Fifth Triennial International Aircraft Fire and Cabin Safety Research Conference

Integrated Fire Protection Systems

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AERONAUTICAL AND SAFETY ENGINEERS

INTEGRATED FIRE PROTECTION SYSTEMS

- Transport Canada have commissioned a research study to:

  Identify the feasibility, practicality, and issues that are likely to result from the implementation of such a system prior to the concept being considered a cost-beneficial safety enhancement.

INTEGRATED FIRE PROTECTION SYSTEMS

We would also like to thank the

U.S. Federal Aviation Administration

U.K. Civil Aviation Authority

for the collaboration and supporting activities given to this project since its conception

OBIGGS= Onboard Inert Gas Generating System

OBOGS = Onboard Oxygen Generating System

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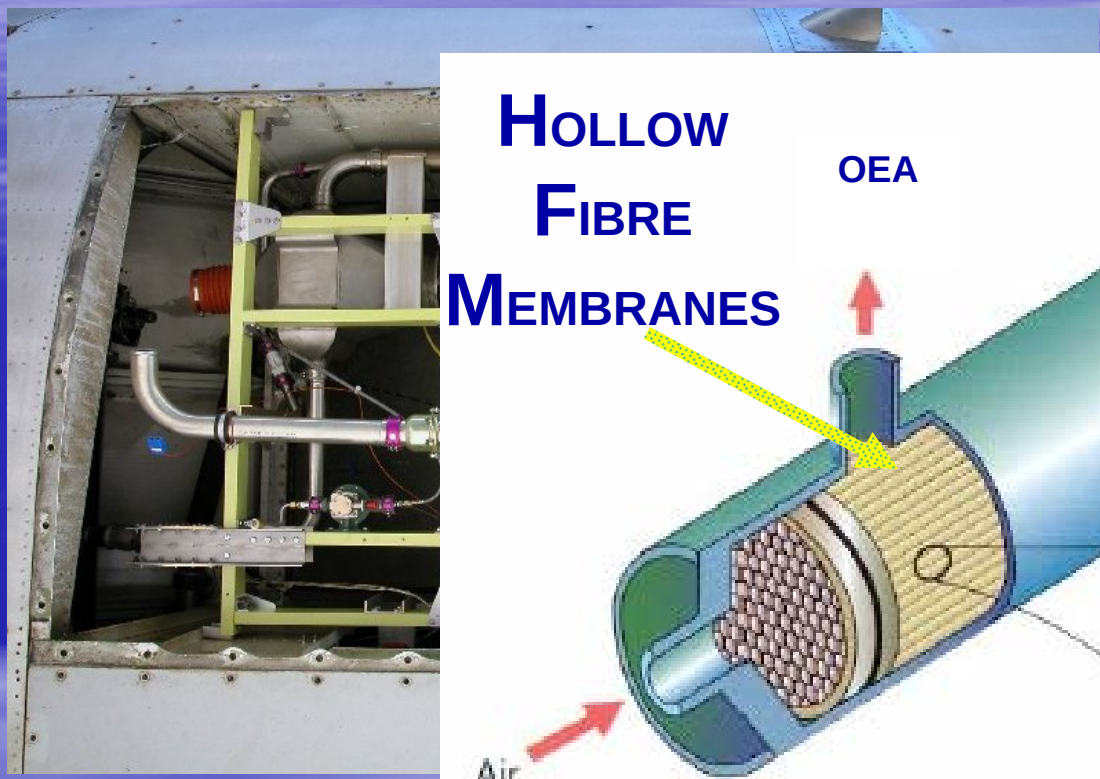
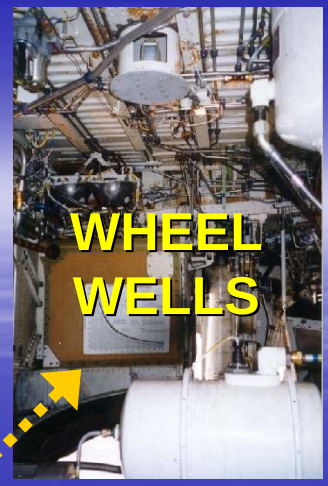
OBIGGS/OBOGS





