# Could Future Supersonic Aircraft Engines Be More Fuel Efficient? Proof of Concept for a Dual-Mode Supersonic Propulsion System

Shafrir, Daniel (School: Galili High School)

The majority of passenger aircraft today are powered by Turbofan engines, renowned for their quiet and efficient operation at subsonic speeds. The Turbofan engine is, however, unable to exceed the speed of sound (~750 MPH). The Concorde - the last commercial supersonic plane, used a Turbojet engine, which operates efficiently around Mach 2 but is wildly inefficient below the speed of sound. The objective of my project is to design a proof of concept for a hybrid jet engine that combines the operation modes of the Turbojet and Turbofan engines, enabling reduced fuel consumption for future commercial supersonic aircraft. The project involved designing the new engine's structure using CAD software. Computational Fluid Dynamics (CFD) simulations were used for an optimization process. This process aimed to minimize the drag force exerted on the engine while maintaining appropriate pressure and temperature values for the air entering the engine's core. The variables mentioned were incorporated into a performance model, calculating the engine's fuel efficiency (TSFC values) at varying altitudes and speeds. MATLAB's work environment was used to simulate some of the Concorde's flight paths. The fuel consumption for each flight path was calculated and compared with the use of a standard Turbojet engine. The calculation results indicate a 7%-19% reduction in fuel consumption when using the new engine. My research demonstrates the economic viability of the concept as a cost-effective alternative for companies developing supersonic passenger aircraft. To the extent analyzed, it also confirms the technical feasibility of such an engine.

**Awards Won:**