

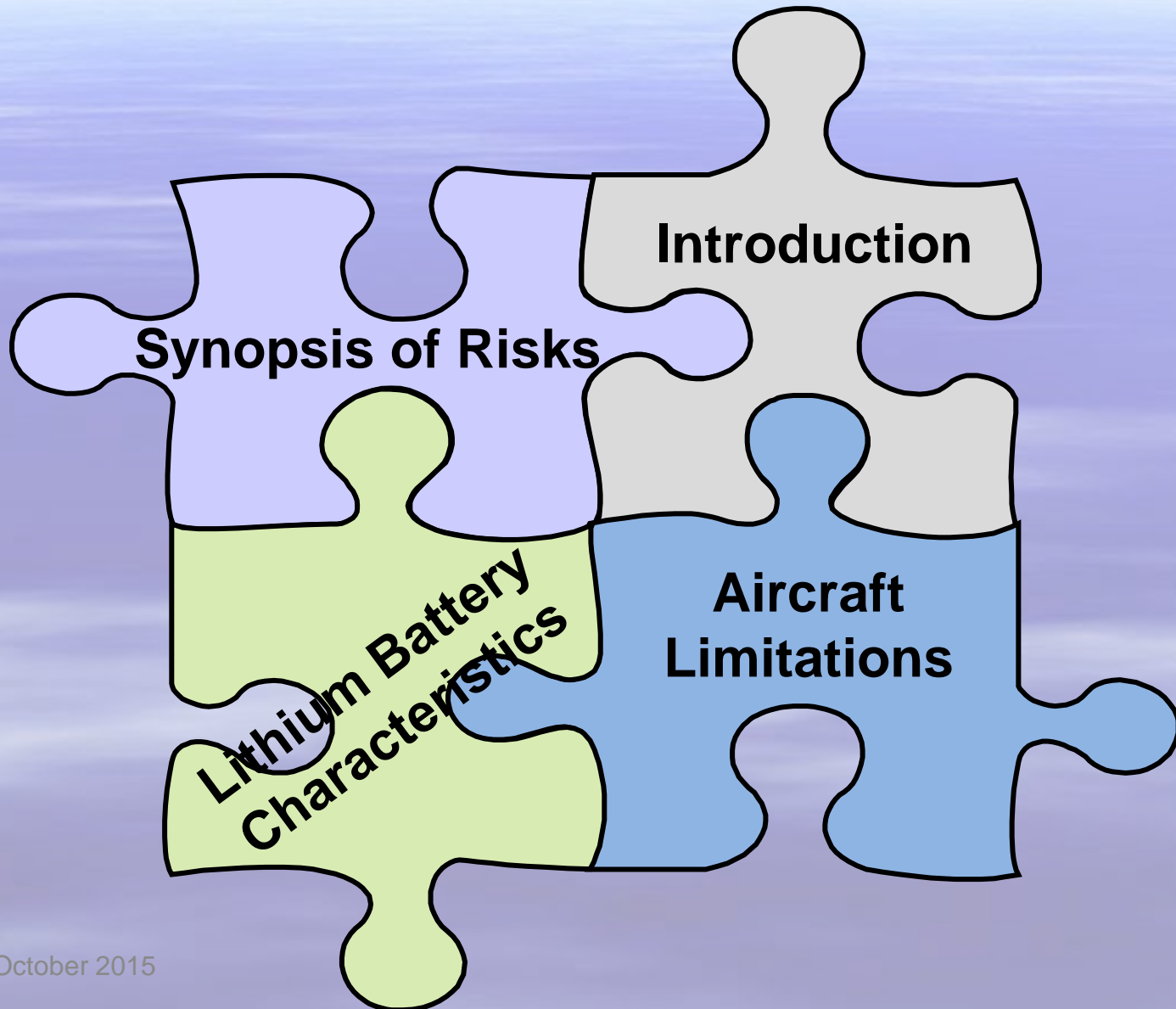


Transport of Lithium Batteries as Cargo via Air – Update on recent activity

Presented by ICCAIA to the International Aircraft
Systems Fire Protection Working Group (IASFPWG)
– October 2015, Atlantic City, NJ