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CABIN WATER MIST SYSTEM

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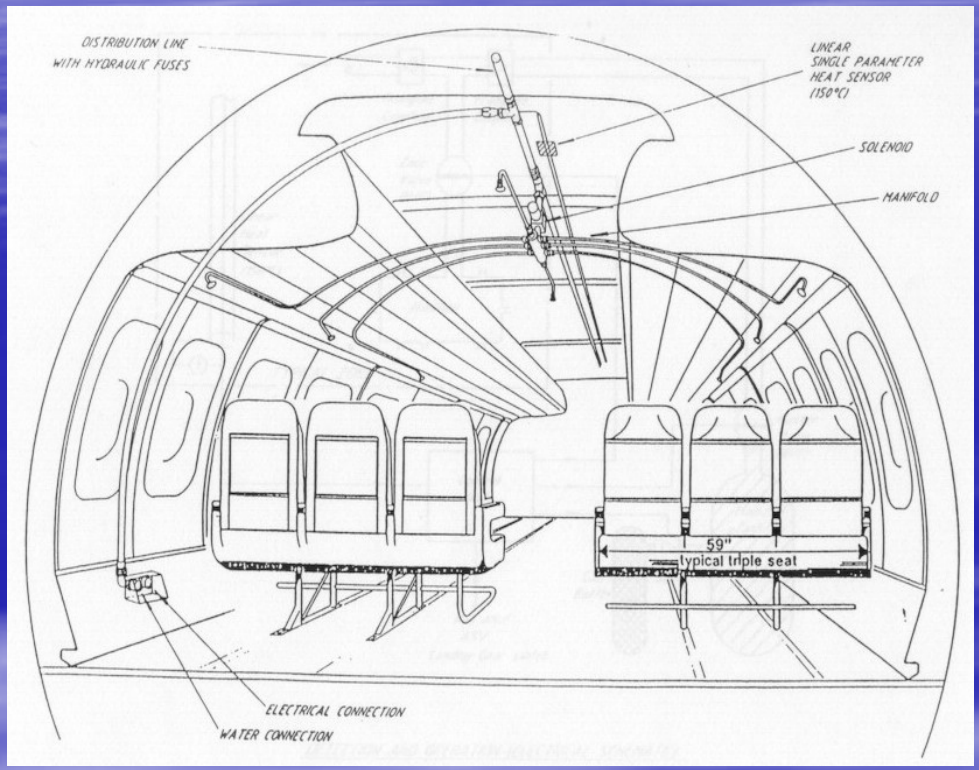
INTEGRATED FIRE PROTECTION SYSTEM

Cabin Water Mist System



- Post-crash survivability
- In-flight cabin fire

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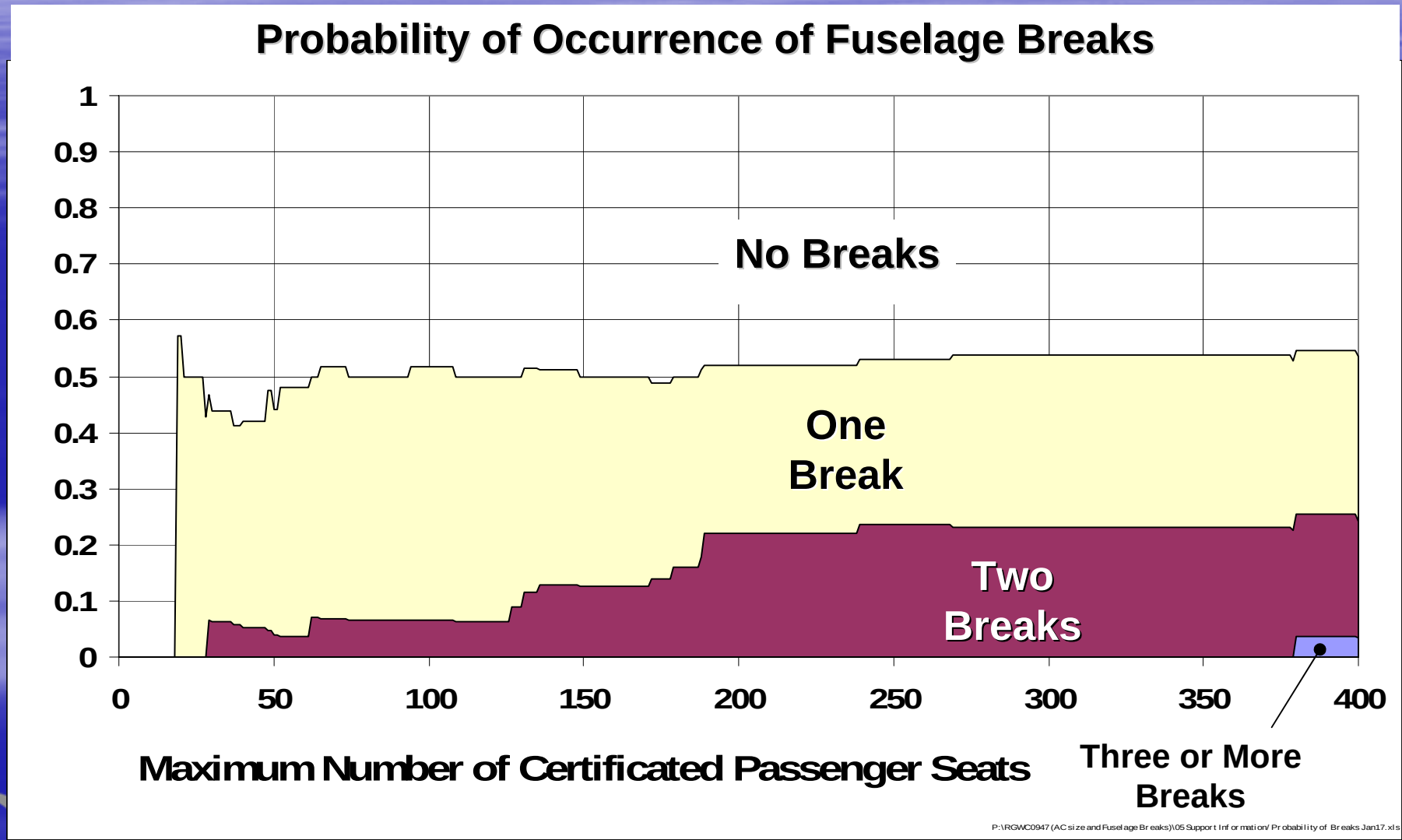
INTEGRATED FIRE PROTECTION SYSTEM

