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Aviation Safety Facilitators Corp.

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TO: **Submission to Docket No. FAA-1999-6411; Notice No. 99-18**
Transport Airplane Fuel Tank Design Review, Flammability Reduction, and Maintenance and Inspection Requirements
U. S. Department of Transportation; Federal Aviation Administration
400 Seventh Street SW., Room Plaza 401,
Washington DC 20590

FROM: Aviation Safety Facilitators, Corp., 30 Amethyst Street, P. O. Box 498, Elmont, New York 11003
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SUMMARY OF SUBMISSION TO DOCKET No. FAA-1999-6411; Notice No. 99-1

This submission supports in the affirmative the proposed changes to Part 25.981, Fuel tank ignition prevention. The solution here in specifically addresses the proposed 25.981(c); The fuel tank installation must include—(1) Means to minimize the development of flammable vapors in the fuel tanks. This can be accomplished with full time, on-aircraft inerting that is effective in preventing fuel tank ignition in all ground and flight profiles by maintaining the oxygen level of fuel vapors below the percentage that would permit ignition.

In the NPRM section titled Fuel Tank Flammability, (Ref. Page 26) it is stated that the FAA has undertaken a parallel effort to address the threat of fuel tank explosions by eliminating or significantly reducing the presence of explosive fuel air mixtures, within the fuel tanks, of new type designs, in-production, and the existing fleet of transport airplanes. The information submitted supports that effort by describing full time, on-aircraft inerting. Also, this submission to the NPRM supports of the Aviation Rulemaking Advisory Committee (ARAC) recommendation for the FAA to continue to evaluate means for minimizing the development of flammable vapors within fuel tanks to determine whether other alternatives could be shown cost effective (Ref. Page 28-29). Aviation Safety Facilitators, Corp. is pleased to offer full time, fuel tank inerting on the aircraft. We request that the final rule acknowledge and enable the use of full time, on-aircraft inerting, as one way to fulfill the intent of the regulation through Type Certificates for new aircraft and Supplemental Type Certificates for aircraft presently in service. This approach is a viable solution to the third proposal in the NPRM by enhancing fuel tank safety while continuously reducing the flammable vapors in the tank.

Full time inerting will never permit the oxygen level in the flammable vapors to support an explosion or fire. Thus full time, on-aircraft inerting minimizes the development of flammable vapors in fuel tanks and provides a means to prevent catastrophic damage by preventing ignition. The same technology that is available for the fuel tank inerting is also adaptable for cargo compartments. The same installation will inert fuel tanks, cargo compartments and inaccessible areas of the aircraft. In many installations a single source of inerting agent will accommodate the whole aircraft Aviation Safety Facilitators, Corp. is prepared to develop Supplemental Type Certificates (STCs) that will incorporate full time inerting technology which would not impose any operational limitations on a particular type of the aircraft.

The system is active at all times whether on the ground or in flight. The inerting system is self monitoring and the oxygen sensor is presently designed for a 60 calendar month in service life. Instructions for Continued Airworthiness will be provided with the STC. Installation of full time, on-aircraft inerting systems can be installed well within the time frame as proposed in the NPRM.

Full time, on-aircraft inerting systems would support the proposed change to of the title of part 25.981 from "Fuel tank temperature" to "Fuel tank ignition prevention." The safety analysis required by the new paragraph (a)(3) would be easier to accomplish, based on the installed inerting system, in the aircraft type being analyzed (Ref. Page 43). The ARAC received a briefing on full time, on-aircraft inerting and some economic data was available. At the time of the closing of the NPRM full time on-aircraft inerting is now a practical alternative. This inerting system will operate in a operational conditions and temperatures on the ground and in flight. Full time inerting minimizes the development of flammable vapors within the tanks even when the aircraft is parked with no external power source through the hot battery bus. We agree that part 25.981 should be revised to add the requirement that fuel tank installations be designed to minimize the development of flammable in the fuel tanks (Ref. Page 47). Full time, on-aircraft inerting does provide total prevention and is now feasible. Full time inerting does not require any fuel tank cooling to be completely effective (Ref. Page 48).

