Engineering Brief # 31

Date: April 22, 1983

Subject: INFORMATION: Engineering Brief No. 31, Test of
Turbojet Powered Airport Ice Removal Equipment

From: Manager, Design and Operations Criteria Division, AAS-100
To: All Regions

Attn: Chief, Airports Division

Vipond: x63061

The purpose of this type of engineering brief is to keep FAA field offices informed of snow and ice control techniques which have bee evaluated, but which are not necessarily known to field offices or ADOs. The information contained in this brief is not necessarily to be construed as general approval tv the Office of Airport standards.

Any comments you care to make concerning this brief will be appreciated.

Enclosure

Vipond/AAS-120/63061/4/11/83/mrg
cc: AAS-100
AAS-120
ARP-llb
No Control
CPT (Vipond Disk)

ENGINEERING BRIEF NO. 31

TEST OF TURBOJET POWERED
AIRPORT ICE REMOVAL EQUIPMENT
AT MID-STATE AIRPORT, PHILLIPSBURG, PA.

On March 15-16, 1983, a test was held at Mid-State Airport to determine the potential of turbojet powered equipment to remove ice from airport pavements.

Summary of Results:

Under the test conditions, the equipment demonstrated it's ability to remove clear, bonded ice from an asphalt pavement and leave a dry, ice-free surface. The ice-free swath varied from 8 to 10 feet with vehicle speed of approximately 2 mph.

Discussion:

Two different models of turbojet powered equipment supplied by the Coverick Corporation of Transfer, Pennsylvania were inspected at the Mid-State Airport. The two different models were model

T52, powered by a rebuilt surplus J52 jet engine and model T57, powered by a rebuilt surplus J57 jet engine. More complete specifications are contained in Attachments 1 and 2. The J52 powered model was inspected at Dulles Airport in August of 1982. Various improvements had been made to the equipment since that inspection, including the addition of remote electric throttle controls that eliminate fuel lines in the operators cab, a simplified starting system, and improved operational malfunction warning systems. After an equipment engineering and construction inspection, an area of asphalt pavement 300 feet x 500 feet was flooded with a hose on the evening of March 15. At approximately 5:30 a.m. on March 16, with weather at the Mid-State Flight Service Station (FSS) of: clear sky, 22 degrees F air temperature, and wind calm the flooded area was completely covered with l/8" to l/4" of clear ice. The ice was tested with a sharp instrument at 10 to 15 locations and found to be securely bonded to the pavement. The ice could not be separated from the pavement surface by chopping or scraping, i.e. after chopping/scraping, some ice would still remain on the pavement surface.

A total of three tests were run:

Test (1) - The J52 vehicle was run across the ice patch at approximately 2 mph. Within a swath of approximately 10 feet, about 50 percent of the ice was removed, with the rest remaining bonded to the pavement. The ice that was removed was blown several hundred feet in front of the equipment and did not fall back into the partially cleared swath. When the test was completed, it was observed that the nozzle had not been fully depressed towards the pavement. Neither the operator or the observers had discovered this until the test was over. It was decided that the test would be re-run with a fully deflected nozzle.

Test (2) - The larger J57 vehicle was run next across another portion of the ice patch at approximately 1 mph. This vehicle removed approximately 60 percent of all ice within a swath width of about 10 feet. As before, all loose ice was blown far from the machine and did not accumulate on or near the swath. During the test the nozzle seemed to be too distant from the pavement to be completely effective. However, on this model the nozzle could not be depressed closer to the pavement because of design constraints.

Test (3) - The J52 vehicle was run again over an undisturbed portion of the ice patch. This time the nozzle was dropped to its lower stop limit by the operator. During this test, the vehicle removed 100 percent of all ice in the approximately 10 foot swath width, and left the pavement dry and clear. The improvement in ice cleaning action was apparently due to the lower nozzle position in this test and to the operator heating and melting the ice to form a small pool of water prior to starting the run. The speed of this run was approximately 2 mph.

No damage to the asphalt, crack repair material or painted lines

was observed.

Attached are several photographs (Figures 1 through 4) of both vehicles tested, showing the general layout and characteristics of each.

Conclusions:

The equipment, Model T52, as demonstrated under the test conditions proved capable of completely removing tightly bonded clear ice from airport asphalt pavement within a swath width of approximately 8-10 feet. The surface was left clean and dry and no pavement damage was detectable.

Author's Comments:

I recommend that this equipment incorporate a jet exhaust chute position indicator visible from within the operators cab. The equipment should also have a swath width control and possibly a directional chute for cleaning runway lights.