Cabin Water Mist System – Project Achievements to date include:

1. Development of a specification for a Cabin Water Mist System.
2. Proposed System Architecture (Including an assessment of the number of post-crash fuselage breaks that needs to be accommodated)
3. System Weight Assessment
4. System Reliability Requirements
5. Proposed System Activation Means
6. Water system issues and requirements

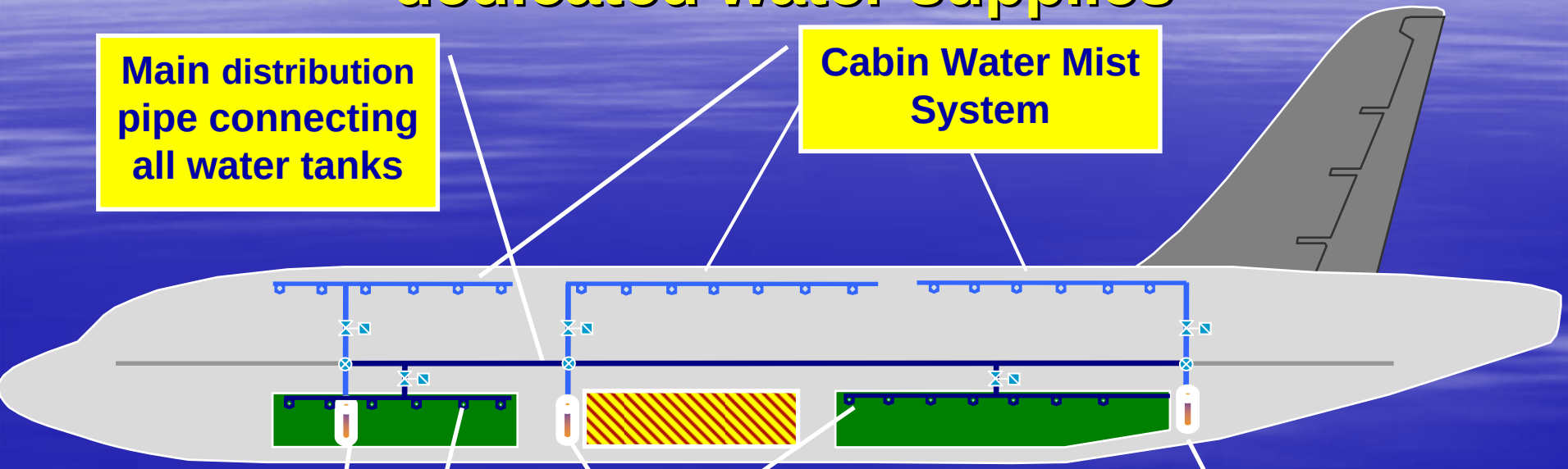
INTEGRATED FIRE PROTECTION SYSTEM

Cabin Water Mist System



INTEGRATED FIRE PROTECTION SYSTEM

Cabin Water Mist System Architecture using dedicated water supplies



Main distribution pipe connecting all water tanks

Cabin Water Mist System

Forward water tank

Aft water tank

Centre water tank

Cargo Bay Water Mist System

INTEGRATED FIRE PROTECTION SYSTEM

Cabin Water Mist System – Some issues requiring resolution

- Development of a Minimum Performance Standard for a Cabin Water Mist System.
- System Weight Reduction
- Effects on aircraft systems of inadvertent operation in flight