The proposed revision to AC 25.981 1A, "Guidelines for Substantiating Compliance With the Fuel Tank Temperature Requirements" needs to reflect the attributes of full time on-aircraft inerting before it goes out for public comments. This proposed revision to this advisory material should show that full time, on-aircraft inerting would be fully effective at any fuel tank temperature. We suggest that the draft revision be reviewed (Ref. Page 49). The ARAC report recommended that the FAA continue to investigate means to achieve cost-effective reduction in flammability exposure for newly manufactured and the existing fleet of transport airplanes. It was stated that the FAA intends to initiate rulemaking to address these airplanes if practical means are established. We contend that full time, on-aircraft inerting is this cost effective and a practical application that is available now (Ref. Page 50, First Paragraph).

The FAA has requested comments and supporting data on the "Costs of Future Fuel Tank Design Changes-Revised Part 25." Aviation Safety Facilitators, Inc. offers supporting data within this submittal to Docket No. FAA-1999-6411; Notice No. 99-18, (Ref. Page 59). We concur that although the proposed changes to part 25 would also affect future fuel tank system STCs, current industry design would not have a significant economic impact on a substantial number of small airplane manufacturing entities (Ref. Page 61, Second Paragraph). Full time, on-aircraft inerting systems will not require any changes in the proposed part 91.410, part 121.370 and part 125.248, Fuel tank system maintenance and inspection instructions, (Ref. Page 81,82, and 83). Within the new STC to enable the installation of the on-aircraft inerting system are instructions for continued airworthiness which specify a 60 calendar month maintenance cycle on the oxygen sensors. The rest of the system is proposed to be on condition and is self monitoring and reporting through the aircraft data busses. Information contained herein is offered to supplement the Preliminary Regulatory Evaluation, Initial Regulatory Flexibility Determination, and Analysis, Trade Impact Assessment, and Unfunded Mandates Act Determination for Proposed Rule: Transport Airplane Fuel Tank System Design Review, and Inspection and Maintenance Requirements, Office Aviation Policy and Plans Aircraft Regulatory Analysis Branch, APO-320, Allen A. Mattes, November 1998.

INERTING PROJECT

- Presentation By:

• AVIATION SAFETY FACILITATORS INC.

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FIRE SUPPRESSION
VIA
FUEL CELL VAPOR CONTROL
FIRE DETECTION

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FIRE DETECTION

System Developed By:

Mr. Kenneth A. Susko

FIRE SUPPRESSION
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FIRE DETECTION

Kenneth Susko's Experience:

- United Airlines, 20 Years Ground Equipment/Facility Maintenance.
- Consultant and Control Systems OEM, 25 Years.
- Military Experience:

  US Navy, four years active duty, Aircraft Engine Mechanic

  US Navy Reserve, 25 years Flight Crew

  P2V Flight Engineer, 15 years

  P3 A/B Submarine Warfare Technician, 10 Years
- US Patent #4986497 Owner - Aircraft Deicing Blending System
- Critique FAA Advisory on Handling of Airport Waste and Hazardous Materials - Comments were incorporated into Federal Regulation.

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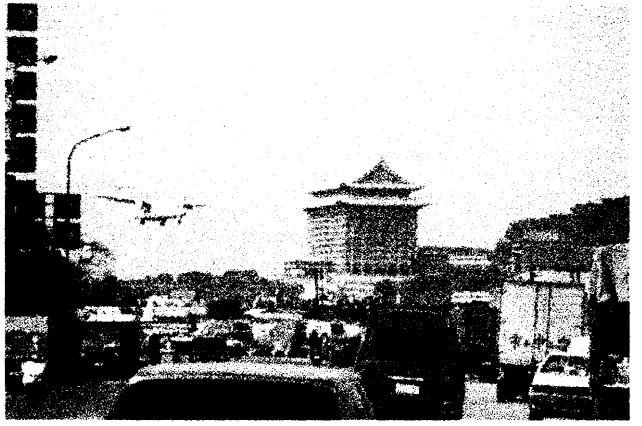

System Development Cooperative:

Mr. Kenneth A. Susko

Mr. Fred Workley - President, Workley Aircraft & Maintenance Inc.

