Federal Aviation Administration

International Aircraft Materials Fire Test Working Group Meeting

Sonic Burner Cargo Liner Testing for Test Cell Airflow Study

Presented to: International Aircraft Materials Fire Test Working Group

By: Tim Salter, FAA Technical Center

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Introduction

- **Sonic Burner Cargo Test Cell Airflow Study**
  - Overview
  - Airflow study testing at FAA Technical Center
  - Round robin test cell airflow study for 2016
- **Proposed Changes to Handbook Chapter 8**
  - Easier to follow when using Sonic Burner
  - Other updates to Handbook
- **Cargo Liner Sonic Burner Instruction Video**
  - Video viewing during cargo task group

Test Cell Airflow Study

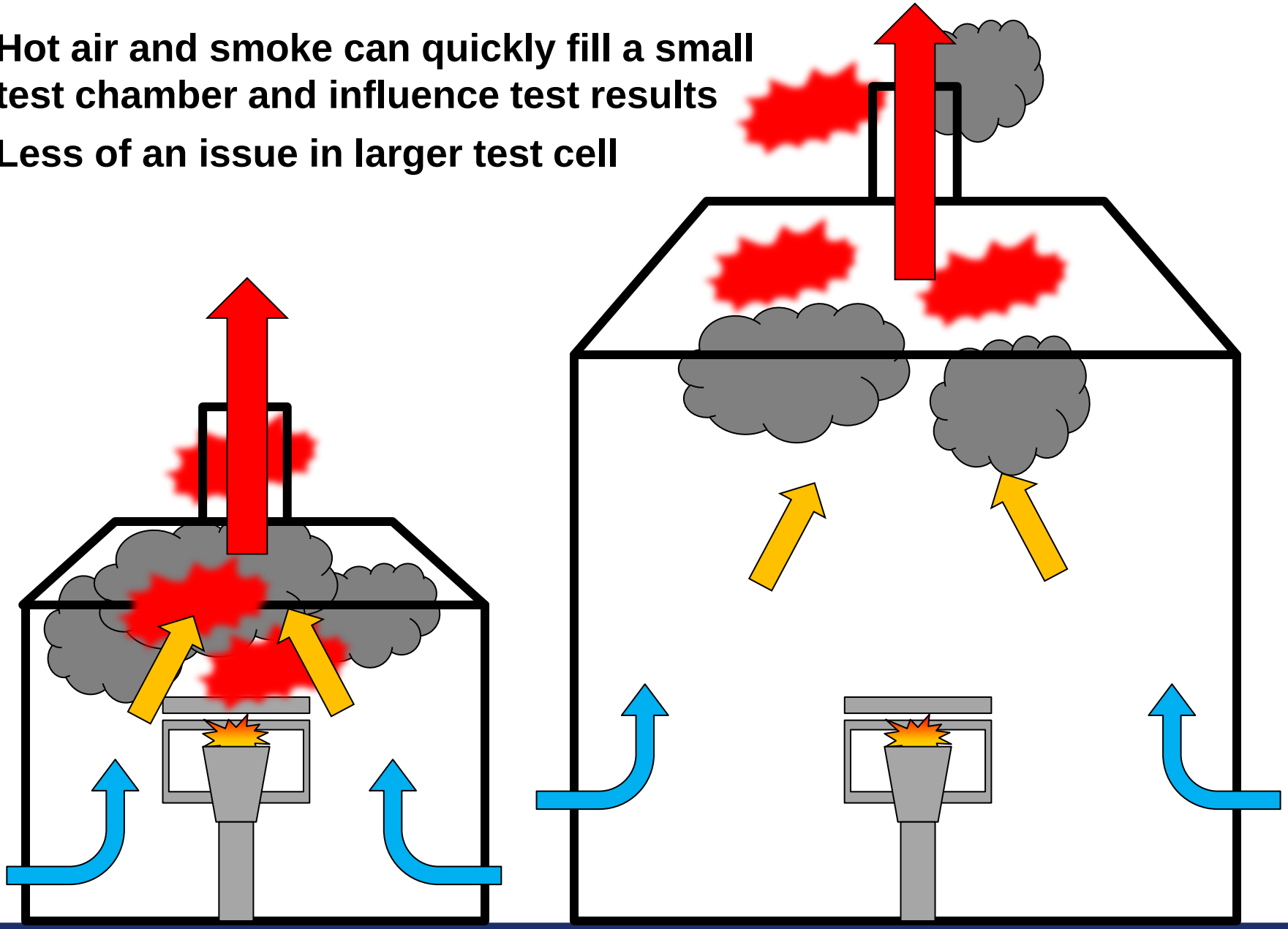
Test Cell Airflow Study

- **All Sonic Burners configured identically**
  - Sonic Burner capable of producing repeatable results *within the same test lab*
- **All test cells are unique in design**
  - The test environment can effect the test
  - Unique test cell design leads to unique test results
- **Possible Solution:**
  - Require all test labs to be constructed using a single design configuration specified by FAA
    - *Industry unlikely to accept this proposal*

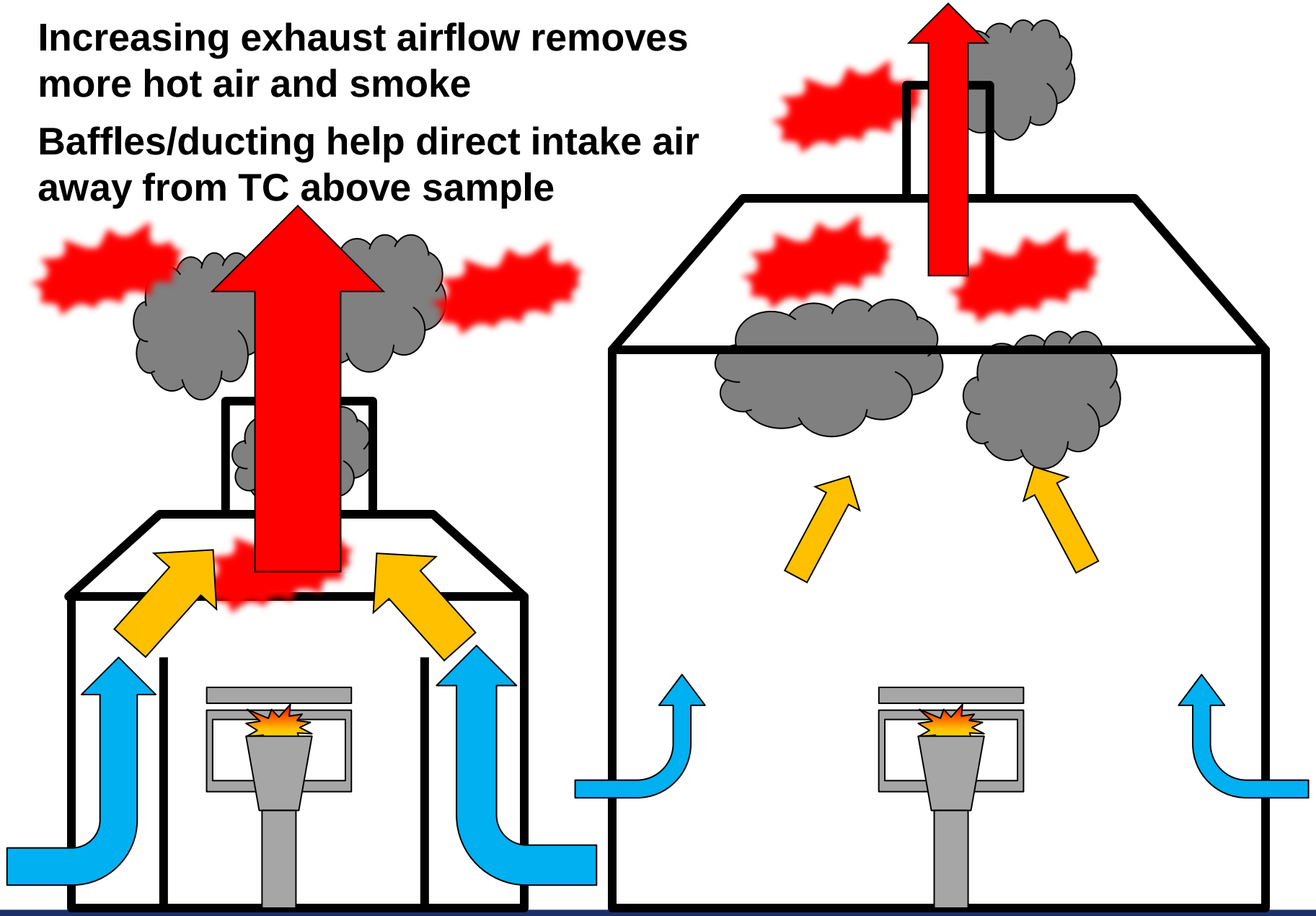
Test Cell Airflow Study

- **Small Test Cell**
  - Heat reradiated from nearby walls or partitions
  - Test cell air temperature may rise quickly
  - Cell hot before test begins (burner warmup)
  - Contributes to a more severe test condition/result
- **Large Test Cell**
  - Heat less likely to reradiate from walls/partitions
  - Hot air and combustion byproducts have more space to dissipate away from test sample
  - Less likely to influence test result

- **Hot air and smoke can quickly fill a small test chamber and influence test results**
- **Less of an issue in larger test cell**



- **Increasing exhaust airflow removes more hot air and smoke**
- **Baffles/ducting help direct intake air away from TC above sample**

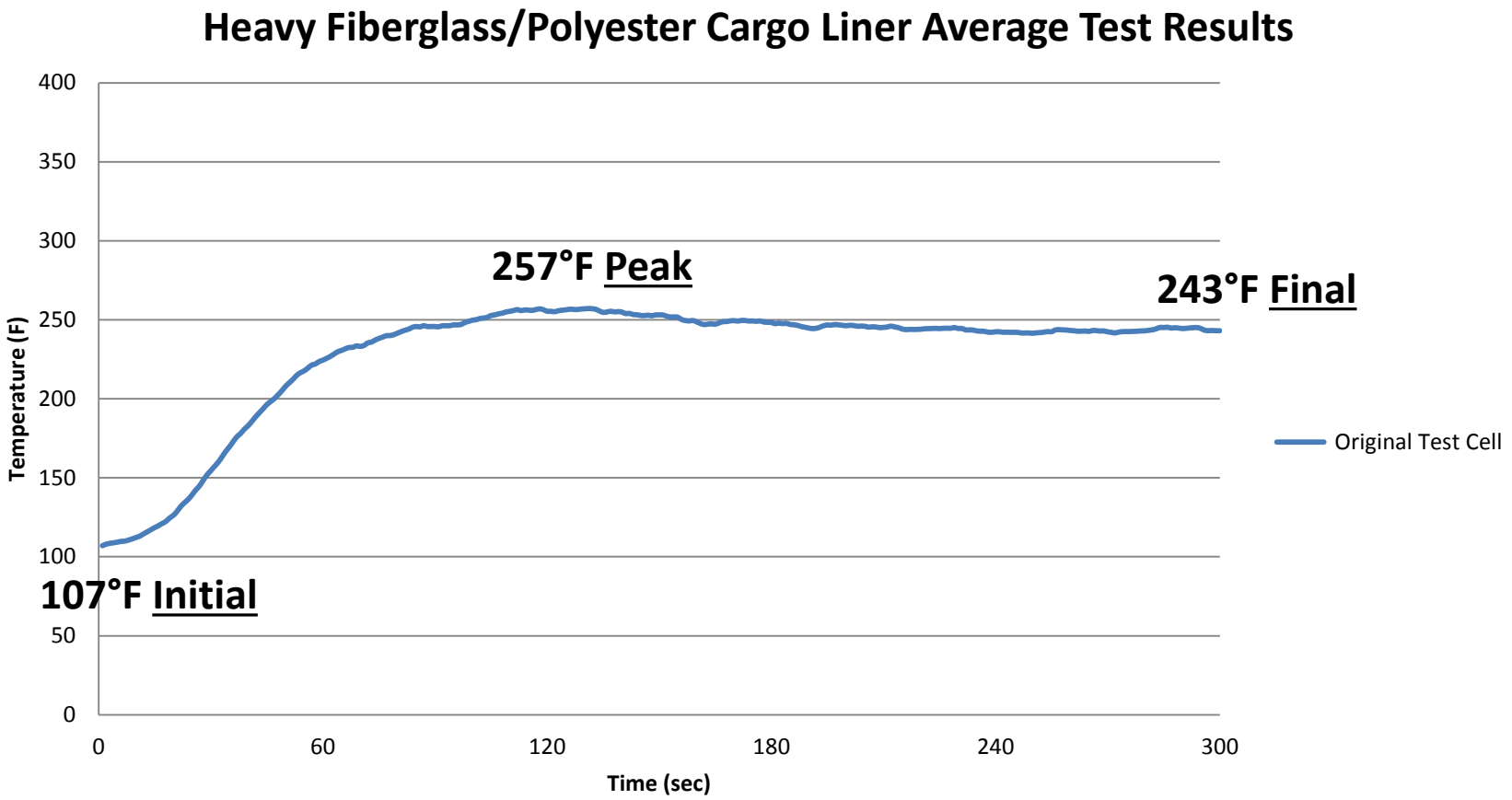


Test Cell Airflow Study

- **Initial tests run in FAA Technical Center Sonic Burner cargo liner test cell**
  - Test cell 10 x 10 ft. floor area, 10 ft. ceiling
  - Approximately 1000 cubic feet
  - Exhaust airflow rate kept to a minimum to avoid influencing TC readings (1000-1200 CFM)
  - Small cell size combined with low exhaust airflow rate resulted in considerably higher temperatures throughout test compared labs in past RR study
  - 107°F at time 0:00 in test cell (relatively high)


~1000 Cubic Feet

Test Cell Airflow Study

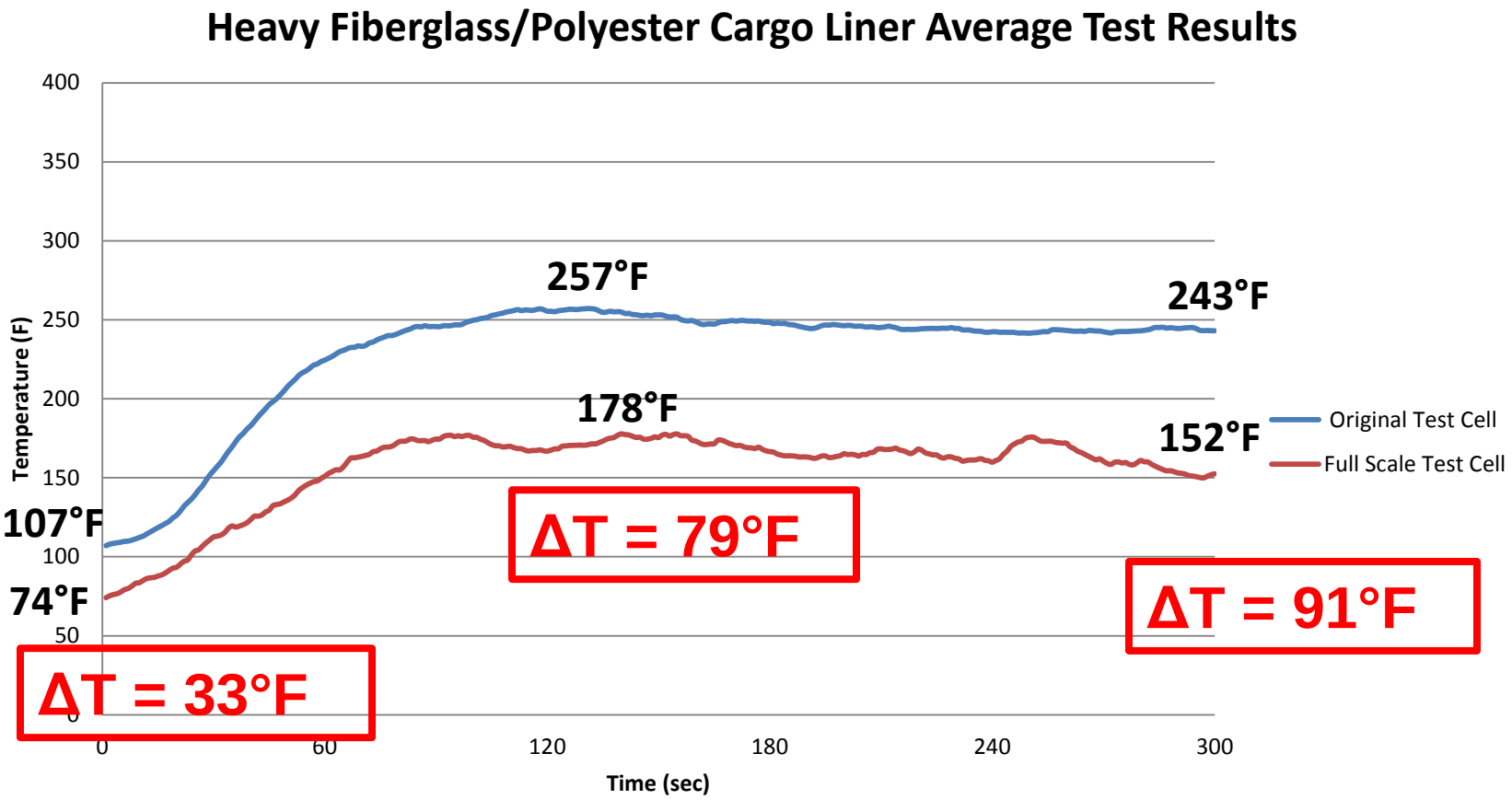


Test Cell Airflow Study

- **Test apparatus moved to Full Scale Facility**
  - Considered “infinite” space (~455,000 cubic feet)
  - Air velocity ~0 ft/min around test sample
  - Heat and combustion byproducts allowed to dissipate without the use of exhaust system
- **Significant drop in sample temperature**
  - Temperature measured 4 inches above the test sample in full scale test cell ~80°F lower after 2:00 into to test compared to small test cell results
  - 75°F at time 0:00 in full scale test cell (30°F lower)

