US Army PEO Aviation Halon Replacement Program

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Overview

- PEO AVN HR IPT Overview
- Program Objectives
- RAH-66 Comanche
- AH-64 Apache
- CH-47 Chinook
  - Ground Test
  - Flight Test

Program Overview

- Army policy – Eliminate ODC Dependency
- PEO Aviation sponsored
  - Inviting all relevant stakeholders from onset
    - All Army Aviation PMs
    - Aviation Engineering Directorate (AED)
    - 46th Test Wing (Wright Patt AFB)
    - US Army Center for Health Promotion and Preventative Medicine (CHPPM)
    - Assistant Sec Army Acq Log Tech ASA (ALT)
    - Manufacturers – Boeing, Sikorsky

Program Objectives

- Initial goals
  - Identify 1 common agent for all Army aviation systems
  - Minimize weight increase
  - Minimize cost
  - Minimize GWP/ODP
- 3 Phase fire and concentration tests

3 Phase Program

- Phase I –
  - Industry wide agent search,
    - HFC 125, CF3I, Novac 1230, HFE 7100, SPGG, HFE
  - Limited fire testing in generic simulator
    - Evaluate effectiveness at extreme temperatures
  - Aerojet review of SPGG and HFE
  - Cursory toxicity screen & material compatibility
  - Design and fabricate system simulator
  - Initial down select to phase II agents

Phase II

- Full testing of agents from Phase I
  - HFC 125, SPGG, SPGG Hybrid
  - Rotorcraft specific nacelle and airflows
  - Hot surfaces to actual engine temps
- Material compatibility coupon testing
- Toxicity study – No testing
- Down select to 1 common agent
- Independent Review Committee
  - NAVAIR, NIST, Boeing, Army IPT
- HFC – 125 selected as single agent

HFC -125 Selection

- Other agents possibly more effective but greater overall cost
- CF3I
  - Significant toxicity testing
  - Final approval - Uphill battle
- SPGG & Hybrid
  - Did not show weight saving over 125
- Active agent SPGG not tested

Comanche

- 0 and 160 flight conditions
- Hot and cold temp
- Initial concentrations required over 6 pounds of agent
- System design and optimization
  - Discharge nozzle design
  - 600 and 800 psi bottle pressure
- Final agent weight 3.25

Apache

- Fire Testing
  - Designed and built engine and nacelle simulator
  - Approximately 10lb/sec airflow
  - 3 initial fire locations
  - 3 out of 3 – no re-lights
- Concentration testing
  - 28 – 33% concentration required

Chinook

- Limited to Concentration testing
  - Fire test impractical
    - Unable to determine airflow dynamics
      - Large screened openings in cowlings for cooling
      - Numerous flow sources – bleed band, rotor tip vortices'
    - Impractical to build simulator able to replicate actual conditions
  - Concentration testing
- 2 Phase – Ground and Flight Test

Chinook

- Concentration testing
  - Based on TDP Equations
    - 26% concentration required to extinguish fires
    - 6 pound HFC – 125 required to achieve 26%
  - Current system designed for 3 pounds of halon
  - Limited redesign required to accommodate increased agent

Chinook, System Redesign

- Bread Board Testing
  - Conducted at Pacific Scientific to determine plumbing size required for 6 – 8 lbs of 125
  - Maximum discharge time 1 second
  - Enlarge plumbing to 1 in. with varying size ends.

