Aviation Fire Dynamics

Introduction

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The study of the fluid dynamics, heat transfer, and thermochemistry as they relate to ignition and propagation of fire in fuel and air regulated phases, and dealing with the variables in pre and post flashover fire development.
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Purpose

• To provide a scientific study of hostile fires applying physics, chemistry, and engineering principles with the objective of quantitatively describing fire and related processes.

• To provide a better understanding of the Safety/Survivability of transportation vehicles.
  – Aerospace
  – Ground
  – Marine

• Enhance Search and Rescue Operations
Course Outline

1) An Overview of Combustion
   – The combustion process
   – Chemistry of combustion

2) Flammability Limits and Premixed Flames
   – Flammability limits
   – Structure & heat loss from of premixed flames
   – Burning velocity and its variation

3) Diffusion Flames
   – Laminar flames
   – Turbulent flames

4) Fire Plumes
   – The structure of fire plumes
   – Conditions effecting fire plume development

5) Fluid Dynamics & Heat Transfer of Steady Burning:
   – Solid fuels
   – Liquid fuels
   – Gaseous fuels
6) The Ignition Process
   – Ignition of flammable vapor/air mixtures
   – Ignition of liquid fuels
   – Ignition of solids
   – Spontaneous ignition of solid fuels
   – Hot surface ignition
   – Flame extinction

7) Flame Spread
   – The phenomenology of flame spread

8) Combustion Modes
   – Spontaneous combustion
   – Smoldering combustion
   – Glowing combustion

9) Pre-Flashover Compartment Fire
   – Definition of flashover
   – The growth and development of flashover

10) Post-Flashover Compartment Fires
    – Define the burning regimes
    – Fully developed fire behavior
Resources

• An Introduction to Fire Dynamics
  – By Dougal Drysdale

• Principles of Fire Behavior
  – James G. Quintiere

• Fire Dynamics: Introduction
  – By Larry Krammer (Fall 2003)
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    University of Cincinnati