455 times larger than cargo test cell

Test Cell Airflow Study



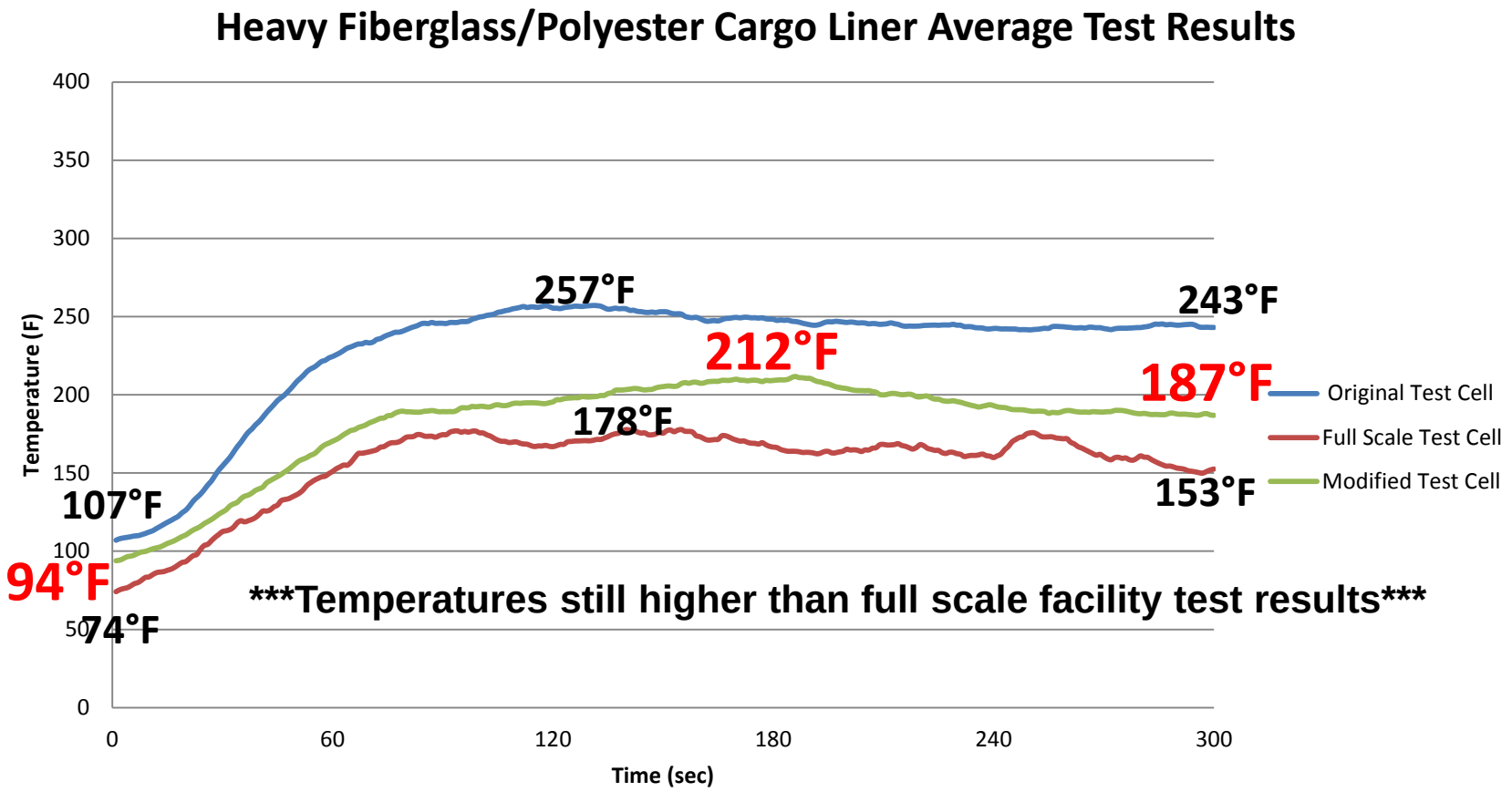
Test Cell Airflow Study

- **Apparatus returned to cargo liner test cell**
- **Test cell modified in attempt to replicate results obtained in full scale test cell**
  - Intake air vents enlarged
  - Ducting added to route intake air past sample
  - Exhaust fan speed increase
    - 814 RPM increased to 1725 RPM (2.12 X RPM)
  - Exhaust airflow doubled after modifications