Formerly National Air Transportation Association, Manager Maintenance Operations, and Washington Liaison.

Mr. Steven Kaplansky, Consultant, Government Relations.

FIRE SUPPRESSION
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FIRE DETECTION

Kenneth Susko, a consultant in the industry working in conjunction with Fred Workley of Workley Aircraft & Maintenance, Inc. has developed such a system. Mr. Susko's 29 years of aviation and military flight crew experience has resulted in a new suppression system design which will address explosive vapors in fuel cells as well as fires in inaccessible areas of both commercial and passenger aircraft. It is believed that Mr. Susko's design will be an answer to the government agency's as well as the public's concern for increase of flight safety.

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR CONTROL
FIRE DETECTION

The event of fires aboard passenger and/or cargo aircraft on the ground or in flight is the most serious problem facing industry today.

Public concern is continuously increasing over the aircraft industry's need to provide a safer fire suppression system aboard flights.

Recent aircraft disasters that have been caused by fires and/or explosions have resulted in increased pressure on the government to provide a solution.

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR CONTROL
FIRE DETECTION

Several recently publicized aircraft disasters include:

ValuJet 592	Everglades - Florlda
Federal Express	Stewart Airport - New York
TWA Flight 800	Long Island - New York

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR
CONTROL
FIRE DETECTION

Fires which occur in accessible areas can be contained and/or extinguished by the in-flight crew with proper extinguishing equipment.

Most of these accessible fires occur in the lavatory or gallery trash receptacles.

Fires which occur in areas inaccessible to the in-flight crew occur due to one or a combination of factors.

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR
CONTROL
FIRE DETECTION

Such factors include:

- Fuel vapors in fuel cells.
- Cargo shipments on passenger/cargo aircraft.
- Passenger baggage and cartons.
- Electrical.

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR
CONTROL FIRE DETECTION

- verview
- Recent Developments/Motivation Towards Solution
- Prime Areas of Concern
- Solution

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR CONTROL
FIRE DETECTION

Recent Developments/Motivations for Solutions:

- Increased Public Concern

- Montreal protocol banning use of Halon gas worldwide.

FIRE SUPPRESSION
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FIRE DETECTION

Recent Developments/Motivations for Solutions (continued):

- "Minimum performance standard lavatory trash receptacle automatic fire extinguisher" requirement DOT/FAA/AR-96/122.

- Revised standards for cargo/baggage compartments.

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR CONTROL
FIRE DETECTION

PRIMARY AREAS OF CONCERN:

- **Fuel Cells located throughout aircraft.**
- **Lavatory/Galley Trash Receptacles.**
- **Cargo Compartments and Lower Deck.**

FIRE SUPPRESSION
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FIRE DETECTION

Sealed Compartments-

- Federal Aviation Regulations
- Seal Damage
- Improper Maintenance

FIRE SUPPRESSION
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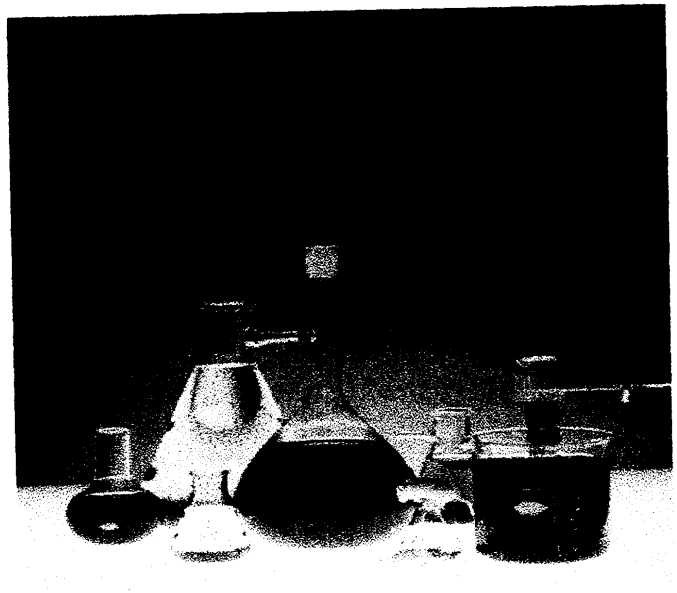
FIRE DETECTION