EQUIPMENT BAY INERTING

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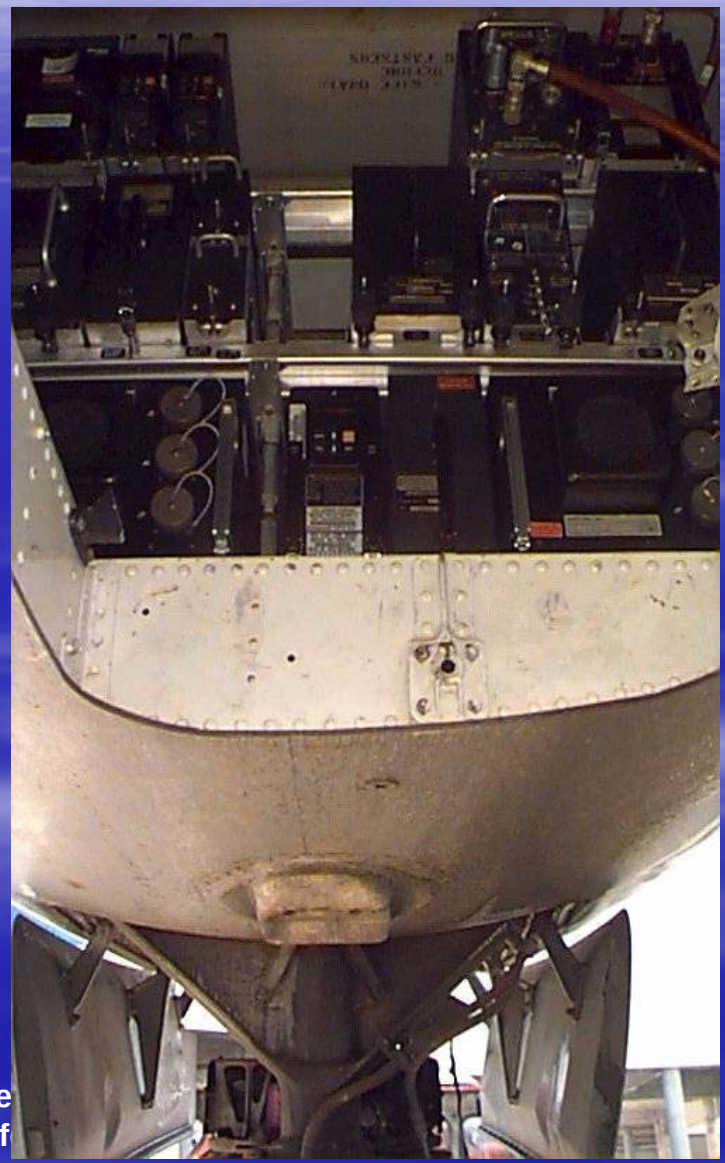
INTEGRATED FIRE PROTECTION SYSTEM

Equipment Bay Inerting using NEA

- A model has been developed for electrical equipment bay inerting
- Primary Issues
  - Will the system be Cost Beneficial
  - Air flow rates into and out of Equipment Bays



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HIDDEN AREAS INERTING

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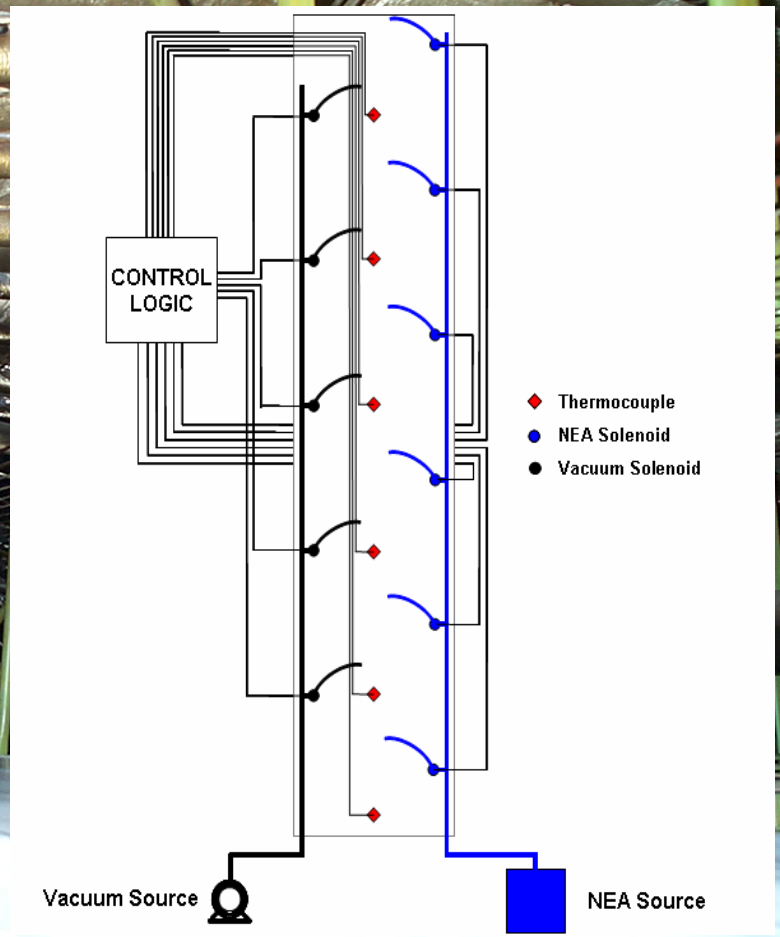
INTEGRATED FIRE PROTECTION SYSTEM