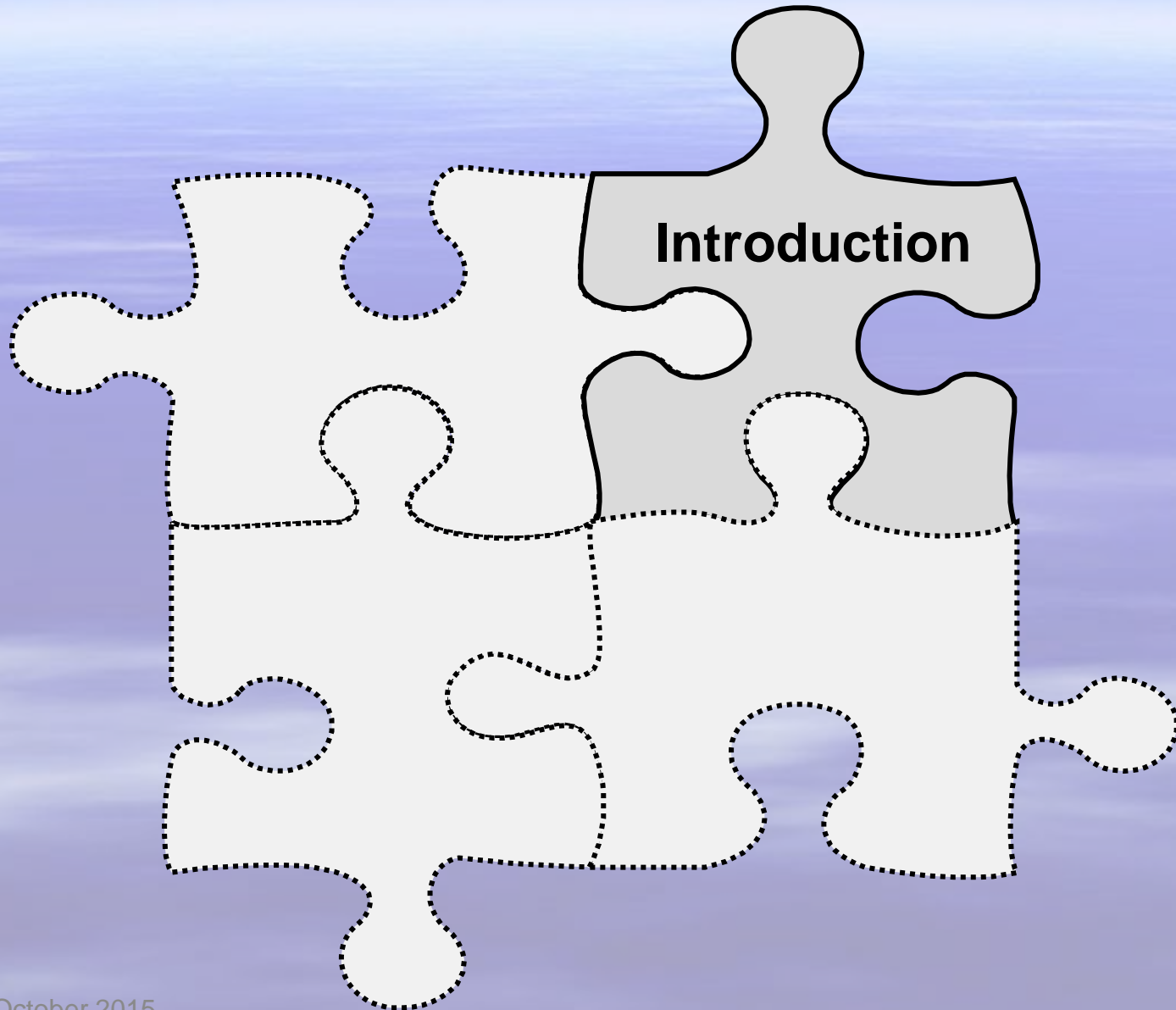


Scope of Presentation





Scope of Presentation





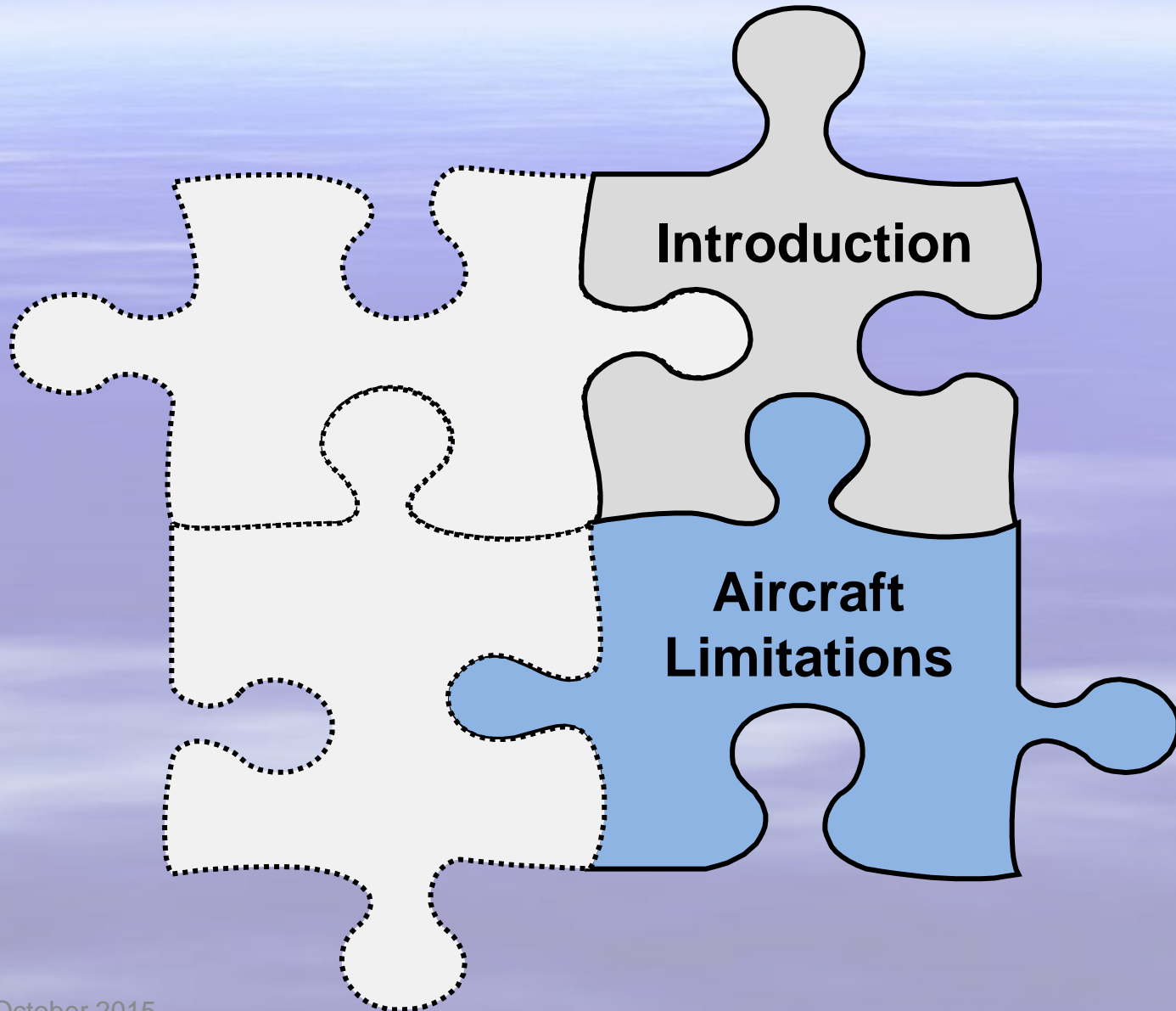
Introduction / Summary

The International Civil Aviation Organization (ICAO) Dangerous Goods Panel asked the International Coordination Council for Aerospace Industry Association (ICCAIA) for their expertise with respect to cargo compartment fire protection capability, especially related to carriage of lithium batteries as cargo.