Solution

Utilization of existing inert gases and chemicals.



FIRE SUPPRESSION
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FIRE DETECTION

Utilization of existing inert gases and chemicals.

Advantages :

1. Familiarity with inert gases.

2. Minimizes training.

3. Government Agencies familiarity.

4. Reduction in Qualifications Testing.

FIRE SUPPRESSION
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FIRE DETECTION

Representatives from industry are responding to the National Transportation Safety Board's interest in new approaches to providing detection and fire suppression on commercial and passenger aircraft. Fires that are undetected or occur in inaccessible areas of the airplane cannot be extinguished by the crew. Control of explosive fuel vapors in the fuel cells must also be controlled. Therefore, any viable solution must address both issues.

Fire in inaccessible areas could occur from several sources. These include fuel vapors in fuel tanks, cargo shipments on passenger and cargo aircraft, passenger baggage, cartons containing flammable agent, and from electrical sources.

FIRE SUPPRESSION
VIA
FUEL CELL VAPOR CONTROL
FIRE DETECTION

By installing state of the art oxygen analyzers in various points in the fuel tanks, the mixture of fuel vapor and oxygen can be continuously and remotely monitored. When the mixture is combustible an alarm condition would exist. At that point, the alarm generated by the oxygen analyzer would open a valve and inject an inert gas into the specific fuel cell. When the oxygen is displaced by the inert gas a non-combustible condition will exist, the valve will close and the alarm condition will no longer exist. Metering of the inert gas is automatic and can occur both on the ground and in flight. A newly designed cylinder would partially reduce the weight of the gas cylinders which will be constantly checked and monitored.

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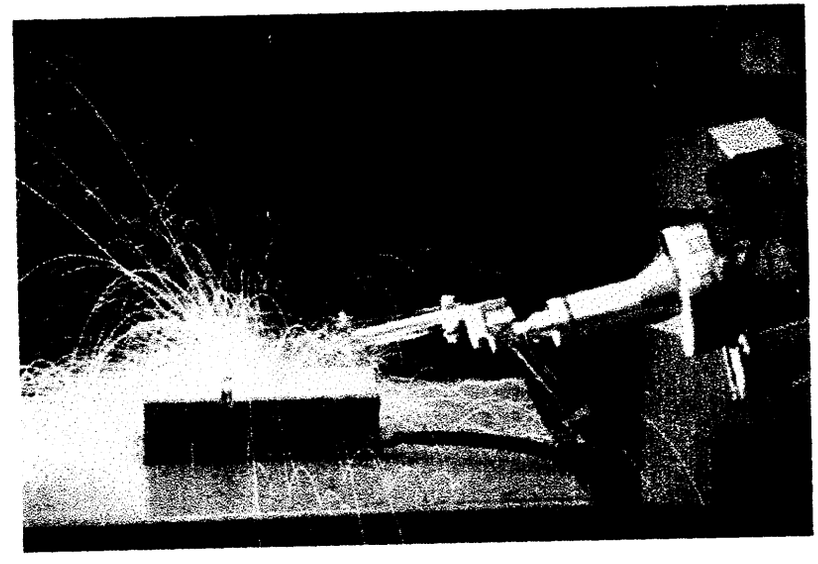
FIRE DETECTION

Modified Design of Gas Cylinders.



