Process of Developing the Artificial Snow Machine System

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Introduction:

An artificial snow machine was developed to test a variety of deicing and anti-icing fluids in a laboratory environment. These fluids are required to be certified before being used. Winter weather accumulation can effect critical areas on aircraft surfaces that prevent proper airflow and these fluids are used to prevent their buildup, allowing for safe aircraft operations in these conditions. The NCAR snow machine allows the opportunity to research the factors that influence the failure of deicing and anti-icing fluids and allows the researcher to control all the variables related to fluid failure (i.e. wind, temperature, precipitation rate, etc.) in a more comprehensive way. Therefore, it is important to create a machine that can be used to test anti-icing fluids all year long under controlled conditions.

Methodology:

- The design process started with measuring and cutting long aluminum struts using the horizontal band saw for structural framing
- In Figure 6, the top frame of the snow machine was measured and cut at 45 degree angles to eliminate overlapping of metals for a smoother & flatter surface
- For each aluminum strut the midpoints were measured, marked and drilled with the bench drill press before attachment for maximum support
- After all the midpoints were drilled, 2-inch C-clamps were used to make a standing model of the framework to join the corners of the struts using bolts
- Polycarbonate sheets (Plexiglas) were measured and fitted to the sides of the machine using quarter-inch screws with the tapping method to prevent any air currents outside the machine from interfering with the snowfall patterns inside the machine (Figure 7 -8)
- Wheels were bolted on the ends of the bottom surface of the snow machine for easy transport (Figure 9)

Documentation:

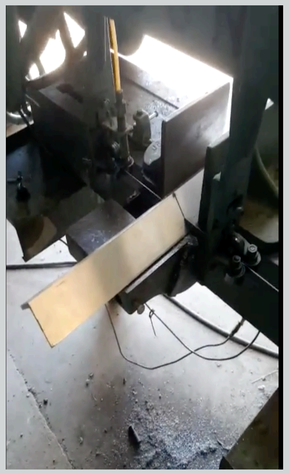

Figure 1: This is a horizontal band saw used to cut the aluminum struts

Figure 2: Drill press used to make holes on the marked midpoints of the struts

Figure 3: The standing model of the snow machine before being bolted together

Figure 4: Completed standing model, where each clamp represents the point at which each strut will be bolted

Figure 5: Each midpoint was bolted with a quarter inch bolt using a socket wrench

Figure 6: Top view of the snow machine that depicts the 45 degree angle cuts

Figure 7: Plexiglas used to make the sides of the snow machine

Figure 8: The four metal plates provide support to keep the Plexiglas from moving inward and possibly breaking

Figure 9: Wheels on the bottom are used for easier transport of the system by tipping the system onto the wheels and moving it around and the holes drilled between them will be used for bolting a support plate for the Plexiglas to stay intact

Figure 10:The completed snow machine frame without the doors

Results and Future work:

- The snow machine will be used to test anti-icing fluids under controlled conditions in a cold-chamber
- A prior-developed machine is known for accurately replicating natural snowfall compared to outdoor rates
- There are additional testing and software/mechanical developments that are ongoing to improve the performance of the snow machine
- The new machine is expected to help determine the effects of wind on anti-icing fluid failure times

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