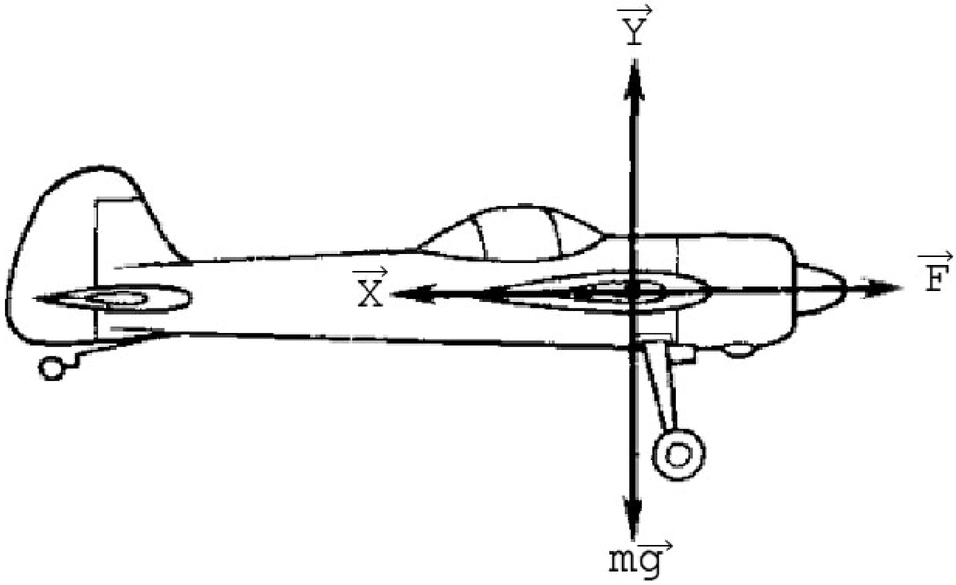
What will happen to the speed of aircraft if the mass of the same reduces during the flight but the engine force remains the same?

Solution.



From the theory aerodynamics of the flight: an aircraft flies horizontally, when:

$$Y = mg;$$
$$X = F.$$

in these equations:

Y – the force of the lift;

mg – a weight of the aircraft;

F – the force of the thrust;

X – a force of the drag is opposed to the thrust.

$$Y = C_L \frac{\rho v^2}{2} S;$$
$$X = C_D \frac{\rho v^2}{2} S;$$

in these formulas:

C_L - lift coefficient;

C_D - drag coefficient;

S - a wings area;

v – a speed of the aircraft;

ρ - a density of the air.

We have:

$$m_1 g = C_L \frac{\rho_1 v_1^2}{2} S;$$
$$F = C_D \frac{\rho_1 v_1^2}{2} S;$$

If the mass of the aircraft reduces $m_2 < m_1$, then:

$m_2 g < C_L \frac{\rho_1 v_1^2}{2} S$ – an aircraft climbs up, where the density of the air is less $\rho_2 < \rho_1$ (if altitude increases then the air density decreases) and $m_2 g = C_L \frac{\rho_2 v_1^2}{2} S$.

The engine force remains the same, but $\rho_2 < \rho_1$, then the speed of aircraft increases $v_2 > v_1$ until a force of the drag is equal the force of the thrust $F = C_D \frac{\rho_2 v_2^2}{2} S$.
The altitude changes until:

$$m_2 g = C_L \frac{\rho_2 v_2^2}{2} S$$

and

$$F = C_D \frac{\rho_2 v_2^2}{2} S.$$

Therefore, if the mass of the aircraft reduces during the flight but the engine force remains the same, the speed of the aircraft increases.

Answer: if the mass of the aircraft reduces during the flight but the engine force remains the same, the speed of the aircraft increases.