high aspect-ratio (slender) wings, and rounded features like the nose and leading edges.

Where are the flaps? How does flaps work?

Flaps are usually located behind the wings. During the take off and landing high lift is needed. Flaps work by increasing the area and chamber of the wings.Flaps can increase maximum speed, delay the onset stall and increase drag.

Aircraft 4:



This IL-76. In this report, you will:

1. Investigate the performance and design features of IL-76.
2. Answer the following questions using the knowledge learnt from this course:

- Why is there an anhedral angle on the wing?
- What is the type of its wing? Why does it use this type of wing?
- Where is the center of gravity? How to maintain the static longitudinal stability of this aircraft?
- Please state the benefits to put the engine below and in front of the pylon.
- In the lower figure, what is the name of that device? What is it used for?

Type your report here: