Домашнее задание №6 26.10.23

text 8C:

(1) How could a man make such heavy machines fly? The power of thought of a human being is amazing. Build a model, then you'll know what the issues are and whether it is viable. If Icarus's mishap is true, the engineers have advanced a long way since then. Now we know that to make a heavy machine fly one should take into account the laws of aerodynamics. Aerodynamics from Greek (ἀήρ aero-air + δυναμική-dynamics) is the study of motion of air, particularly when affected by a solid object, such as an airplane wing. In modern times George Cayley invented the first flying machine that technically demonstrated the chambered lifting wing, stabilisers, control surfaces and identified the four forces acting on an aircraft: propulsion1(he used a horse to get into the air more quickly) countered by drag, aerodynamic lift countered by weight.(2) What modern aircraft can do is the most spectacular thing in transportation technologies. The Su-35 with vectored thrust2engines and unstable design, is probably the most maneuverable plane. The aerobatics of the Su-35 leaves the impression that the aircraft is weightless: it can stop in mid-air and descend3in circles, sailing like a leaf on the wind. There are plenty of airshow videos showing the Sukhoi do backflips and J turns and what not. It can hover, move in any direction and stop on a dime, rotate very quickly through any axis, stop and immediately reverse. Nothing we have seen really comes close to doing what it can do in terms of maneuverability.(3) The Tu-114 is a long-haul aircraft, which is made for the transport of passengers and is equipped with turboprop4engines. It was designed in the mid-1950s on the basis of the Tu-95 bomber. The Tu-114 had no equal in the world in terms of the number of passengers that could be accommodated on board and it had remained the largest passenger plane untill the early 1970s. Due to the fact that the aircraft was low-wing, the designers equipped it with a fairly high chassis, which was not found in any aircraft of this class. But this landing gear5system also brought its disadvantages to the aircraft. With the help of this plane, as many as 32 world records were set. They were obtained for the following achievements:- this was the largest turbofan aircraft at the time that was able to carry passengers on board;- it was also the fastest passenger liner in the world with this type of engine;- it had the most powerful engines in the world back in its time. At the moment, there are no operating Tu-114s left in the world. Only three non-operationalversions exist and all the

three are used as museum exhibits. During its service life, only two Tu-114s crashed. So, probably, it was also one of the safest aircraft ever.(4) Although it is the Concorde that earned a place in history, the lesser known Tu-144 beat it twice: it had its maiden flight on December 31, 1968, two months before Concorde, and then achieved its first supersonic flight in June, 1969, beating the competitor by four months. Both planes were clearly ahead of their time, as civil aviation had barely just transitioned from propsto jets. But their striking similarities have long fuelled spy stories. Although they looked alike and could fly at nearly twice the speed of sound cutting travel time in half, they were rather different planes. The Tu-144 was bigger and faster than the Concorde. Europeans managed to create a liner more suitable for the conditions of market operation. It was more economical, had a longer range and was definitely safer. The Tu-144 had been in passenger service for a year before it was withdrawn6over safety concerns, after only 55 flights. Concorde had been twenty-seven years in service and was retired three years after the crash outside Paris on July 25, 2000. So, at this moment there is no supersonic passenger plane in service. Still some companies are working on its development. Will we fly supersonic again?

1. Read text 8C from our course book (p. 39), make sure you understand and can explain all the terms and active vocabulary used in the text.

Aerodynamics: The study of the motion of air, particularly when influenced by a solid object like an airplane wing.

Vectored Thrust Engines: Engines that can direct their thrust in different directions, contributing to enhanced maneuverability.

Turboprop Engines: Gas turbine engines that drive a propeller.

Chambered Lifting Wing: A wing design that includes chambers for improved lift.

Landing Gear: The undercarriage of an aircraft, including wheels and other structures, that supports the aircraft during landing and ground operations.

Supersonic Flight: Flying at a speed greater than the speed of sound.

2. Research additional information online (not mentioned in the text) about the following aircraft:

a) The Su-35

b) The Tu-114

c) The Tu-144

and prepare 1-3 facts about each aircraft to share with your groupmates.

a) Su-35 "Flanker-E"

Fact 1 (In-Flight Refueling): The Su-35 has the capability of in-flight refueling, allowing it to extend its range and mission duration significantly.

Fact 2 (Versatile Armament): Known for its versatility, the Su-35 can carry a wide range of air-to-air and air-to-surface missiles, making it a potent multirole fighter.