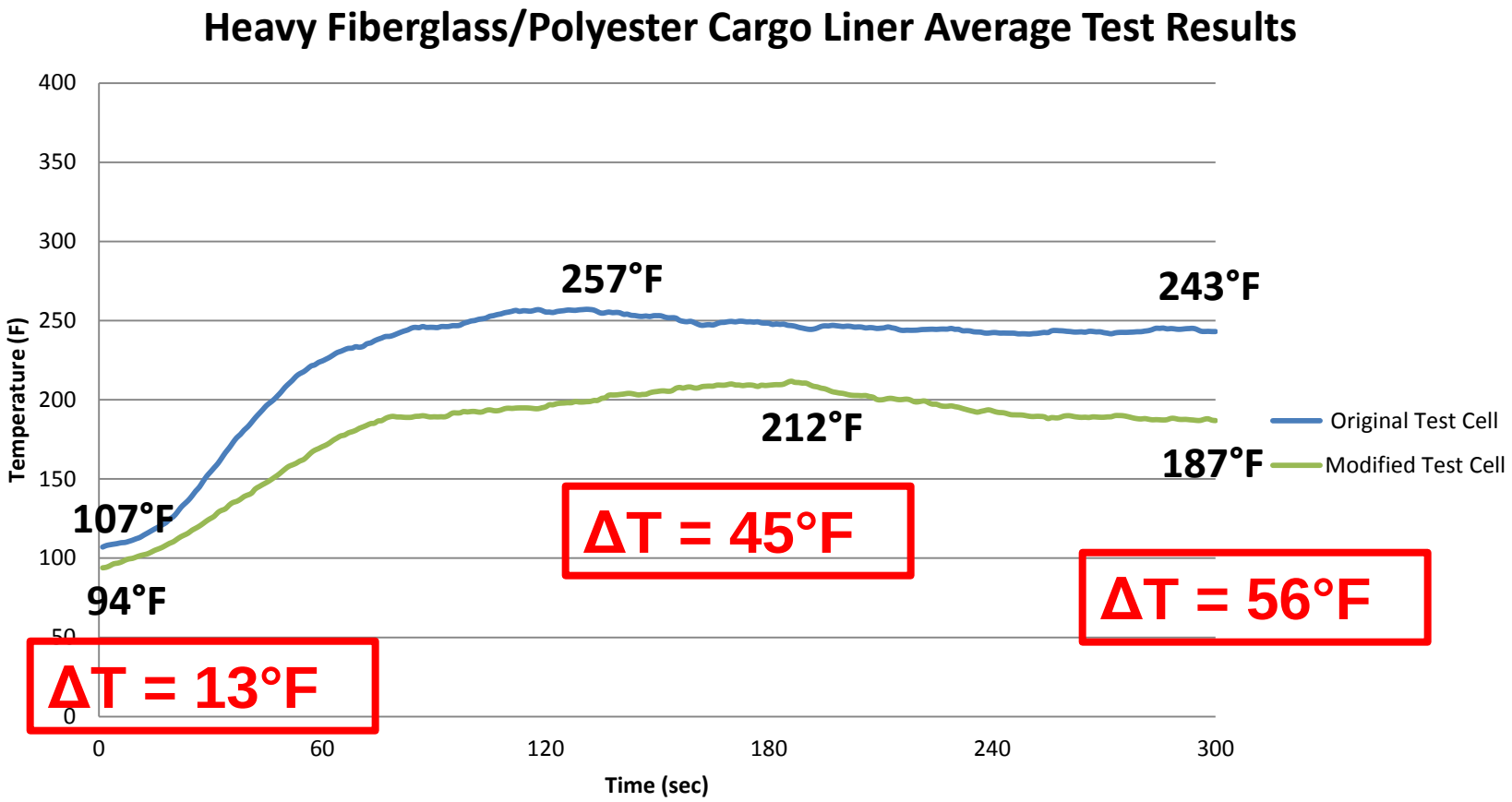
    Before: 1000-1200 CFM

    After: 2300-2500 CFM

Test Cell Airflow Study



Test Cell Airflow Study



Test Cell Airflow Study

- **Observation**
  - Increasing the exhaust airflow in the test cell reduced test result temperatures
- **Hypothesis**
  - Possible correlation between test cell size and required exhaust airflow rate to prevent overheating test cell and increasing severity of test
- **Sonic Burner Cargo Liner Round Robin**
  - Conduct interlab study to confirm

Test Cell Airflow Study

- **Seven labs participating (including FAA)**
- **Same sample materials provided to all labs**
- **Conduct tests using Sonic Burner setup**
- **Replicate FAA full scale test cell results**
  - Begin by testing a sample using typical lab configuration/airflow to establish baseline data
  - Replicate FAA full scale facility test results by adjusting exhaust airflow in test cell (trial and error)
  - Report back with exhaust airflow rate change, test cell dimensions, and exhaust system description

Test Cell Airflow Study

- **Round Robin Final Outcome**
  - Labs will return test results and information requested regarding test cell design
  - Intend to produce guidance information regarding recommended exhaust airflow rate based on size and design of the test cell
  - 3 of 7 labs have returned data at this point in time
  - Important that all participating labs complete testing and return data on time
  - Possible similar round robin for seat test method?