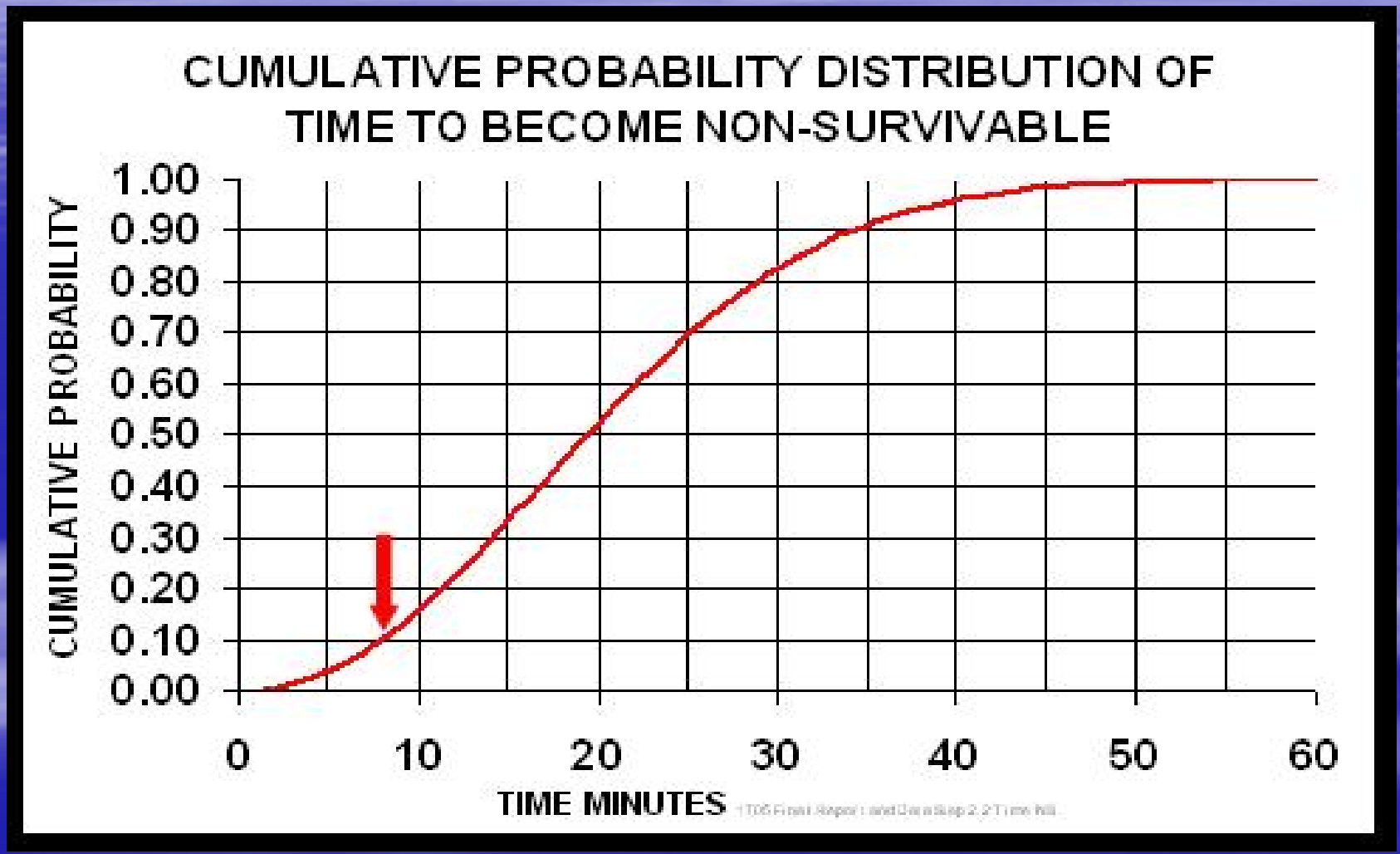
Hidden Areas Inerting

- Distributing NEA from OBIGGS to extinguish fire in hidden areas by inerting
- Main issue: containing inert condition in the fire area with a high airflow condition
- FAA ongoing research



INTEGRATED FIRE PROTECTION SYSTEM

Hidden Areas Inerting



INTEGRATED FIRE PROTECTION SYSTEM

Hidden Areas Inerting – Percentage of Free Space inerted in 8 minutes

	% Free Space Inerted	
Aircraft Type	**NEA 5%**	**NEA 8%**
B737-800	22%	27%
B747-400	5%	6%
B757-300	31%	37%
B767-300ER	23%	27%

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WHEEL WELL INERTING

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INTEGRATED FIRE PROTECTION SYSTEM

Wheel Well Inerting with NEA

- Main Issues
  - Air flows in the wheel well
  - Are there more effective ways of achieving the same level of safety?