FIRE SUPPRESSION
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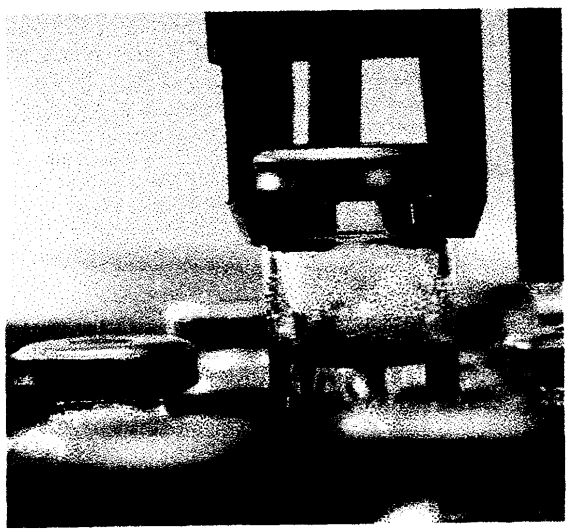
FIRE DETECTION

Advantages of Modified Cylinders:

- Weight
- Monitoring
- Servicing
- Maintenance



FIRE SUPPRESSION
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FIRE DETECTION

Therefore industry representatives see the use of an inert gas as a solution to keep the oxygen level below the ignition point and preventing combustion as an acceptable alternative to Halon gas which was banned by the Montreal protocol. Such an inert gas has been used for many years as a fire extinguishing agent in the aviation industry. The use of said inert gas appears to be a promising solution to the NTSB's efforts to save lives and to protect property by detecting and suppressing fires aboard aircraft.

FIRE SUPPRESSION
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FIRE DETECTION

Summarization:

Causes-

Recent Aircraft Disasters

Increased Public Concern

Solution-

Replacement of Halon/Water

Replacement of Cylinder

Methods-

Use of inert gas and chemicals.

Modified Cylinder Design.

FLY FIBER PROJECT

- Presentation By:

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Fly Fiber

Application of

Fiber Optic Sensor Technology

for

Safety Monitoring in Aviation Applications

To Fly Fiber Optic Sensors

Aviation Safety Facilitators

Agenda

- Introduction
- Aviation Issues
- Technology Issues
- Cargo Hold Solution
- Sensors
- Controllers
- System
- Fuel Tank Solution
- Sensor Demonstration

Introduction

- **Aviation Safety Facilitators**
- **Technical Consortium formed to address certain aircraft safety issues which require monitoring systems**
- **Present safety issues and proposed solutions for fuel tank and cargo hold fire hazards**
- **Demonstrate the core technology**

Aviation Issues

- **Fire has been the cause, or effect, in several well publicized accidents.**
- **Fire suppression systems do not provide adequate cockpit feedback**
- **Fire requires fuel, ignition and source of Oxygen, the first two cannot be eliminated, so Oxygen source must be targeted**
- **Industry has weight concerns which must be addressed**
- **Industry has serviceability concerns which must be addressed**

Technology Issues

- All Oxygen elimination systems eventually require Oxygen measurement
- Sensor technologies have (historically) been too complex, or inappropriate for aviation applications - short life, pressure sensitive, temperature sensitive
- Fiber Optic Spectroscopy offers first viable monitoring solution for airborne systems

Cargo Hold Problem

- Current fire suppression systems do not include proactive control of release of suppressant based on monitoring
- ALPA has complained that pilots do not have feedback of cargo space conditions after fire suppressant has been released
- Once the fire detection and suppression system has been activated there is insufficient information available to make emergency decisions

Cargo Hold Solution

- A system can be installed to monitor cargo space Oxygen, feed the information to the cockpit and, possibly, manage timed release of suppressant
- The monitoring system will allow the cockpit crew to make data based emergency in flight decisions
- The monitoring system will provide additional benefits of increased data to flight recorders and flight analysis systems