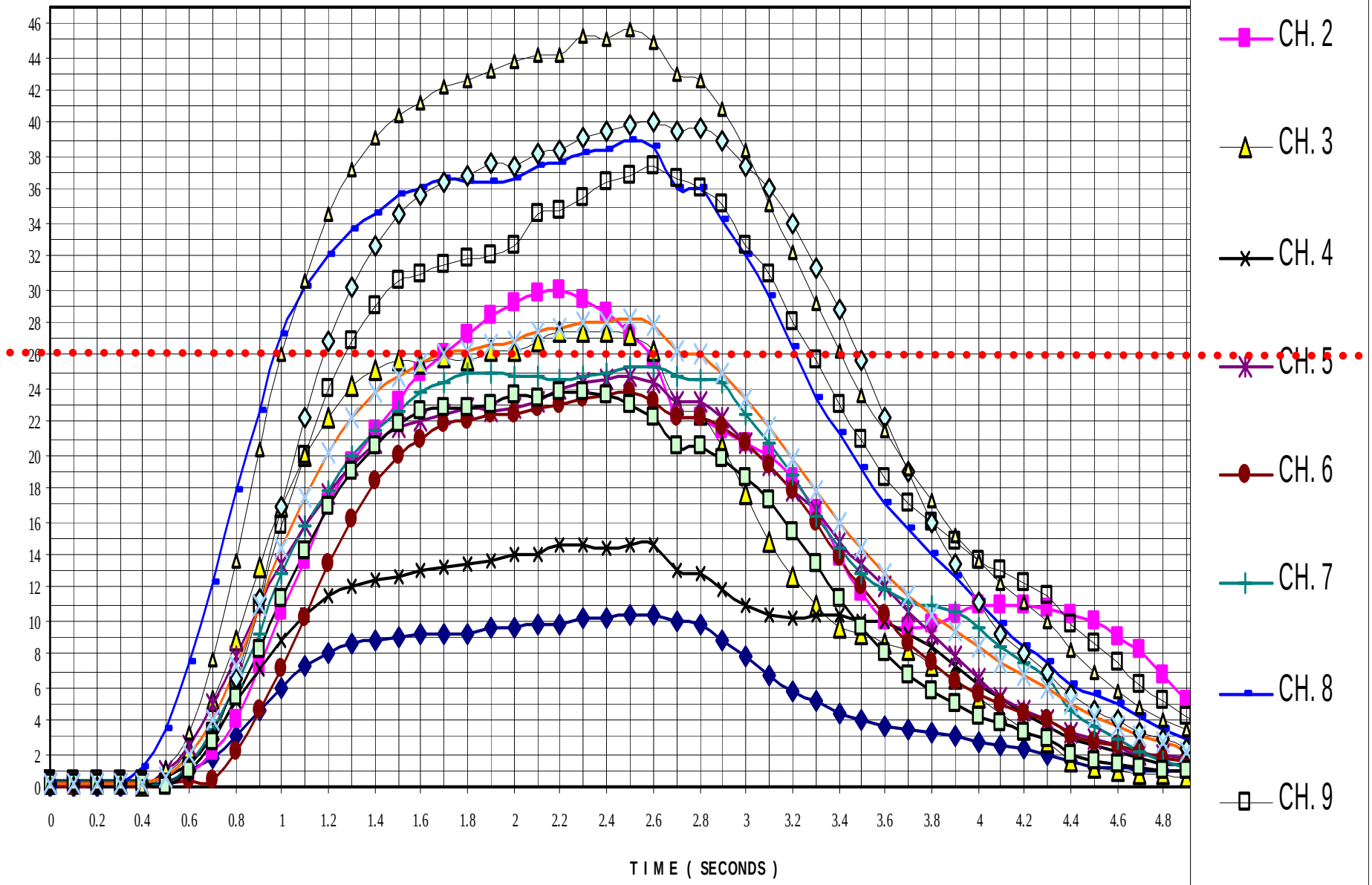
Chinook

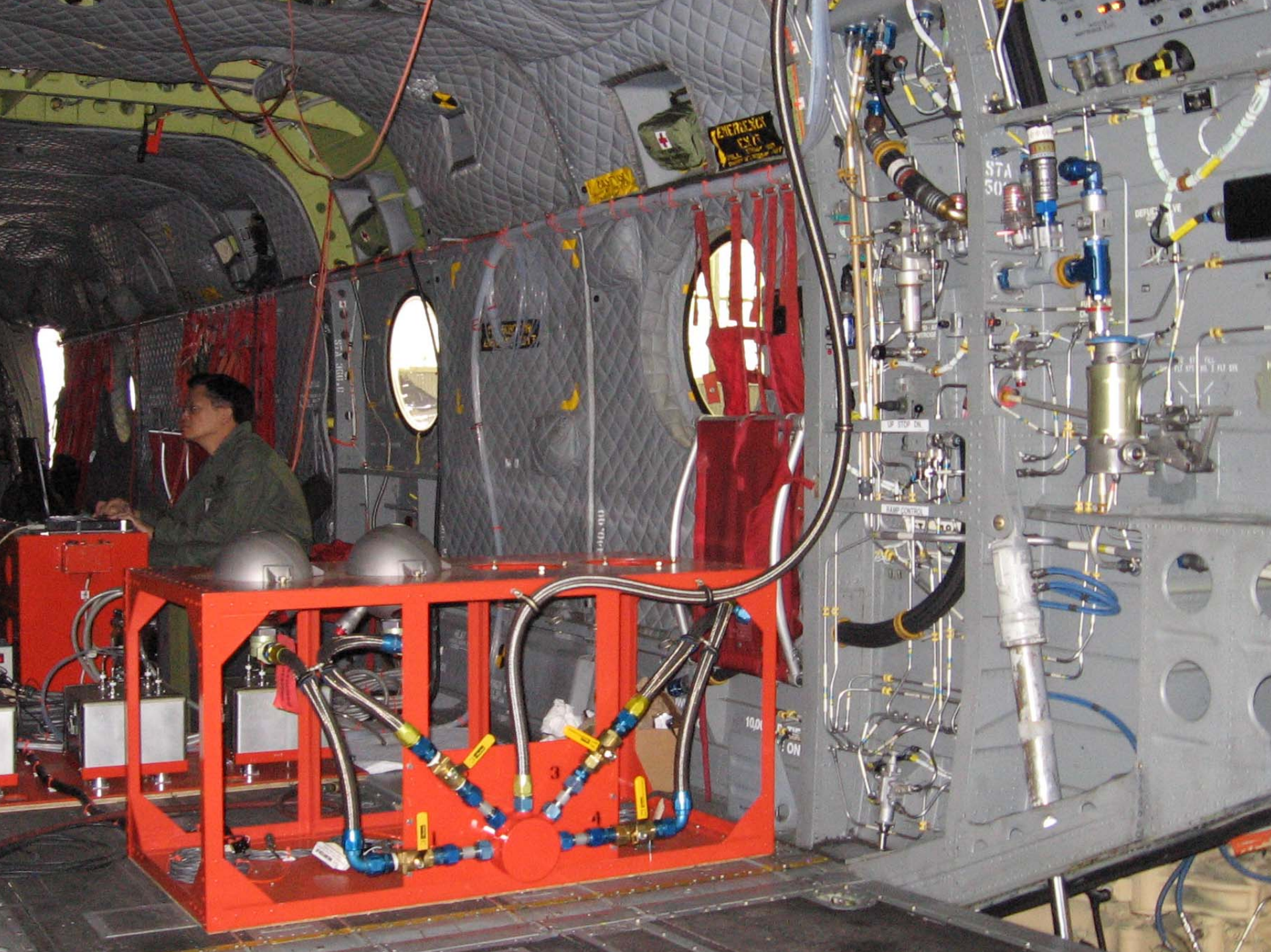
- Ground test
  - Replicate conditions in 1969 Boeing study
  - Engines power - 92% n1
  - Discharge sequence – simulated normal EPs
    - Power Control lever off
    - 2 Second delay
    - Bottle discharge
  - Engine speed 60% n1 at discharge
  - System optimization

"%VOLUMETRIC CONCENTRATION vs. TIME

CH47 WITH ENGINE ON AT SEA LEVEL. DISCHARGE TEST WITH 8LBS HFC-125

Pacsci Test No. V306 Date : March. 16, 2006"

