Passage 10

The planemakers

There are two main things that make aircraft engineering difficult: the need to make every component as reliable as possible and the need to build everything as light as possible. The fact that an aeroplane is up in the air and cannot stop if anything goes wrong, makes it perhaps a matter of life or death that its performance is absolutely dependable.

Given a certain power of engine, and consequently a certain fuel consumption, there is a practical limit to the total weight of aircraft that can be made to fly. Out of that weight as much as possible is wanted for fuel, radio navigational instruments, passenger seats, or freight room, and, of course, the passengers or freight themselves. So the structure of the aircraft has to be as small and light as safety and efficiency will allow. The designer must calculate the normal load that each part will bear. This specialist is called the 'stress man'. He takes account of any unusual stress that may be put on the part as a precaution against errors in manufacture, accidental damage, etc.

The stress man's calculations go to the designer of the part, and he must make it as strong as the stress man says is necessary. One or two samples are always tested to prove that they are as strong as the designer intended. Each separate part is tested, then a whole assembly - for example, a complete wing, and finally the whole aeroplane. When a new type of aeroplane is being made, normally only one of the first three made will be flown. Two will be destroyed on the ground in structural tests. The third one will be tested in the air.

Two kinds of ground strength tests are carried out. The first is to find the resistance to loading of the wings, tail, etc. until they reach their maximum load and collapse. The other test is for fatigue strength. Relatively small loads are applied thousands of times. Each may be well under what the structure could stand as a single load, but many repetitions can result in collapse. One form of this test is done on the passenger cabin. It is filled with air at high pressure as for high-altitude flying and completely submerged in a large tank of water while the test is going on. The surrounding water prevents the cabin from bursting like a bomb if there is a failure.

When a plane has passed all the tests it can get a government certificate of airworthiness, without which it is illegal to fly, except for test flying.

Making the working parts reliable is as difficult as making the structure strong enough. The flying controls, the electrical equipment, the fire precautions, etc. must not only be light in weight, but must work both at high altitudes where the temperature may be below freezing point and in the hot air of an airfield in the tropics.

To solve all these problems the aircraft industry has a large number of research workers, with elaborate laboratories and test houses, and new materials to give the best strength in relation to weight are constantly being tested. 40

Ideas

Select the answer which is most accurate according to the information given in the passage.

1 The two main requirements of aircraft design are
a) speed and cheapness.
b) reliability and passenger comfort.
c) making things both light and dependable.
d) ability to stay up in the air and avoid breakdowns.

2 The maximum possible weight of an aircraft is determined by
a) the engine power.
b) the amount of freight room.
c) the number of passengers.
d) international regulations.

3 The stress man's job is to calculate
a) how safe the plane is.
b) how strong each part must be.
c) what height the plane will fly at.
d) the amount of luggage each passenger may carry.

4 The first three aeroplanes of a new type
a) are all destroyed.
b) do not fly.
c) are later broken up for spare parts.
d) are used for testing purposes.

5 The passenger cabin test in water is designed to
a) make sure the plane would be safe if it landed in water.
b) test fatigue strength.
c) see if the cabin will burst like a bomb.
d) keep the cabin cool

6 All equipment in an aircraft must
a) work especially well at high temperatures.
b) be tested to destruction.
c) not be too light in weight.
d) work perfectly within a wide range of temperatures.

7 Certificates of airworthiness are issued by
a) the aircraft industry.
b) research workers.
c) stress men.
d) governments.

8 Research workers
a) are employed in large numbers by the aircraft industry.
b) seldom find solutions to practical problems.
c) also test houses.
d) do not need elaborate laboratories.

9 New materials are
a) too expensive to use in aircraft.
b) avoided if possible.
c) put to a variety of tests.
d) tested at a constant temperature.

10 Except for experimental flights, no new aircraft leaves the ground
a) after being completely tested for safety.
b) without having a stress man on board.
c) until it has been thoroughly tested and approved.
d) unless flown by a government official.

Vocabulary

Find the following words in the passage and select the meaning you think is *most likely* to correspond among the choices given.

1 *component* (line 2)
a) complete
b) employee
c) part
d) engineer

2 *performance* (line 5)
a) show
b) operation
c) appearance
d) demonstration

3 *navigational* (line 9)
a) steering
b) navy
c) shipping
d) recreational

4 *freight* (line 10)
a) cargo
b) fear
c) free
d) cooking

5 *efficiency* (line 11)
a) regular servicing
b) adequate precautions
c) effective operation
d) speed

6 *precaution* (line 14)
a) warning bell
b) safety measure
c) complaint
d) protest

7 *fatigue strength* (line 26)
a) inability to resist tiredness
b) strong feeling of tiredness
c) prolonged resistance to weakening
d) tendency to become weary

8 *relatively* (line 27)
a) comparatively
b) connectedly
c) excessively
d) connected

9 *submerged* (line 31)
a) overburdened
b) suppressed
c) put below the surface
d) raised

10 *elaborate* (line 41)
a) expensively jewelled
b) difficult
c) complicated
d) decorated

Similar or different?

Say whether or not the statement is similar in meaning to the sentence from the passage indicated by the line number in brackets.

1 An aircraft has to operate as perfectly as possible because people might die if anything went wrong while it was in flight. (lines 3–5)
2 The total possible weight of an aircraft depends on the power of the engine and the amount of fuel it requires. (lines 6–8)
3 Two tests are made on the strength of the ground. (line 24)
4 Repeating the loading many times may cause a part to break up even though each single load is within the limits of safety. (lines 27–29)
5 Making the structure strong enough is no less difficult than making the working parts dependable. (lines 35–36)
6 It is not an essential for the controls, the equipment, the safety measures to be light-weight, but they must work efficiently within a wide range of temperatures. (lines 36–39)