PASSENGER OXYGEN

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INTEGRATED FIRE PROTECTION SYSTEM

Passenger Oxygen using OEA

- Current Hollow Fibre Membrane technology capable of producing OEA at c 35% oxygen not viable as a direct replacement for the supplemental oxygen system

INTEGRATED FIRE PROTECTION SYSTEM

Passenger Oxygen using OEA

- However, there is potential to reduce the amount of stored oxygen required with perhaps a consequential cost and weight reduction.

CARGO COMPARTMENTS

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INTEGRATED FIRE PROTECTION SYSTEM

Cargo Compartment Water Mist/NEA System

- Halon replacement fire suppression system utilising NEA from OBIGGS and a water mist system has been shown to pass the Minimum Performance Standard FAA DOT/FAA/AR-TN05/20

INTEGRATED FIRE PROTECTION SYSTEM
Cargo Compartment Water Mist/NEA System

1. Development of a comprehensive cargo compartment inerting model which assesses inerting capability and system weight.
   - Aircraft specific data (Cargo Compartment Volumes and leakage rates, Number of ASMs required for Center Fuel Tank Inerting, etc)
   - ASM performance data based on FAA testing

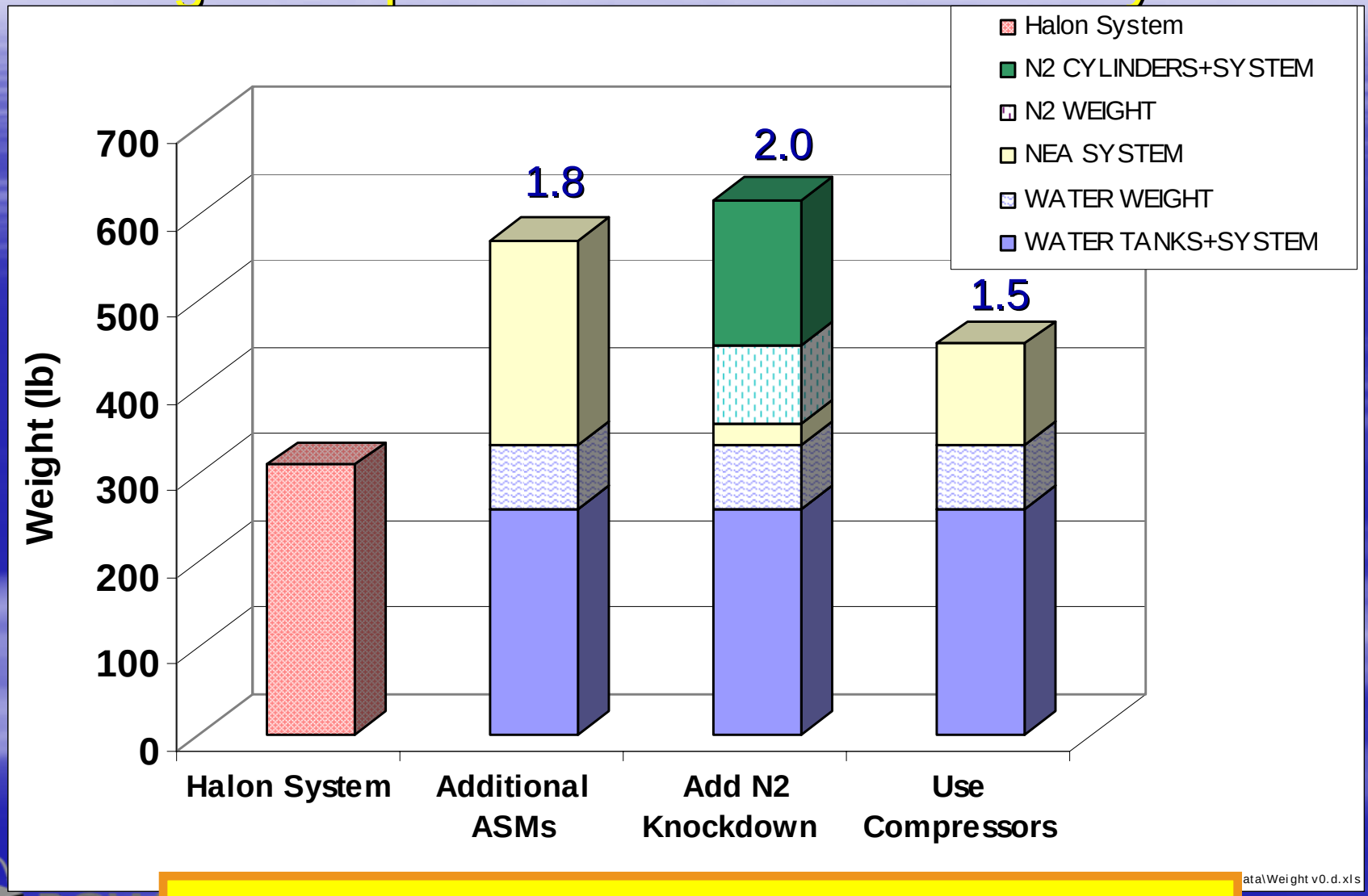
INTEGRATED FIRE PROTECTION SYSTEM

Cargo Compartment Water Mist/NEA System

2. "Design concepts" evaluated:
   a) Additional ASMs
   b) Supplementing inerting with Pure Nitrogen
   c) Using compressors to enhance ASM performance

INTEGRATED FIRE PROTECTION SYSTEM

Cargo Compartment Water Mist/NEA System



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B767- 300ER aft Cargo Compartment 3152 ft^3
6 ASMs installed for Fuel Tank Inerting

INTEGRATED FIRE PROTECTION SYSTEM

Cargo Compartment Water Mist/NEA System

FUTURE WORK

- Reassessment of system weight based on FAA testing of cargo bay target inerting level
- Development of a specification for a Water Mist/Nitrogen Enriched Air system
- Investigation of fuel cell technology
- New water mist technology?