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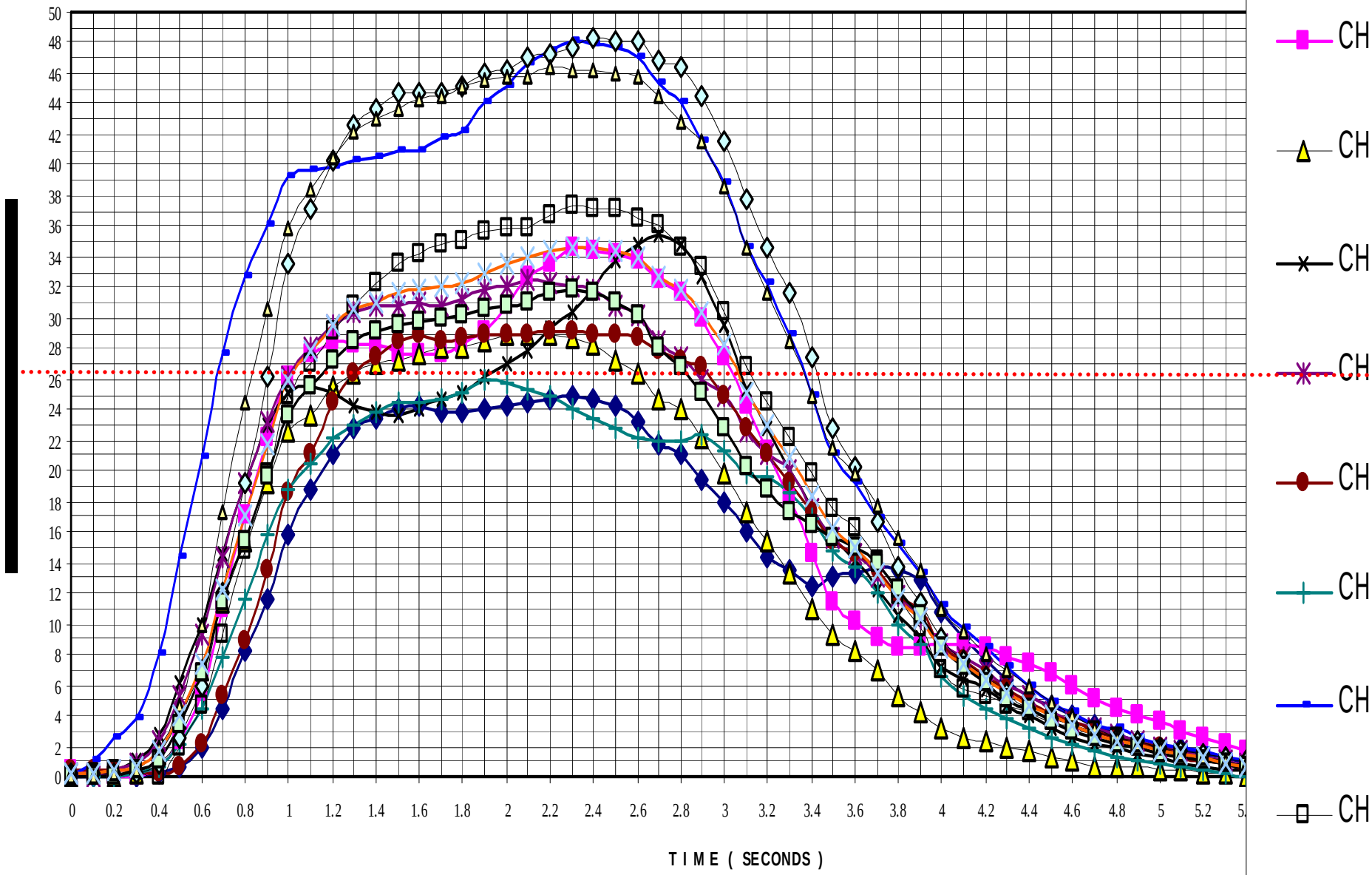
"%VOLUMETRIC CONCENTRATION vs. TIME

