Background

- All of the specified oil burners are no longer commercially available.
- Industry is left with the propane burner, which can be obtained and is typically preferred due to its consistency and ease of use.
  - Propane and jet fuel flames, despite having similar measured temperatures and heat flux, are fundamentally different.
  - Propane will provide a less severe flame than a jet fuel flame, due to the transparency of the propane flame vs. the opacity of the jet fuel flame.
  - As test components approach the flame temperature, they begin to re-radiate due to the high surface temperature.
  - Heat is lost readily from the hot surface through the transparent propane flame.
  - Heat is not lost through the opaque jet fuel flame.
- Intent of regulations is to provide protection against an *engine* fire, which is a jet fuel flame, not a propane flame.
- FAA Tech Center Fire Safety Branch has been tasked by Transport Airplane Directorate to develop burner performance standards for the next-generation fire test burner for powerplant fire testing.
Update on Burner Configuration

- Cooler/ice water bath has been replaced with a small (5.1 cu. ft.) freezer filled with a 50/50 mixture of antifreeze and distilled water.
- This eliminates the need for ice/water replenishment and provides consistent cooling for both the fuel/air lines.

[Diagram showing the flow of water, fuel, and air through the system with labels for Water Pump, Cooler, Fuel Tank, Heat Exchanger, Condensate Separator, and Burner. Blue = Water Lines, Orange = Fuel Lines, Black = Air Lines]
Update on Burner Configuration

• Attempts to utilize a new stator that would eliminate ignitors/wires within burner tube were abandoned after Seat Cushion testing results showed poor correlation.

• Utilizing standardized igniter positions and wire length/positioning determined by seat cushion testing as shown on following slides
Update on Burner Configuration – Ignition Wires

- New wire length and positions minimize airflow disturbance
- Standardized wire positions to minimize variability in burner performance and data results
- Improved repeatability
Ignition Wire Positions
Igniter Positions

- Standardized igniter positions
- Gap between igniters
  - 1/8”
- Nozzle center to igniter
  - ¼”
- Nozzle face to igniter
  - 1/8”

*Diagrams shown only for igniter tip spacing*
A Roadmap to NextGen Burner Implementation for Powerplant Testing

Powerplants User Survey
Used to gain insight into current calibration/operating conditions. Additionally, requested test data will help to initially set NextGen burner settings.

Setting of NextGen Burner Parameters
Utilizing the test data obtained from Oil/Propane burner testing, NextGen burner parameters will be set. Testing will be conducted to compare NextGen with Oil/Propane burners.

Round Robin Testing
This initial round robin testing, along with the test data requested in the survey will aid in the initial setting of operating parameters of NextGen Burner.

Additional Round Robin/NextGen Testing
Additional round robin testing with more advanced components will be conducted and compared with NextGen burner performance to help refine NextGen burner settings.

Report Publication
An FAA report will be published detailing the NextGen burner settings and performance characteristics. This report will also detail testing and calibration guidelines/procedures for the NextGen burner.

Revision of AC 20-135
Once a powerplants test method utilizing the NextGen burner has been defined and standardized, a revision of AC 20-135 and other regulatory material will be able to proceed.
Current Status

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Current Status – Powerplants User Survey

• In conjunction with DGA and EASA, a detailed user survey was created and released on the Powerplants KSN website.
• This survey was aimed at providing authorities better insight as to how the various labs are operating/calibrating their burners and what parts of the test standards need clarification and/or modification.
• As part of the survey, users were asked to conduct a sample test on a 24”x24” sheet of 2024 aluminum with a nut/bolt installation.
• A total of 10 responses to the survey were received.
• 5 labs submitted a total of 12 oil burner test results.
• 5 labs submitted a total of 12 propane burner test results.
• Survey and tests results have been analyzed and results have been presented.
Powerplants User Survey – FAA Results

• NexGen burner testing conducted with two different nozzles
  • 2.0 gph Delavan, Solid-Cone
  • 2.25 gph Delavan, Solid-Cone

• Test specimen and calibration stands positioned 4 inches out from the burner cone and 1 inch up from centerline

• Results indicate that 2.25 gph nozzle at 100-110 psi with an air pressure of 40 psi produces results consistent with those obtained from survey participants.

• This will serve as our initial burner settings for all tests going further
Powerplants User Survey

Used to gain insight into current calibration/operating conditions. Additionally, requested test data will help to initially set NextGen burner settings.

Round Robin Testing

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Revision of AC 20-135

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Current Status – Round Robin Testing

• Round Robin testing to be initiated with various labs and burners (Park DPL 3400, NexGen, and Propane). Materials to be tested include:
  • Slug Calorimeter
    • Sheet of copper with thermal absorptive coating, and thermocouple(s) on back face to determine heat flux
  • 2024 Aluminum Sheet
  • Metallic Firewall (steel)
  • Polyacrylonitrile (PAN)

• Initial testing to be conducted with FAA NexGen burner under initial burner settings to ensure consistency in results prior to initiating round robin.
Current Status – Round Robin Testing

• This testing has been delayed due to a severe roof leak in the test lab which has forced us to halt testing until repairs are made (~2-3 months).

• Information will be posted on the Powerplants KSN site as soon as available to request participants.

• Additionally, at that time we will likely be holding a Task Group meeting via conference call to discuss testing in further detail.