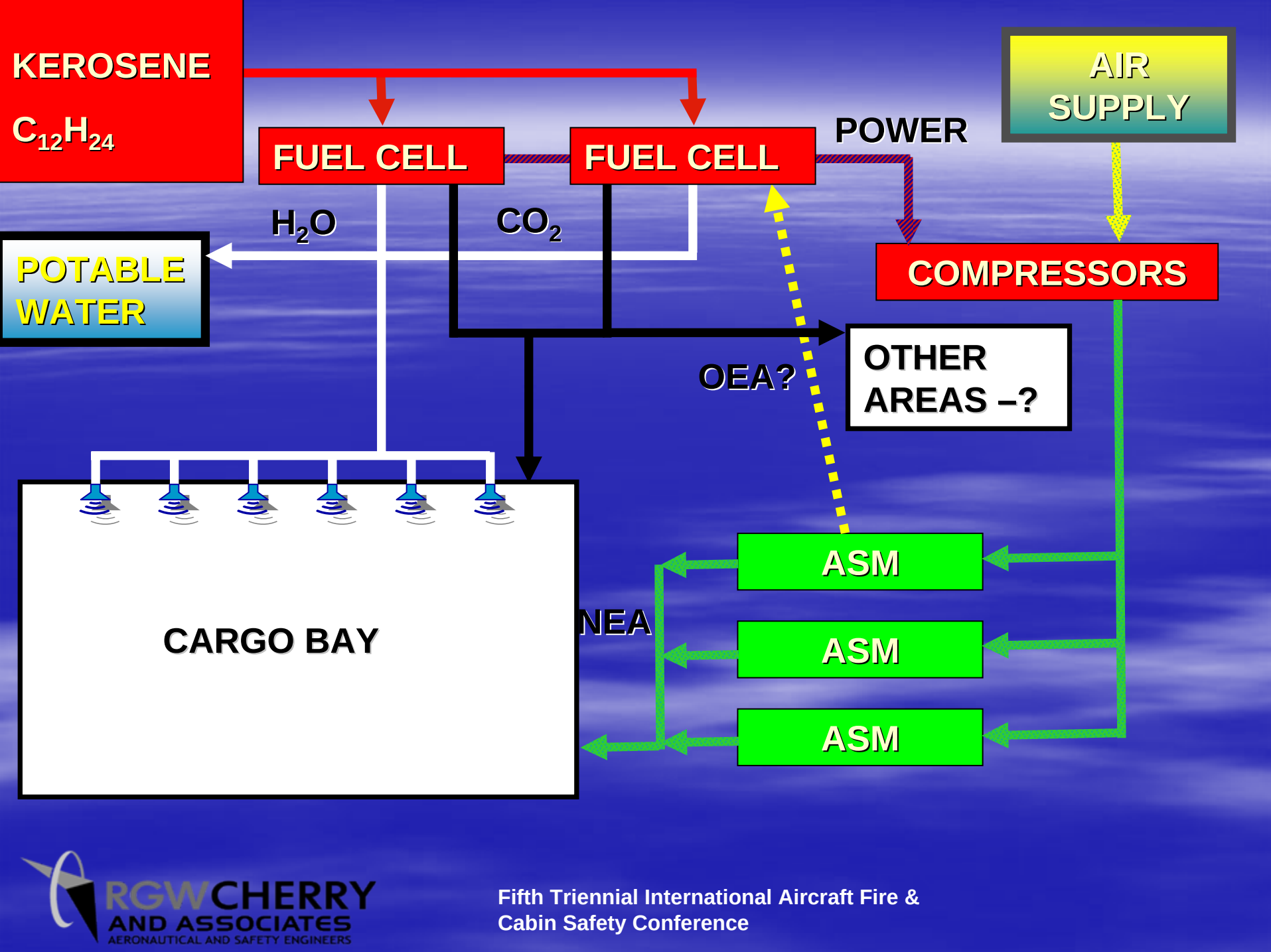
INTEGRATED FIRE PROTECTION SYSTEM

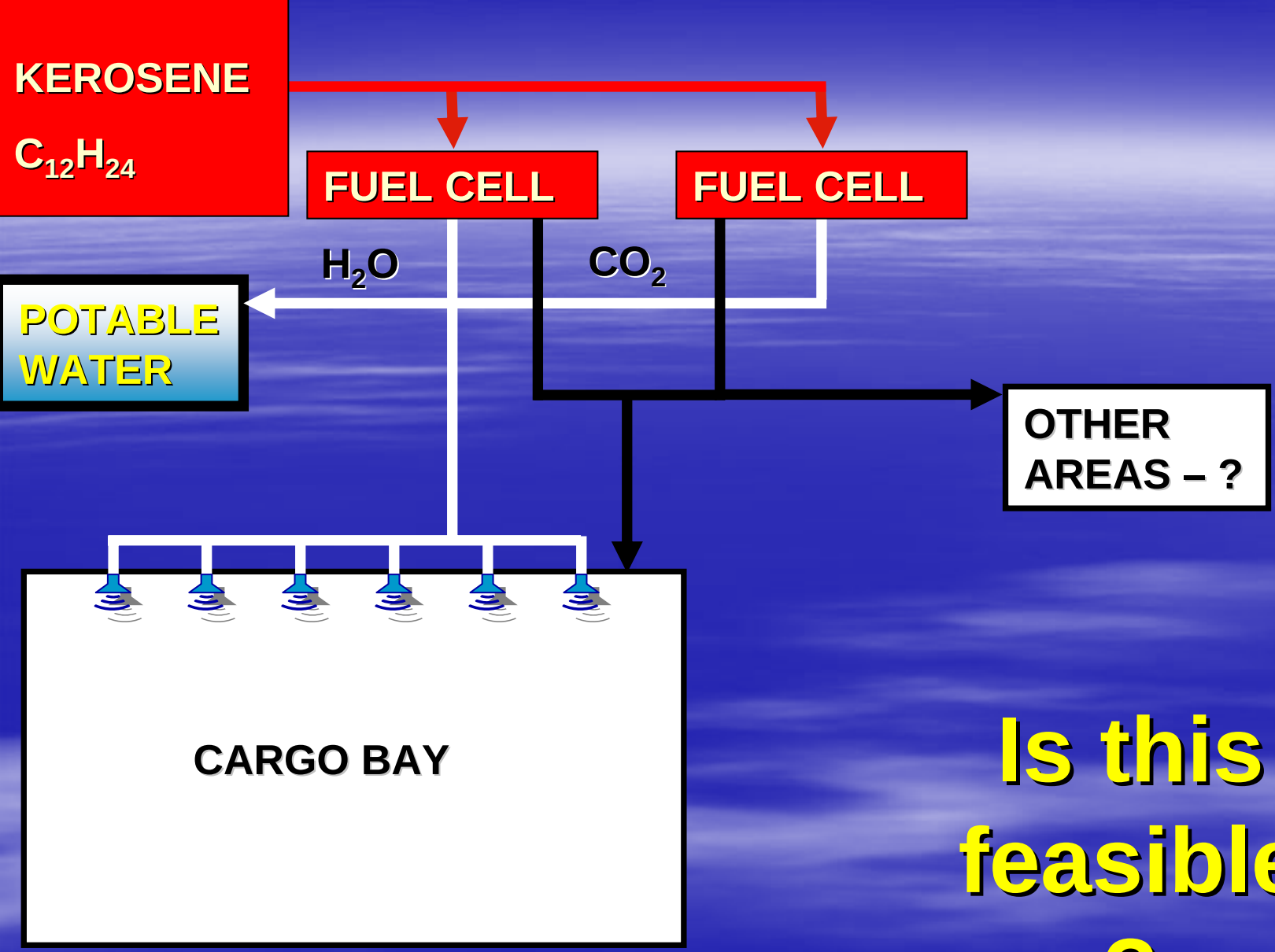
Cargo Compartment Water Mist/NEA System

PRIMARY ISSUES

- System Weight
- Power Demand for Compressor System

FUEL CELLS


KEROSENE
$C_{12}H_{24}$
FUEL CELL
FUEL CELL
POWER
AIR SUPPLY
H_2O
CO_2
POTABLE WATER
COMPRESSORS
OEA?
OTHER AREAS –?
CARGO BAY
NEA
ASM
ASM
ASM



Is this feasible ?