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MODERN RESEARCH ON RAMJET JET ENGINES

Consider a system: a narrow tube attached to the body of a flying airplane. Air flows through this tube without changing its velocity. Inside the tube the air heats up, changes its density and accelerates to maintain equal pressure. With this setup, the force of the outgoing air does not pressurize the engine structure and the efficiency is 0 because as the air heats up, it tends to expand in all directions, including against the incoming air. As a result, we get increased pressure upstream of the heating elements throughout the air intake. This means that only a portion of the incoming air can enter the air intake and the rest will tend to leave the engine case. As a result, the engine is repelled by the incoming air and neutralizes the jetting effect.

Consider the reason why high speeds are necessary for engine operation using an idealized gas cycle. First the air enters at normal pressure, then it is compressed without releasing heat, which increases the pressure and decreases

the volume. Next, the air increases in volume by heating, and then passes through a special nozzle, reducing pressure and increasing volume. Let's look at the graph showing pressure and volume. To be more efficient, we need a large pressure drop when the air is compressed, which allows for high velocities, ideally above the speed of sound.

For the engine to work properly, a specially shaped center housing is placed inside the air intake, which creates a gap between the center housing and the engine housing in which the air is compressed. The incoming air is then slowed down and heated due to the high pressure. A Laval nozzle is also installed at the rear to create a powerful supersonic jet and increase efficiency. Also, we need to create a sharp point in the center of the body. A Mach cone will form at this point, which will force the flow to accelerate to supersonic levels. As air flows through the intake, it will increase in pressure until it reaches a point where the flow slows down again.

Current research into turbofan engines aims to push the boundaries of innovation and technology. One major area of research is to make these engines more efficient and environmentally friendly. Another important area of research is to ensure the reliability and durability of these engines. Researchers are also looking at new ideas on how to make the engines even more powerful by combining them with electrical systems and using new fuels. Work is also being done on cybersecurity. Because of the growing number of electronics in engines, it is important to ensure that they operate safely. This is especially important for the military, where these engines are most often used.

Let's take a specific example of ongoing research. The German Center for Aeronautics and Rocket Technology (DLR) is right now studying the effectiveness of straight-through air-rocket engines. They are looking at the concept of using air-rocket engines to accelerate cargo rockets in the atmosphere, reducing launch costs. Research is also underway to develop hybrid systems combining air-rocket and rocket engines.

In this way we have figured out how a ramjet engine works. Current research in this field focuses on pushing the boundaries of efficiency, environmental friendliness, power output, and reliability. This research includes exploring alternative engine types like air-rocket engines and hybrid systems, showcasing the constant drive for innovation in the world of aircraft propulsion.