A presentation was previously provided by ICCAIA to the IASFPWG in Dresden, Germany, in May, 2015, providing more detail on the background, aircraft limitations, lithium battery characteristics and a synopsis of the risks.



Scope of Presentation





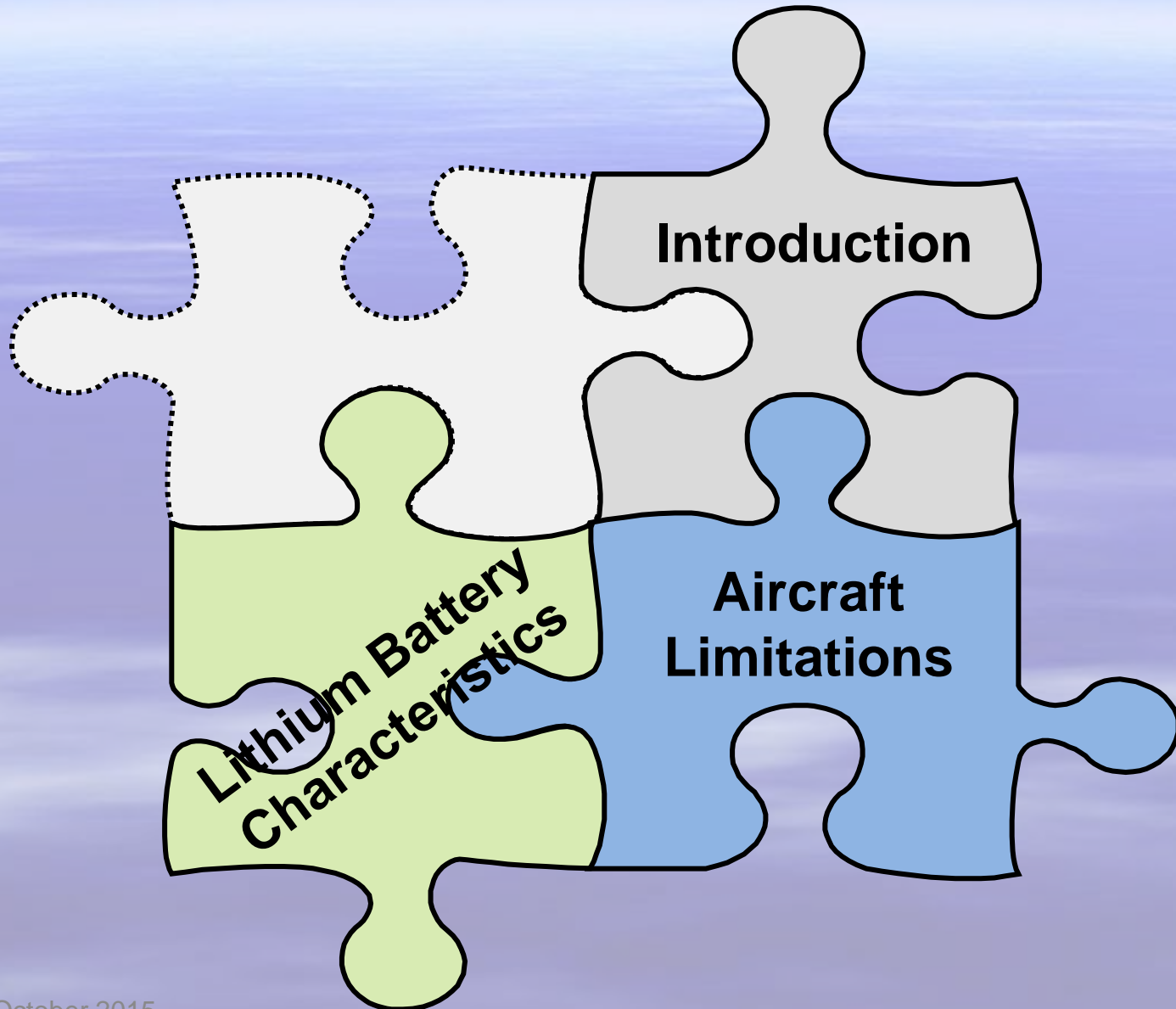
Aircraft Cargo Compartment

Fire Protection Definition

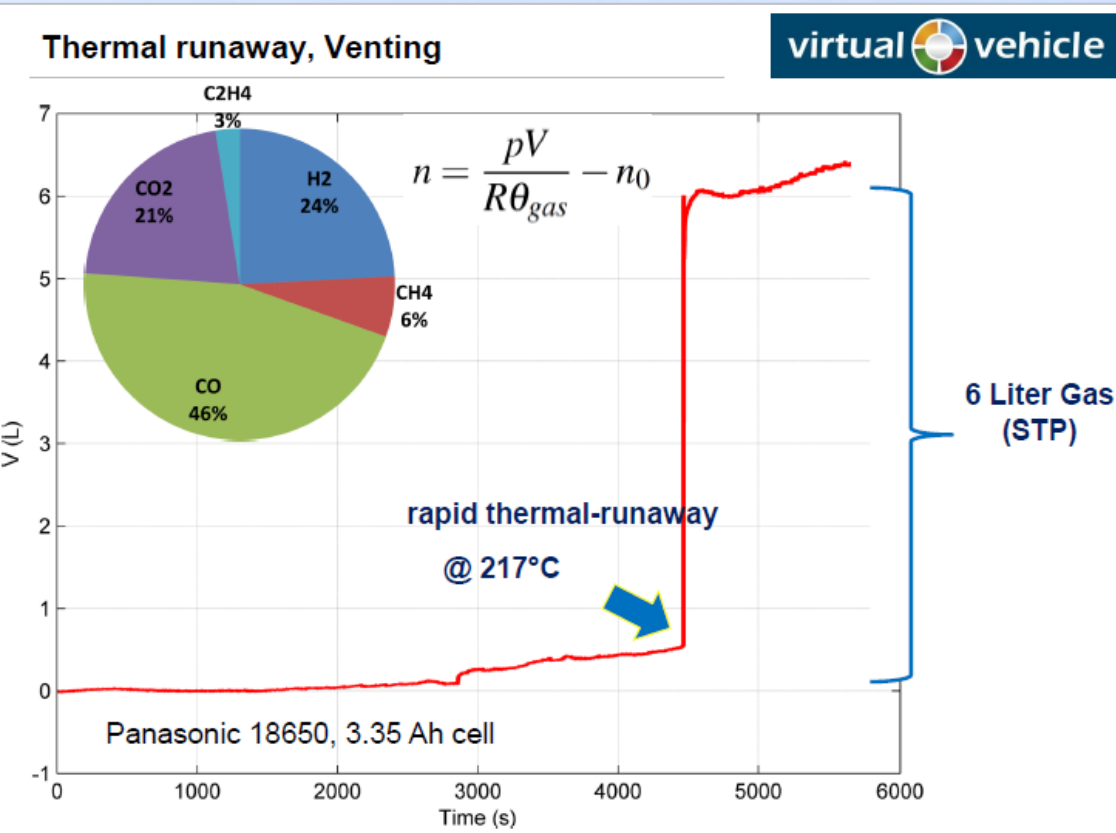
- Around 40 years ago the current design regulations CS/FAR 25.857 were developed to protect the aircraft for the duration of flight from fires which were likely to occur in cargo compartments.
- Mainly class A fire loads: combustible materials such as wood, cloth, paper, rubber, and plastics.
- The hazards from dangerous goods, especially fires involving lithium batteries, is not considered within the current aircraft design standards.
 - Dangerous Goods are specified and regulated by the dangerous goods regulations ICAO Annex 18 and the operational regulations ICAO Annex 6



Scope of Presentation



Lithium Battery Characteristics

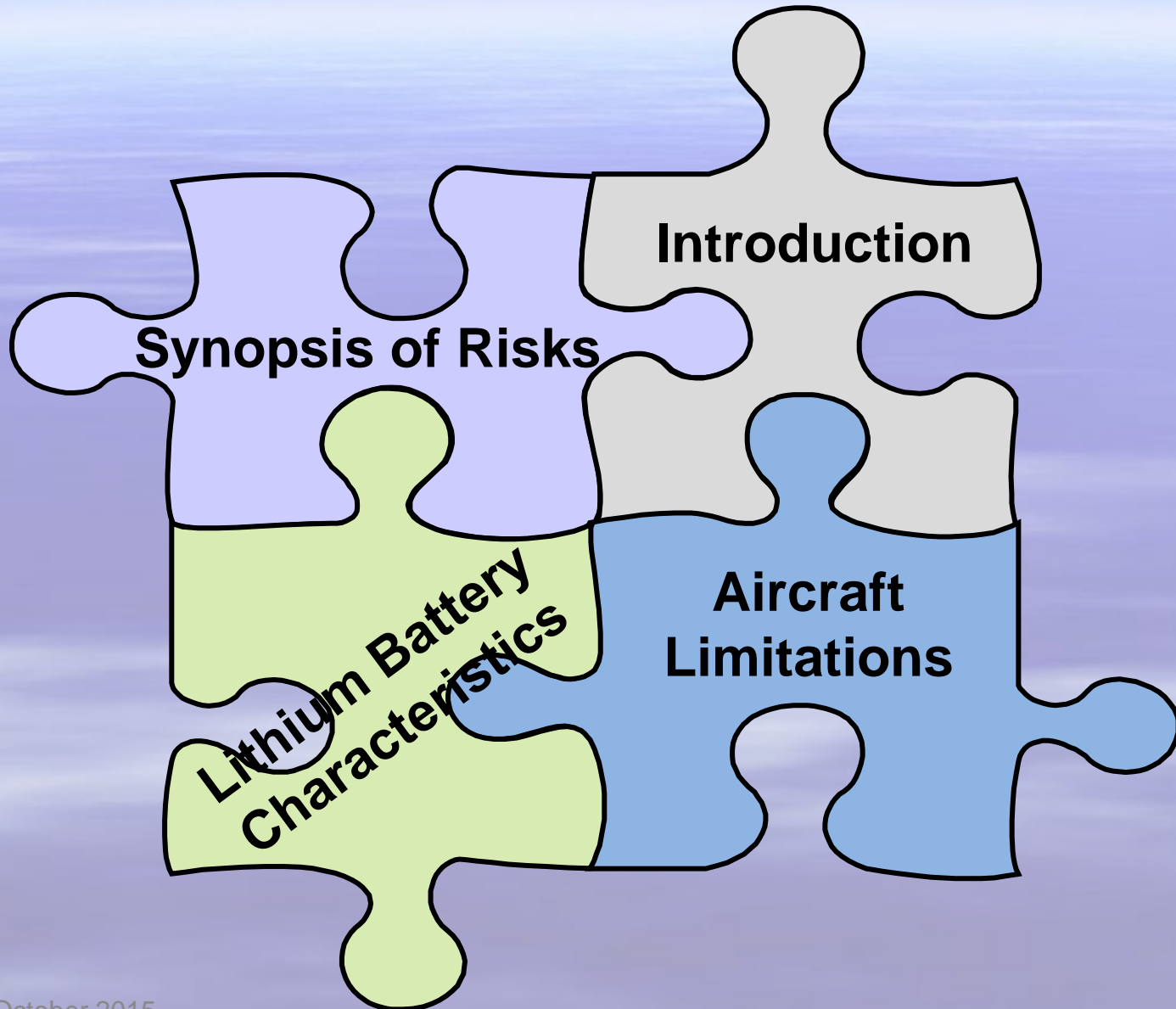


- It has been shown that the quantity of heat, smoke and fumes produced by a lithium battery fire is significantly greater than that produced by a fire involving general cargo.
- Furthermore as thermal runaway progresses throughout the packages of batteries in the compartment, the fume and smoke production rate continues to increase.