Fact 3 (Electronically Steered Radar): One of its advanced features is the Irbis-E radar, which uses electronic beam scanning, providing a high level of situational awareness and target tracking.

b) Tu-114 "Cleat"

Fact 1 (Longest Propeller-Driven Flight): The Tu-114 once held the record for the longest non-stop propeller-driven flight, covering a distance of over 8,000 miles during a demonstration flight.

Fact 2 (Unique Engines): Powered by four Kuznetsov NK-12 turboprop engines, the Tu-114 had the largest turboprop engines ever fitted to a combat aircraft.

Fact 3 (VIP Configuration): Apart from its passenger role, some Tu-114s were configured for VIP transport, emphasizing its adaptability for various purposes.

c) Tu-144 "Charger"

Fact 1 (Double-Delta Wings): The Tu-144 featured distinctive double-delta wings, contributing to its supersonic capabilities and distinguishing it from other commercial aircraft of its time.

Fact 2 (Cargo Version): In addition to passenger flights, the Tu-144 had a cargo version (Tu-144S), showcasing its versatility beyond passenger transport.

Fact 3 (First Commercial SST Flight): The Tu-144 made history by performing the world's first commercial supersonic transport flight, carrying passengers from Moscow to Almaty on December 26, 1975.

3. Do ex. 18, 19.4.* (Optional, for 2,5 bonus grades) ex. 20 - provide a clear and concise explanation of how an aircraft takes off- with any visual demonstration (drawing on the board, showing images, using models, etc)- without referring to any notes while presentingPlease note that if there are multiple volunteers for exercise 20, the student will be chosen randomly.If you have any further questions, feel free to ask.

4*. Scan the text and find the following information as quickly as possible. 1. What is Leonardo da Vinci credited with? 2. When and where did Lomonosov demonstrate his model? 3. When did the first airplane make its first flight? 4. What might flying in the future be like?

1. Leonardo da Vinci is credited with designing early ancestors of the airplane based on the flight of birds.
2. Lomonosov demonstrated his model to the Russian Academy of Sciences in 1754.
3. The first airplane made its maiden flight on December 17, 1903.

4. Flying in the future might involve lace-like structures to reduce fuel costs, upward curves on the tail to reduce noise pollution, new seating zones that harvest energy, and wider entrances for hand luggage with automatic delivery to seats. The industry aims to address environmental impact, enhance efficiency, and ensure safety

18. Look at the picture and answer the questions. Then match the words with numbers 1-6 with the words with letters (a-f). Which of the forces moves the aircraft forward? Which of the forces moves it up? Which of the forces are natural and which are artificial?

1. the forward acting force

2. the downward acting force

3. the backward acting force

4. the upward acting force

5. to counter

6. propulsion

a. drag

b. to oppose

c. lift

d. weight

e. driving forward

f. thrust

The force that moves the aircraft forward is "thrust" (6). The force that moves it up is "lift" (4). The forces that are natural are "weight" (2) and "lift" (4), and the forces that are artificial are "thrust" (6) and "drag" (a). Matching them:
the forward acting force - f.

thrustthe downward acting force - d.

weightthe backward acting force - a.

dragthe upward acting force - c.

liftto counter - b. to oppositepropulsion - e. driving forward

The force moving the aircraft forward is "thrust." The force moving it up is "lift." The natural forces are "weight", while the artificial forces are "thrust".

Match: 1 - e (driving forward), 2 - d (weight), 3 - f (thrust), 4 - c (lift), 5 - b (to oppose), 6 - a (drag).

19. Complete the sentences with the words below.
    1. Thrust is the force that moves an aircraft in the direction of the motion.
    2. Drag is the force that acts opposite to the direction of motion.
    3. Weight is the force caused by gravity.
    4. Lift is the force that holds an airplane.
    5. If thrust is greater than drag, the plane moves forward.
    6. If drag is greater than thrust, the plane moves backwards.
    7. If lift is greater than weight, the plane moves upwards.
    8. If weight is greater than lift, the plane stays on the ground and can’t fly.
    9. During the flight, the weight is countered by both lift and drag.
    10. To overcome drag, airplanes use a propulsion system to generate thrust.

20. Use the phrases to write about how an aircraft takes off. Thrust pushes, accelerates engine, propulsion system... created by engine, by increasing propulsion system, thrust counters, drag reduces, friction between aircraft, lift pushes …up against, gravity reduces, weight pulls…to, if lift is greater than … the plane moves, special design of the wing

Aircraft take off as engines create thrust, accelerating the propulsion system. This counters drag, reducing friction with the ground. Wing design generates lift, overcoming gravity, and once lift exceeds weight, the plane smoothly ascends.