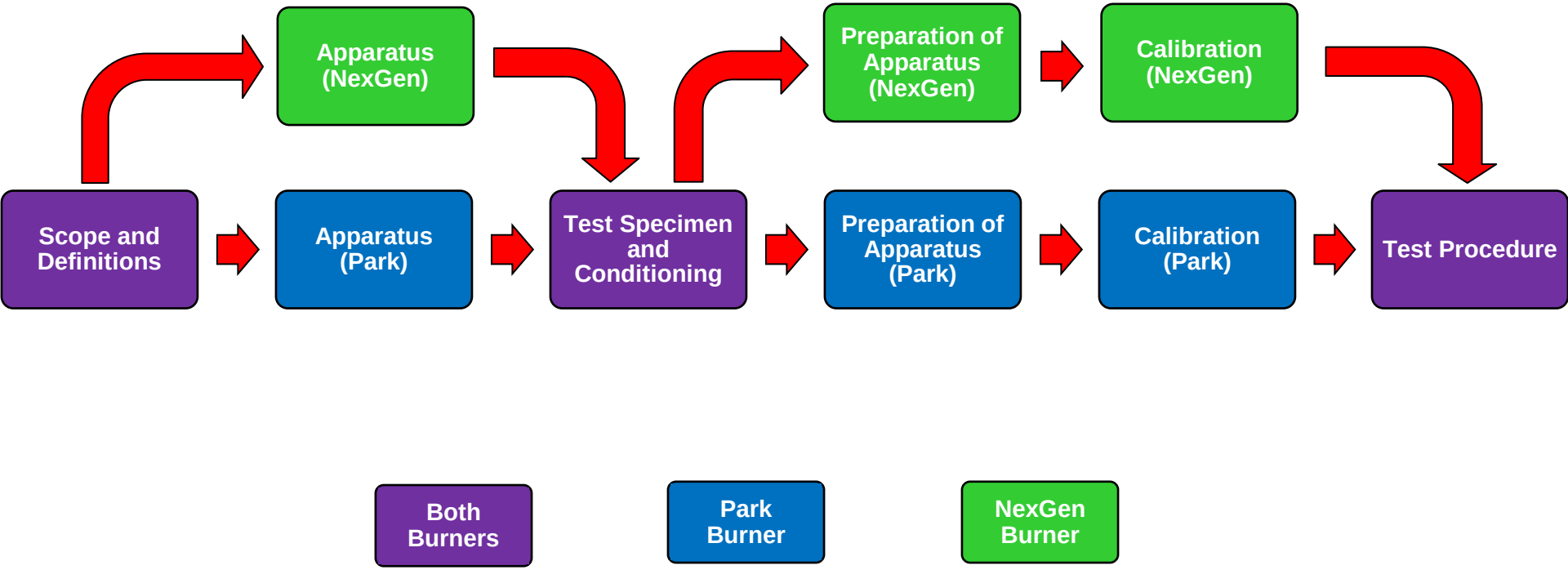
Handbook Chapter 8 Update

Handbook Chapter 8 Update

- **Current Chapter 8 of the Handbook**
  - Includes the Park and sonic burners for use in the cargo liner oil burner test method
- **Industry Feedback**
  - Difficult to follow Chapter 8 when using sonic burner
- **Proposed Update to Chapter 8**
  - Park burner and test method in main chapter only
  - Sonic burner information in supplement
  - Other information from original supplement is now included in the main chapter

