CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Calvin Le; Dylan Zhang

Project Number
J0213

Project Title
Volcanic Particle's Effect on Airplane Engines: Ash vs. Engine

Abstract

Objectives/Goals
Our goal is to see how much volcanic ash is needed to stall an airplane engine and which engine is most vulnerable. Our Hypothesis: The fighter jet will take an average of 10 tablespoons to break down, the commercial jet will take 18 tablespoons, and the propeller plane will take 25 tablespoons.

Methods/Materials
blow-dryers with protection: commercial jet engine; blow-dryers without protection: military jet engine; 1 RC propeller engine: propeller plane; 1 Fan capable of turning to High; 1 stable platform; Tape; Sand; Tube to regulate air particle input (for jet engine); Cardboard to block particles.

We simulated what would happen if three different types of airplane engines flew through a volcanic ash cloud: a commercial jet engine, a fighter jet, and a propeller plane. We used hair dryers for the jet planes (with some protection for the commercial jet, to simulate the brush seal, and no protection on the fighter jet) and an RC propeller engine for the propeller plane. We collected data by blowing 1 tablespoon at a time of sand, simulating the ash in the air, flying at the engine. We made the amount flying in as accurate as possible by funneling the particles towards the intake area. Once the engine stopped working, we analyzed how many tablespoons were used and averaged the results. We wore safety gear all the while.

Results
The fighter jet used 13 tablespoons to become stalled. The commercial jet: 55 tablespoons. The propeller plane: 37 tablespoons to stall. We also had high speed tests where we threw the particles into the engine. This was inaccurate; the particles missed.

Conclusions/Discussion
Our tests showed that the jet is the most vulnerable and the propeller is the least. The intake of air, in engines like the jet airplane, makes the engine prone to damage because particles are pulled in and pass through. Less protection of the engine also contributes to the factor of more danger to the engine. Blowing air like the propeller reduces the amount of particles able to pass through. The speed of particles also affects the amount of damage done to the engine. The faster the particles, the more damage that is done; there are more particles passing through in a certain amount of time. Larger, heavier particles do more damage than smaller particles; they can make a larger impact and are heavy enough to pass through the engine.

Summary Statement
Our project is to test how volcanic ash affects airplane engines and which airplane engine is the most vulnerable.

Help Received
mother helped srite report; Calvin's dad helped build simulation