CH47 WITH ENGINE ON AT SEA LEVEL. DISCHARGE TEST WITH 8 LBS HFC-125

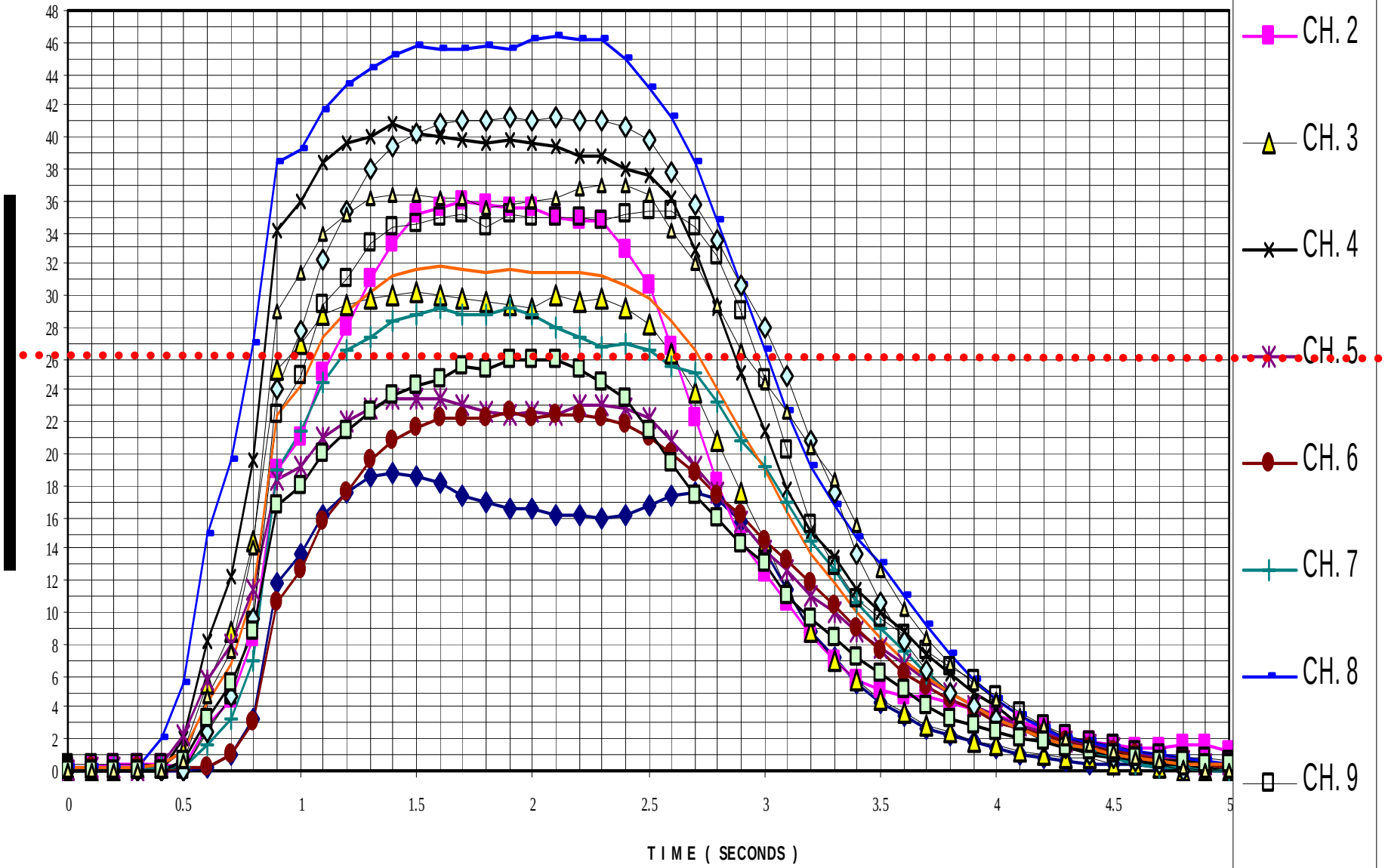
Pacsci Test No. V314 Date : March. 21, 2006"



"%VOLUMETRIC CONCENTRATION vs. TIME

CH47 WITH ENGINE ON AT SEA LEVEL. DISCHARGE TEST WITH 8LBS HFC-125

Pacsci Test No. V355 Date : May. 02, 2006"



Path Forward

- Further work on distribution system needed
- Research on internal modification to maintain concentration levels

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