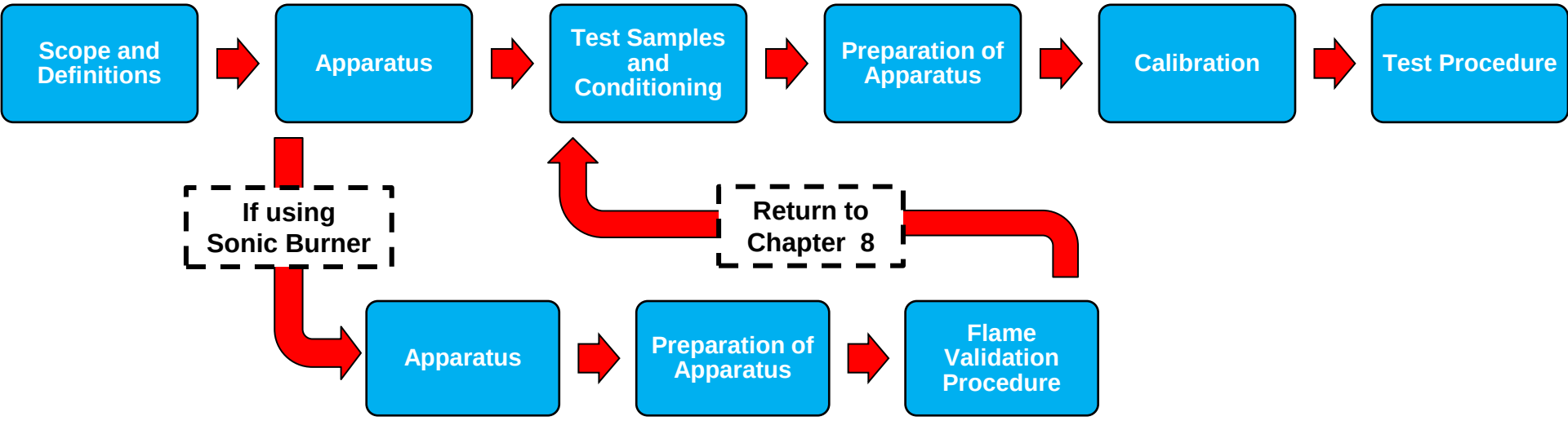
Handbook Chapter 8 Update

Current Chapter 8 and Supplement



Handbook Chapter 8 Update

Proposed Chapter 8



Proposed Chapter 8 Supplement: Sonic Burner

Handbook Chapter 8 Update

- **No changes to the test method or configuration of the Sonic Burner**
- **All Sonic Burner information now appears in Chapter 8 Supplement**
- **Chapter 8 of the Handbook will be updated to this simplified layout following the meeting pending working group approval**

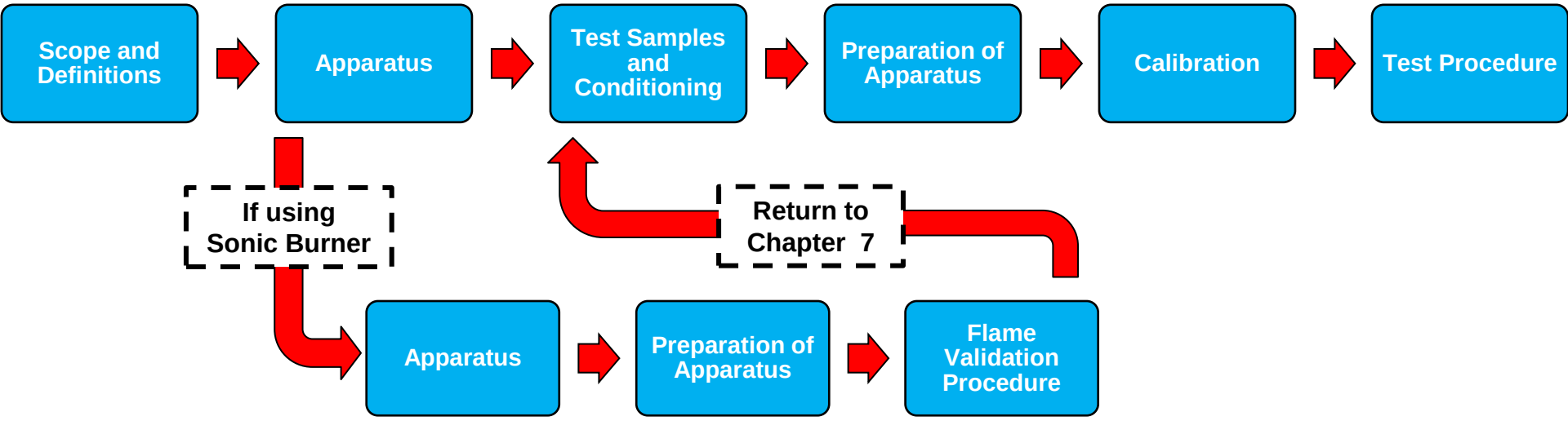
Handbook Chapter 7 Update

Handbook Chapter 7 Update

- **Chapter 7 of the Handbook**
  - The current seat cushion oil burner test method does not include the sonic burner for testing purposes
  - FAA has proposed to update Chapter 7 of the Handbook to ***allow use of the sonic burner***
  - Sonic burner information will appear in the supplemental information of chapter 7
  - Same format as updated Chapter 8
- ***Inclusion of sonic burner into Chapter 7 pending working group approval***

Handbook Chapter 7 Update

Proposed Chapter 7



Proposed Chapter 7 Supplement: Sonic Burner

Cargo Liner Sonic Burner Video

Cargo Liner Sonic Burner Video

- **FAA has been producing updated instructional videos for test methods**
  - Recently completed instructional video for Sonic Burner and the cargo liner test method
  - Video will be shown during cargo task group meeting for those interested
  - Includes test method and Sonic Burner information
  - Ask those attending task group to provide feedback so as to improve video before final release

Future Work

Future Testing and Development

- **Complete Round Robin Study**
  - Produce guidance information based on results
- **Updated Handbook**
  - As described in this presentation
- **Sonic Burner Seat Cushion Video**
  - Coming soon
- **Sonic Burner Support Information**
  - Maintenance and/or troubleshooting checklist

Questions?

timothy.salter@faa.gov

(1)-609-485-6952