Federal Aviation Administration

International Aircraft Materials Fire Test Working Group Meeting

Sonic Cargo Liner Test Air Flow Study and Seat Test Update

Presented to: International Aircraft Materials Fire Test Working Group

By: Tim Salter, FAA Technical Center

Date: June 7-8, 2017, Cologne, Germany

Topics

- **2017 Cargo Liner Test Airflow Study (sonic burner)**
  - Refresher form previous meeting
  - 2017 study initial test results
  - Planned work and outcome
- **Fire Test Handbook Updates**
  - Chapter 7: Oil Burner Test for Seat Cushions
  - Chapter 8: Oil Burner Test for Cargo Liner
- **Seat Cushion Flammability Video (sonic burner)**
  - Current status and updates for next IAMFTWG

2017 Cargo Liner Test Airflow Study (sonic burner)

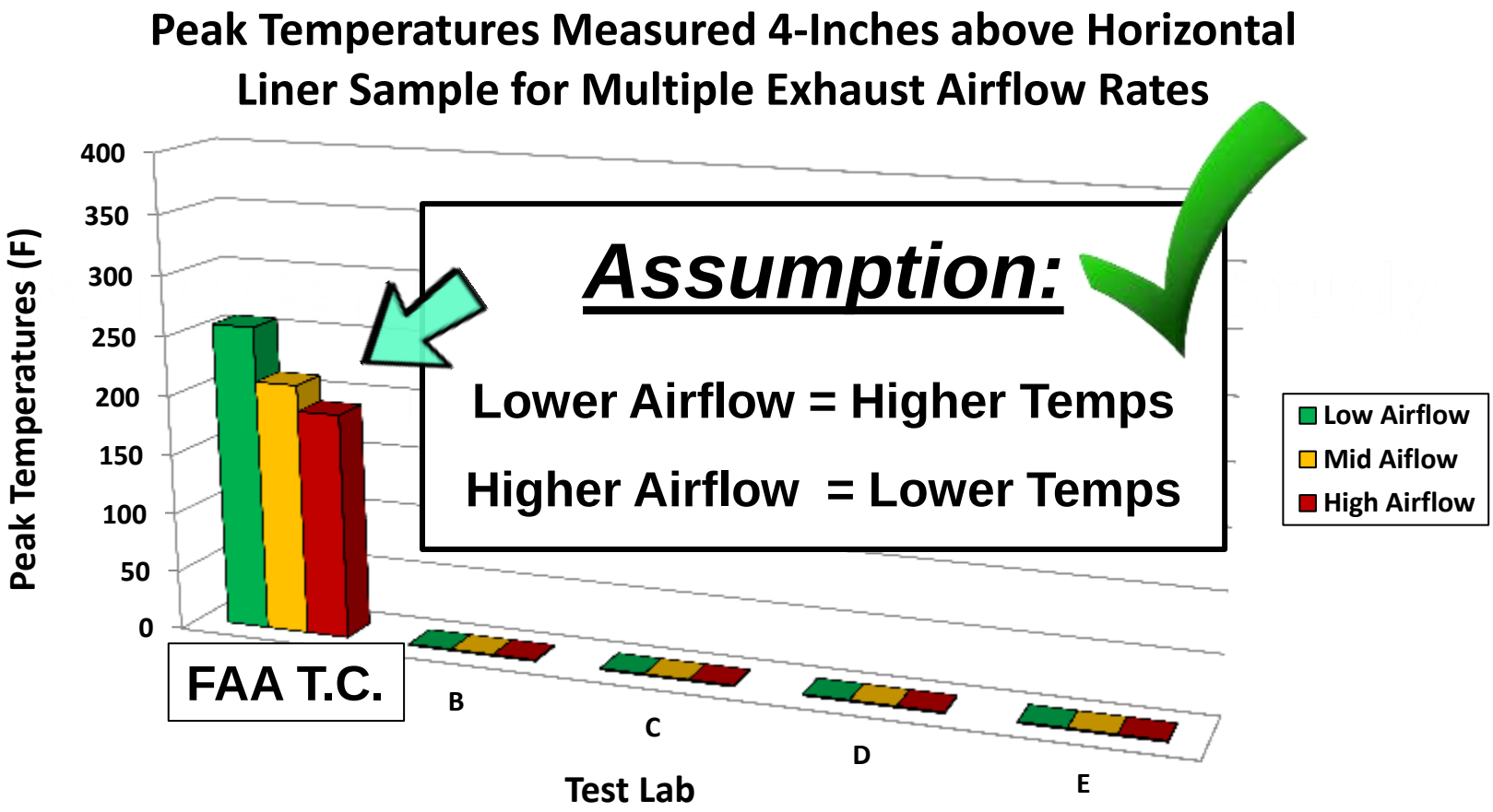
Cargo Liner Test Airflow Study

- **Background and Purpose**
  - Determine correlation between test cell environment and airflow in test cell
    - How do these factors effect test results?
  - Produce guidance material regarding ventilation system requirements based on test cell layout
    - Attempt to minimize test results disparities among labs
  - Initial testing performed at FAA Technical Center
    - In 2016, tests performed in the small cargo liner test cell demonstrated increasing exhaust airflow rates resulted in reduced test cell air temperature, and reduced temperatures measured above liner sample panels

Cargo Liner Airflow Study

2016 Tests Conducted in Small Cargo Liner Test Cell

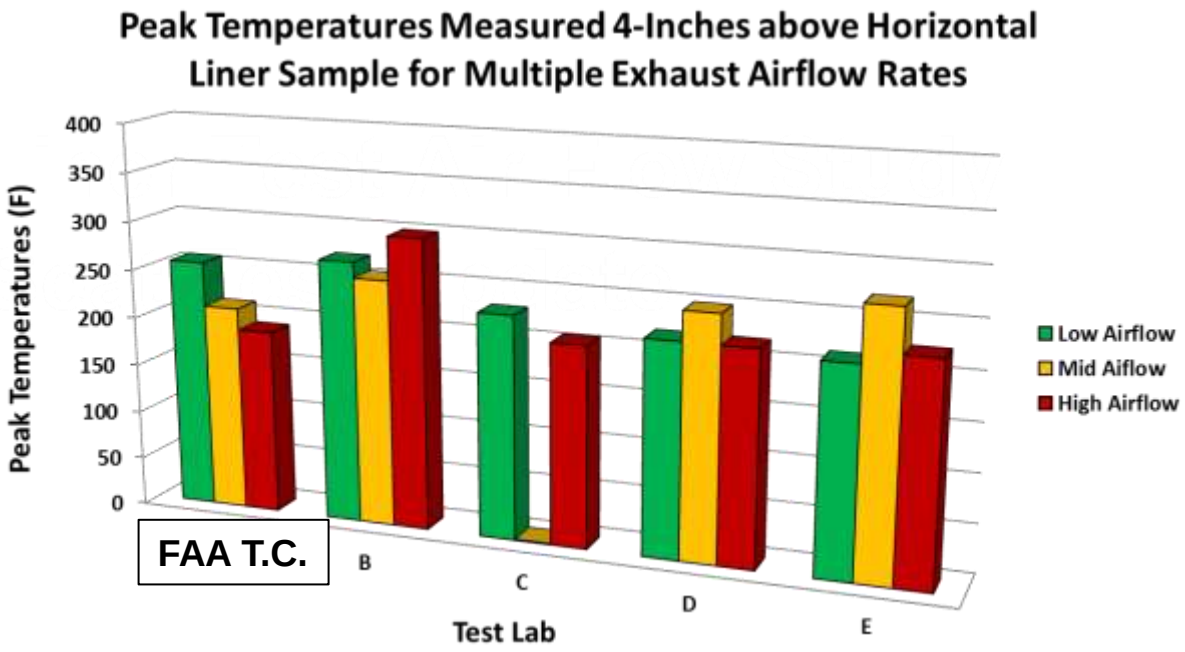
Cargo Liner Airflow Study



Cargo Liner Airflow Study

2016 Test Cell Airflow Interlab Study

- Different results for each lab
- Multiple unknown variables
- Multiple data formats
- Extensive time on return
- No clear correlations
- Interlab study impractical
- Inconclusive outcome



Cargo Liner Airflow Study

- **FAA Technical Center airflow study**
  - Multiple test cells designs
    - Sizes, layout, exhaust hood, etc.
  - Greater control of test variables
    - Burner apparatus, test operator, instrumentation, climate
  - Digitally controlled ventilation system
    - Precise control and high repeatability of exhaust airflow
  - FAA TC work dedicated to R&D study
    - Prolonged time for outside labs to return test results
  - Capability to revaluate test plan and adapt
    - Outside labs follow provided instructions for interlab studies

Cargo Liner Airflow Study

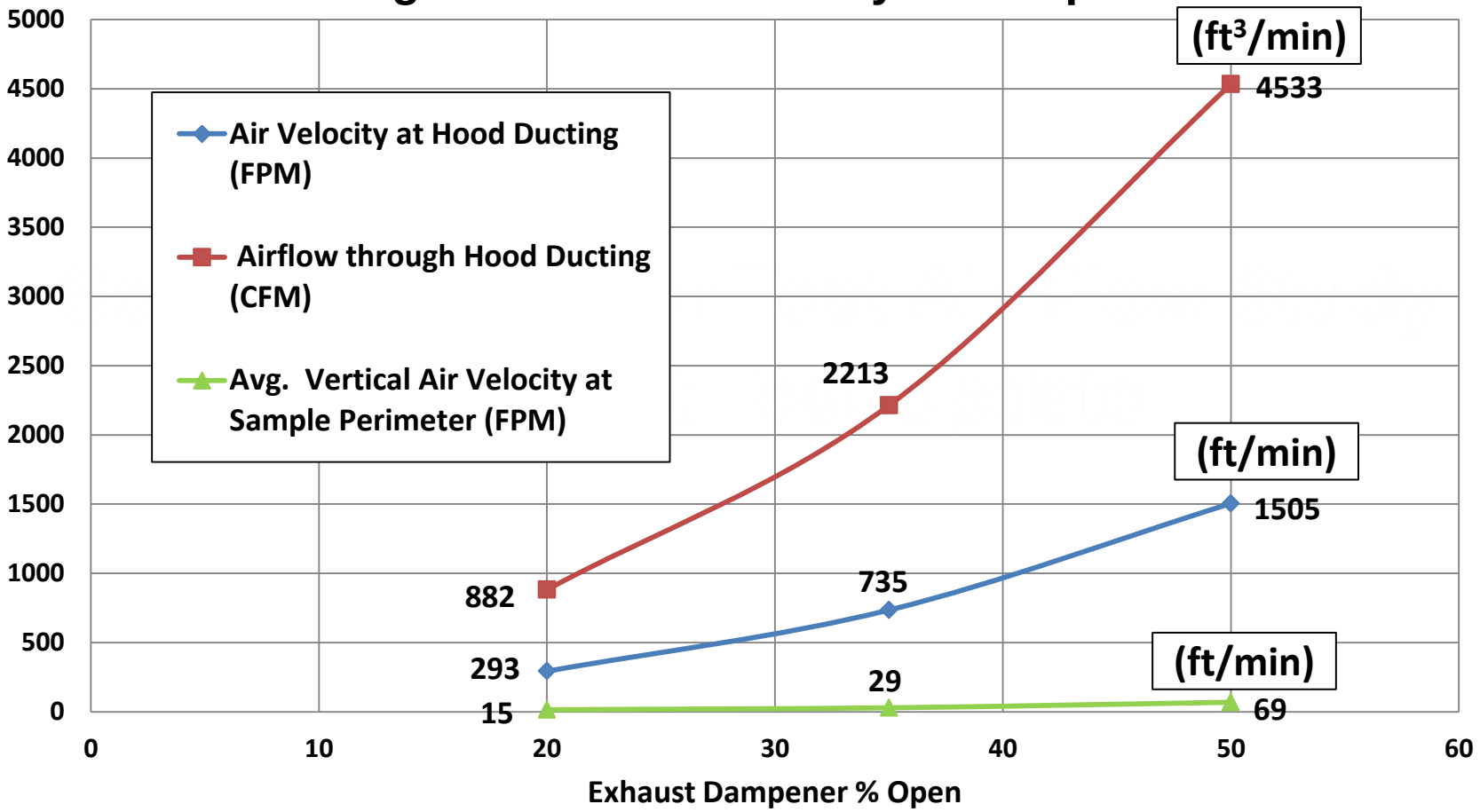
Recent Testing Performed in Large Test Cell with New R&D Sonic Burner Apparatus

Cargo Liner Airflow Study

- **Compile ventilation hood airflow data**
  - Determine airflow rates for multiple settings of exhaust hood dampener setting and measure air velocities around test samples
- **Conduct cargo liner sample tests**
  - Test samples with R&D Sonic burner at each dampener setting
- **Review test data**
  - Determine if there is a correlation between airflow and temperatures measured above test samples

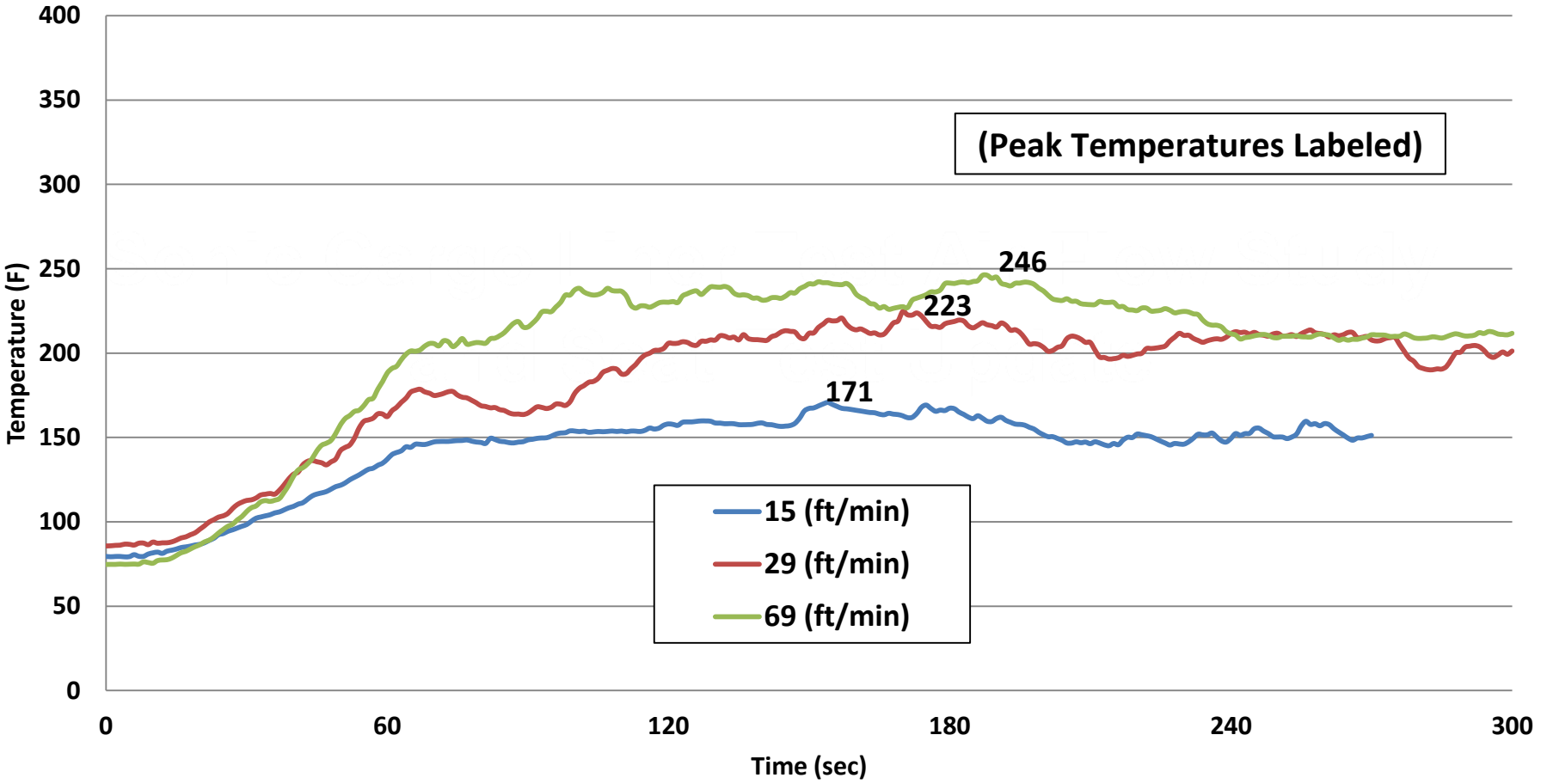
Cargo Liner Airflow Study

Correlation between Hood Exhaust Airflow and Average Vertical Air Velocity at Sample Perimeter



Cargo Liner Airflow Study

Temperature Measured 4-Inches above Liner Sample Panel vs. Average Vertical Air Velocity around Sample Perimeter



Cargo Liner Airflow Study

- **Original assumption did not hold true**
- **Greater exhaust airflow rates did not reduce test sample temperatures measured 4-inches above the horizontal liner panel**
  - Opposite results compared to testing in small cell
- **Test results changed significantly by increasing localized sample air velocity**
  - Average air velocities within 100 ft/min vertical limit

Cargo Liner Airflow Study

- **Test cell design and airflow have a greater influence on test results than expected**
  - Further testing is required to generate guidance material for test cell design and exhaust airflow
- **Future test plans**
  - Continue testing at different exhaust airflows
  - Test different sample materials
  - Relocate apparatus to alternate test environment
  - Adjust testing based on new findings and results

Fire Test Handbook Updates for Chapter 7: Seat Cushion Test Chapter 8: Cargo Liner Test

FTH Updates: Chapters 7 & 8

- **Air velocity limits measured at test sample**
  - New for Chapter 7 (seat cushion test)
  - 100 ft/min vertical maximum
  - 50 ft/min horizontal maximum
  - ***For Sonic burner only!***

- **Define supplemental information**
  - An *example of one possible means or method* of meeting the test requirements
  - Supporting or additional information for test operator

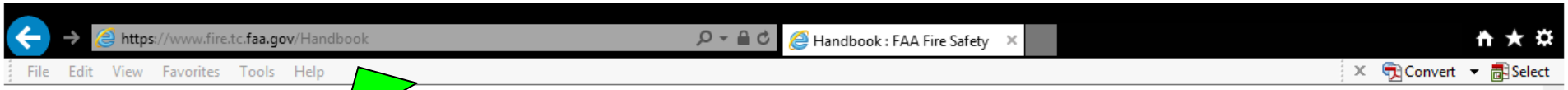
FTH Updates: Chapters 7 & 8

- **Additional information and updates**
  - Seat test rig design details (Chapter 7)
  - Recommended hotwire anemometer models for test cell airflow measurement
  - Flame validation, fuel flow measurement, and burner cone dimension check frequency
  - Clarified airflow check done with *sample in test rig*
  - Instructions for adjustment of fuel nozzle for an even TC rake temperature profile and fuller flame
  - Updated chapters 7 & 8 now on Fire Safety website

Seat Cushion Sonic Burner Video

Seat Cushion Sonic Burner Video

- **Filming complete and editing underway**
  - Review first draft upon completion of editing
  - Task group commenting before final release
  - Final video completed by October meeting
- **Seat Task Group: Video preview for meeting**
- **Future videos planned**
  - Cargo liner patch panels, seams, and fixtures
  - Sonic burner “tips and tricks”
  - Suggestions from task groups



Individual Chap[illegible] and Appendixes (Latest Update)

09/29/09: In an effort to provi[illegible]nstant for simplifying the calibration factor calculation in FAR 25, Appendix F, a long standing error was noted in Chapter 5 (Heat Release Rate Test for Cab[illegible]aterials) of the Handbook. The constant value located in the equation (Paragraph 5.6.6) is currently 23.55 and should actually be

www.fire.tc.faa.gov/Handbook

Chapter 1	Vertical Bunsen Burner Test for Cabin & Cargo Compartment Materials Burn Length Determination Lab Test Form - Bunsen Burner Test
Chapter 2	45-Degree Bunsen Burner Test for Cargo Compartment Liners and Waste Stowage Compartment Material Lab Test Form - Bunsen Burner Test
Chapter 3	Horizontal Bunsen Burner Test for Cabin, Cargo Compartment, and Miscellaneous Materials Lab Test Form - Bunsen Burner Test
Chapter 4	60-Degree Bunsen Burner Test for Electric Wire Lab Test Form - Bunsen Burner Test
Chapter 5	Heat Release Rate Test for Cabin Materials Lab Test Form - OSU Heat Release Test Heat Release Rate Calibration Factor
Chapter 6 Updated	Smoke Test for Cabin Materials Lab Test Form - NBS Smoke Burner Test Report on the Smoke Chamber Furnace New Furnace
Chapter 7	Oil Burner Test for Seat Cushions Advisory Circular on Flammability Requirements for Aircraft Seat [illegible]ons. Lab Test Form - Oil Burner Seat Cushion Test
Chapter 8	Oil Burner Test for Cargo Liners Lab Test Form - Oil Burner Cargo Liner Test Cargo Liner Test Procedures Training Video: View Online | Download
Chapter 9	Radiant Heat Testing of Evacuation Slider, Ramps, and Rafts
Chapter 10	Fire Containment Test of Waste Stowage Compartments
Chapter 11	Powerplant Hose Assemblies Test

Sonic burner cargo liner instructional video can be viewed here

Planned Research and Work

Planned Research and Work

- **Continue cargo liner airflow study**
  - Additional test results and updates next meeting
  - Guidance information based on study results
- **Sonic burner related instructional videos**
  - Sonic seat test full video for next meeting
  - Begin planning and scripts for other videos
- **Additional items**
  - Task group topics
  - Release of Cargo Liner AC document in near future

Questions?

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