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**Aircraft 1:**

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|  | This F-15 Eagle. In this report, you will:   1. Investigate the performance and design features of F-15. 2. Answer the following questions using the knowledge learnt from this course:  * What type of engine does it use? Why does not it use turbojet engine? * How it can achieve a maximum speed of Ma 2.5? * What kind of landing gear does it use? Why does it use this type of landing gear? * Why there is a dog tooth at the leading edge of its horizontal tail? * What’s the device on the back of the aircraft (In the red circle)? What is it used for? |
| Type your report here:  **Ans to the question no: 1**  The McDonnell Douglas F-15 Eagle is an American twin-engine, all-weather tactical fighter aircraft designed by McDonnell Douglas (now part of Boeing). It was produced since 1972 until present with the speed of 3017 km/h, it cost F-15A/B: - US$27.9 million (1998), F-15C/D: US$29.9 million (1998). The Eagle can be armed with combinations of four different air-to-air weapons: AIM-7F/M Sparrow missiles or AIM-120 AMRAAM advanced medium-range air-to-air missiles on its lower fuselage corners, AIM-9L/M Sidewinder or AIM-120 AMRAAM missiles on two pylons under the wings, and an internal 20 mm (0.79 in) M61 Vulcan Gatling gun in the right-wing root. A variety of air-to-air weaponry can be carried by the F-15. An automated weapon system enables the pilot to release weapons effectively and safely, using the head-up display and the avionics and weapons controls located on the engine throttles or control stick. When the pilot changes from one weapon system to another, visual guidance for the selected weapon automatically appears on the head-up display.  **Ans to the question no: 2**   1. The F-15 has a spine-mounted air brake and retractable tricycle landing gear. It is powered by two Pratt & Whitney F100 axial compressor turbofan engines with afterburners, mounted side-by-side in the fuselage and fed by intake ramps. Because the turbofan engines more efficient, makes less noise, generated enough thrust, it doesn’t use jet engine because it has a low propulsive efficiency at low forward speeds, relatively high TSFC at low altitude and low airspeed and takeoff roll requires. 2. F15 can achieve 2.5 Ma because of its stream lined body and the sweep back angle of the wings and with a complement of air-to-air missiles, it means that the aircraft must be in a very high altitude and containing less fuel. 3. The F-15C uses a tricycle landing gear system, with one wheel up front under the cockpit and two wheels under the rear fuselage. The landing gear system is electrically controlled and hydraulically operated. It uses a tricycle gear because it offers better visibility on the ground. A tricycle gear allows full brake application. A tricycle gear makes loading and unloading easier because the fuselage is horizontal. A tricycle gear has less drag during the initial stage of a take-off run. 4. If you look at the horizontal tail surface of an F-15 you will also see a notch or dogtooth. which induces a vortex over the wing to control boundary layer spanwise extension, increasing lift and improving resistance to stall. 5. The device on the back of the aircraft is called the air brake, The [F-15 Eagle](https://en.wikipedia.org/wiki/F-15_Eagle), [Sukhoi Su-27](https://en.wikipedia.org/wiki/Sukhoi_Su-27" \o "Sukhoi Su-27), [F-18 Hornet](https://en.wikipedia.org/wiki/F-18) and other fighters have an air brake located just behind the [cockpit](https://en.wikipedia.org/wiki/Cockpit). In [aeronautics](https://en.wikipedia.org/wiki/Aeronautics), air brakes or speed brakes are a type of [flight control surfaces](https://en.wikipedia.org/wiki/Flight_control_surfaces) used on an [aircraft](https://en.wikipedia.org/wiki/Aircraft) to increase [drag](https://en.wikipedia.org/wiki/Drag_(physics)) or increase the angle of approach during landing. Air brakes differ from [spoilers](https://en.wikipedia.org/wiki/Spoiler_(aeronautics)) in that air brakes are designed to increase [drag](https://en.wikipedia.org/wiki/Aerodynamic_drag) while making little change to [lift](https://en.wikipedia.org/wiki/Lift_(force)), | |

Aircraft 2:

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|  | This F/A-18. In this report, you will:   1. Investigate the performance and design features of F/A-18. 2. Answer the following questions using the knowledge learnt from this course:  * What kind of air inlet does F/A-18 use? Please describe the pros and cons of this type of inlet. * What is the name of the device in red circle? * Why does the vertical tail sit between the wing and the horizontal stabilizer? * What is the benefits of putting missiles at wing tip? * Why does the wing have small leading edge swept angle as F/A-18 is a supersonic fighter? |
| Type your report here: | |

Aircraft 3:

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|  | This Boeing-747. In this report, you will:   1. Investigate the performance and design features of Boeing 747. 2. Answer the following questions using the knowledge learnt from this course:  * What kind of air inlet does Boeing 747 use? Please describe the pros and cons of this type of inlet. * What’s the type of its landing gear? Why does it use this type of landing gear? * What is the type of its engine? Why does it use this type of engine? * What kind of airfoil it uses and why? |
| Type your report here:  **Ans to the question no: 1**  The Boeing 747 is a large [wide-body airliner](https://en.wikipedia.org/wiki/Wide-body_aircraft) and [cargo aircraft](https://en.wikipedia.org/wiki/Cargo_aircraft) manufactured by [Boeing Commercial Airplanes](https://en.wikipedia.org/wiki/Boeing_Commercial_Airplanes) in the United States. It first flight on February 9, 1969, and it’s produced since 1968 until present. The basic soundness of the design has enabled it to be improved and enlarged over time so that the current Boeing 747 can carry up to 524 passengers over distances as far as 8,400 miles. With new, fuel-efficient engines and a two-pilot digital flight deck, the 747has the lowest operating cost per seat mile of any commercial jetliner. As might be expected, the cost of the 747 has climbed over time, from original estimates of $18 million per copy to $25 million to more than $200 million today. The 747 offers a choice of improved turbofans: the Pratt & Whitney PW4000, General Electric CF6-80C2 or Rolls-Royce RB211-524G/H. The match number is 0.785 and at the speed of 583 mph.  **Ans to the question no: 2**   1. Boeing uses high bypass engine with 94inch inlet diameter.   Pros: high efficiency and produce high amount of trust.  Cons: limited speed, it’s mounted under the wing which means that the wing is mounted higher.   1. The Boeing 747 has four main landing gears, they are used to assure a safety l and stability for the aircraft during the landing, they can rotate so it helps the pilot. 2. Boeing 747 use improved high bypass turbofans: the Pratt & Whitney PW4000, General Electric CF6-80C2 or Rolls-Royce RB211-524G/H. It is efficient because it is nearly as fuel efficient as turboprops. Because the fan is enclosed by the inlet and is composed of many blades, it can operate efficiently at higher speeds than a simple propeller. 3. The airfoil that Boeing 747 uses is the supercritical airfoil. Typical airfoil sections are curved on the top and the bottom. The airflow over the top of the airfoil is accelerated. the airspeed over the top of the airfoil is more compared to the free stream velocity. The associated reduced pressure helping to create lift. The supercritical airfoils reduce the fuel required, as they allow the aircraft to cruise at higher speeds with lesser drag. 4. Boeing 747 can travel at Ma 0.8 due to the high bypass turbofan engine, because it delivers more power compared to the turbo jet engines and consuming less fuel, by increasing aspect ratio and long fuselage we can reduce the drag. The hum back is used to reduce the drag and generate more lift. | |

Aircraft 4:

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|  | This Bombardier Q400. In this report, you will:   1. Investigate the performance and design features of Q400. 2. Answer the following questions using the knowledge learnt from this course:  * What kind of engine does it use? Briefly describe the pros and cons of this type of engine. Compare it with piston engines. * Describe the features of its wing and explain why. * Where is the center of gravity? How to maintain the static longitudinal stability of this aircraft? * Where is its rudder, elevator and flap? Briefly explain how flaps works. * If this aircraft can move backwards on the runway, how can it do this? |
| **Type your report here:**  \*\*A **turboprop** engine is a [turbine engine](https://en.wikipedia.org/wiki/Turbine_engine) that drives an aircraft [propeller](https://en.wikipedia.org/wiki/Propeller_(aeronautics)).  Pros | |