Author: Andrey W. Golubkov, VIRTUAL VEHICLE Research Center Graz, Austria (contact: andrei.golubkov@v2c2.at)



Scope of Presentation





Synopsis of Issue:

Lithium Battery and Existing Designs

- In considering aircraft safety, Lithium battery fire characteristics need to be considered in conjunction with the capabilities of current cargo compartment design & fire protection features.
 - Existing cargo compartment fire protection systems certified to FAR/CS 25.857 are unable to control a fire involving high density shipments of lithium batteries.
 - Preventing propagation of thermal runaway from batteries in one package to batteries in adjacent packages is a basic necessity for adequately controlling the effects of a fire involving lithium batteries.



Definition of High Density of Lithium Batteries

ICCAIA would like to assist the Panel members to find a way to allow operators to safely carry lithium-ion and lithium metal batteries:

“High density” describes a quantity of lithium battery accumulation which has the potential to overwhelm the cargo compartment fire protection features.

- The impact of different characteristics of the batteries, cargo compartments, and loading configurations make it very difficult to define a quantity limitation that is applicable at the aircraft level for all situations.
- Tests have demonstrated some configurations with accumulations of packages, each containing less than 5kg of 18650 lithium ion batteries, have the potential to lead to significant damage of an aircraft.



Synopsis of Issue:

Lithium Battery and Existing Designs

- ICAO DGP regulations for transport of lithium batteries were not intended to control or to contain a fire within required packaging.
 - Flame and gases from a fire are not prevented from exiting the package .
 - Protection from an external ignition or heat source is not provided.
 - Propagation of fire from one package to adjacent package is not prevented, even with compartment fire suppression.
 - The quantity of lithium batteries in a compartment is unrestricted.
- Several characteristics of a lithium battery fire have the potential to defeat the aircraft cargo compartment fire protection system.



Limitations of Protection Means to Lithium Battery Fire

Passive Protection

- A fire involving a high density of lithium batteries will exceed a temperature of 927°C
- Heat release rate will exceed design targets over time

Halon 1301

- Not able to stop a thermal runaway or propagation from one cell to next
- The required Halon concentration could be overwhelmed before the end of flight.

Overpressure Protection

- An overpressure event due to ignition of accumulated flammable vapors will result in opening designed pressure relief features that could feed and spread the fire.

Smoke/Fumes Barrier

- Quantity of smoke/fumes produced is significantly higher than those resulting from general cargo.
- Continued increasing production of smoke/fumes overwhelming the design features could impact aircraft occupants.



Conclusion

- The known and unknown risks associated with transporting lithium batteries by air, coupled with the knowledge that the volume of such cargo is continually increasing, requires action to be taken.
- ICCAIA recommends that appropriate packaging and shipping requirements be established to safely ship lithium ion batteries as cargo on aircraft and that high density packages of lithium ion batteries and cells (such as defined by UN3480) not be transported as cargo on passenger aircraft until such time as safer methods of transport are established and followed.
- It is further recommended that appropriate packaging and shipping requirements are established to more safely ship lithium metal and lithium ion batteries as cargo on freighter aircraft



Recent Activity

- Working Paper DGP-WG/15-WP/4 was presented by ICCAIA and International Federation of Airline Pilots Association (IFALPA) to the Dangerous Goods Panel (DGP) in April, 2015.
- Some airframe manufacturers have provided guidance to operators consistent with the ICCAIA recommendations.



Recent Activity

- A third Multi-Disciplinary Working Group on the Carriage of Lithium Batteries was convened by ICAO in July, 2015
 - Identified high-level requirements for a lithium battery packaging standard to contain hazards.
- The ICAO DGP now has an ICCAIA representative (Paul Rohrbach - Airbus) as an official panel member.