Based on the recent tests, video films, and discussions with observers from other airports, the equipment has the potential (in addition to removing ice) to:

(1) Clean snow from around runway edge lights.

(2) Clean snow and ice from runway in-pavement lights.

(3) Clean ice and sand from pavement grooves.

(4) Clean snow from under parked aircraft and equipment.

(5) Clean debris and FOD from pavements.

Figure 1. Left Side of Model T57

Figure 2. Right Side Model T57

Figure 3. Left Side of Model T52

Figure 4. Right Side of Model T52

ATTACHMENT 1

MODEL T 52

ICE AND SNOW BLOWER

TRUCK CHASSIS MODEL:	Ford C 7000
GVW:	26,500 lbs.

Wheel Base: 153 inches
Axle Front: 9,000 lbs.
Full Power Steering
Axle Rear: 17,500 lbs.
Springs:
Front: 4,500 lbs.
Rear: 11,100 lbs.
Brakes: Full Air
Front 15 X 3 1/2 inches
Rear 16 1/2 X 7 inches
Maxi II Spring Set Parking Brake
Engine: Caterpillar 3208
175 horse power
Transmission: Allison Four Speed Automatic
Tires: 10:00 X 20 12 ply rating Tube Type
Wheels: Cast Spoke
Frame: D 18.0 50,000 w/inverted "L" reinforcing
Cab: Custom Built - Insulated and Heat Shielded
Fuel Tank: 50 gallon Frame Mounted

TURBINE AND COMPONENTS

Turbine: Pratt & Whitney J 52
Thrust: 7,500 lbs.
PTO: Dana Remote Control
Hydraulics:
Pump: Commercial 3,000 psi 50 gpm
Starting Motor: Commercial 3,000 psi 30 gpm
Hosing: Synflex Thermoplastic
2,500 psi Working Pressure
10,000 psi Burst
Pressure Relief Valve: Commercial Adjustable Set @
2,500 psi
Controls: All High Pressure Controls - Remote
Oil Supply Tank: 45 gallons
Fuel:
Control: Bypass System Remote Control 250 - 300 psi working
Filters: Canflo
Inlet Side: 60 gpm 2 spin on replaceable cartridges
Pressure Side: 30 gpm 1 spin on replaceable cartridges
Tank: 1,050 gallon capacity Baffled and Vented
Over Heat Shut Down: Automatic Set @ 950 - 1,000 degrees F
Low Lube Oil Shut Down: Automatic Set @ 3 - 5 psi
Positive Ignition System
Expanding Exhaust Blast Nozzle w/position Indicator
Exhaust Ducting: All 300 Series Stainless Steel

ATTACHMENT 2

MODEL TJ 57

ICE AND SNOW BLOWER

TRUCK CHASSIS MODEL: Ford C 8000
GVW: 34,000 lbs.

Wheel Base: 175 inches
Axle Front: 12,000 lbs.
Full Power Steering
Axle Rear: 23,000 lbs.
Brakes: Full Air
Front 15 X 3 1/2 inches
Rear 16 1/2 X 7 inches
Maxi II Spring Set Parking Brake
Engine: Caterpillar 3208
210 horse power
Transmission: Allison Four Speed Automatic
Tires: 10:00 X 20 12 ply rating Tube Type
Wheels: Cast Spoke
Frame: Double Channel Riveted Assembly
Cab: Custom Built - Insulated and Heat Shielded
Fuel Tank: 50 gallon Frame Mounted

TURBINE AND COMPONENTS

Turbine: Pratt & Whitney J 57
Thrust: 10,000 lbs.
PTO: Dana Remote Control
Hydraulics:
Pump: Commercial 3,000 psi 50 gpm
Starting Motor: Commercial 3,000 psi 30 gpm
Hosing: Synflex Thermoplastic
2,500 psi Working Pressure
10,000 psi Burst
Pressure Relief Valve: Commercial Adjustable Set @
2,500 psi
Controls: All High Pressure Controls - Remote
Oil Supply Tank: 45 gallons
Fuel:
Control: Bypass System Remote Control 250 - 350 psi working
Filters: Canflo
Inlet Side: 60 gpm 2 spin on replaceable cartridges
Pressure Side: 30 gpm 1 spin on replaceable cartridges
Tank: 1,250 gallon capacity Baffled and Vented
Over Heat Shut Down: Automatic Set @ 950 - 1,000 degrees F
Low Lube Oil Shut Down: Automatic Set @ 3 - 5 psi
Positive Ignition System
Expanding Exhaust Blast Nozzle w/position Indicator
Exhaust Ducting: All 300 Series Stainless Steel