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# AIRCRAFT FLAMMABILITY

# FULL SCALE POOL FIRE TESTS

## OUTLINE

- PRIMARY OBJECTIVES
- THREE PHASE PROGRAM
  - OBJECTIVES
  - APPROACH
  - ENVIRONMENTAL CONSIDERATIONS
- SCHEDULE
- STATUS OF REQUIRED MATERIALS
- OPTIONS TO COMPRESS SCHEDULE

## PRIMARY OBJECTIVES

- CONDUCT FULL SCALE TEST WITH 737 FUSELAGE BY END OF 1980
- DEMONSTRATE EVACUATION TIME INCREASE TO 5 MINUTES MINIMUM
- SHOW THAT EXTERIOR FIRE WILL NOT PENETRATE AN INTACT CABIN FOR 5 MINUTES
- SHOW THAT CLOSED CABIN WILL NOT HAVE EXCESS SMOKE OR TEMPERATURES ABOVE 400°F
- DEMONSTRATE THAT FIRE IN CABIN OPENING WILL NOT PROPAGATE THROUGHOUT CABIN

## THREE PHASE PROGRAM

- PHASE I

  CHARACTERIZE AND SIZE POOL FIRES FOR SUBSEQUENT TESTS

- PHASE II

  TEST THREE 10' X 10' FUSELAGE PANELS AT 45° ANGLE OVER POOL FIRE

- PHASE III

  CONDUCT FULL SCALE TEST(S) W/737 FUSELAGE

## PHASE I - POOL FIRE CHAPACTERIZATION

- OBJECTIVES

  - MEASURE THERMAL OUTPUT OF 5' X 5', 10' X 10', AND 15' X 15' POOL FIRES (VARIES W/FUEL AREA AND DEPTH)

  - DETERMINE FIRE GEOMETRY (HEIGHT, WIND EFFECTS)

  - DETERMINE MINIMUM SIZE POOL FIRE FOR 10' X 10' PANEL TESTS (HEAT FLUX $\geq$ 14 BTU/FT$^2$ - SEC TEMP $\geq$ 1600$^{o}$F)

  - IMPROVE IGNITION TECHNIQUES (JET A1 RELATIVELY DIFFICULT TO IGNITE)

  - PROVIDE DATA FOR SELECTION OF FULL SCALE POOL FIRE FOR 737 TEST AND VERIFICATION OF FIRE SEVERITY

# PHASE I

## APPROACH

- USE EXISTING JSC FIREFIGHTERS TRAINING SITE (TTA HAS PORTABLE DATA ACQUISITION EQUIPMENT AVAILABLE)
- INSTRUMENT WITH CALORIMETERS AND TC'S
- UPGRADE CURRENT IGNITION TECHNIQUE TO PROVIDE RAPID FIRE SPREAD OVER POOL SURFACE (SWITCH TO JP4 IF SIGNIFICANT IGNITION PROBLEMS OCCUR)
- EIGHT TO TEN TESTS (FIVE TO TEN MINUTE DURATION)

## ENVIRONMENTAL CONSIDERATIONS

- PROBLEM—AIRCRAFT FUEL FIRE PRODUCES CONSIDERABLE BLACK SMOKE
- CONSIDERATIONS
  - SMOKE CONSISTS MAINLY OF CARBON PARTICULATES
  - LOW LEVEL OF TOXIC GASES (MAINLY CO)
  - TESTS OF SHORT DURATION AND LIMITED IN NUMBER

    BECAUSE OF IGNITION TECHNIQUES DEVELOPED BY TTA, AVAILABILITY OF INSTRUMENTATION AND NEED FOR REAL TIME DECISIONS AND MODIFICATION TESTS SHOULD BE RUN AT JSC
  - TTA IS FUNDED TO SUPPORT PROGRAM

## PHASE II - PANEL TESTS

### OBJECTIVES

- PROVIDE VERIFICATION OF FIRE BARRIER MATERIALS
- VERIFY INSULATION RETENTION TECHNIQUES
- MEASURE TEMPERATURES ACROSS TEST PANEL

### APPROACH

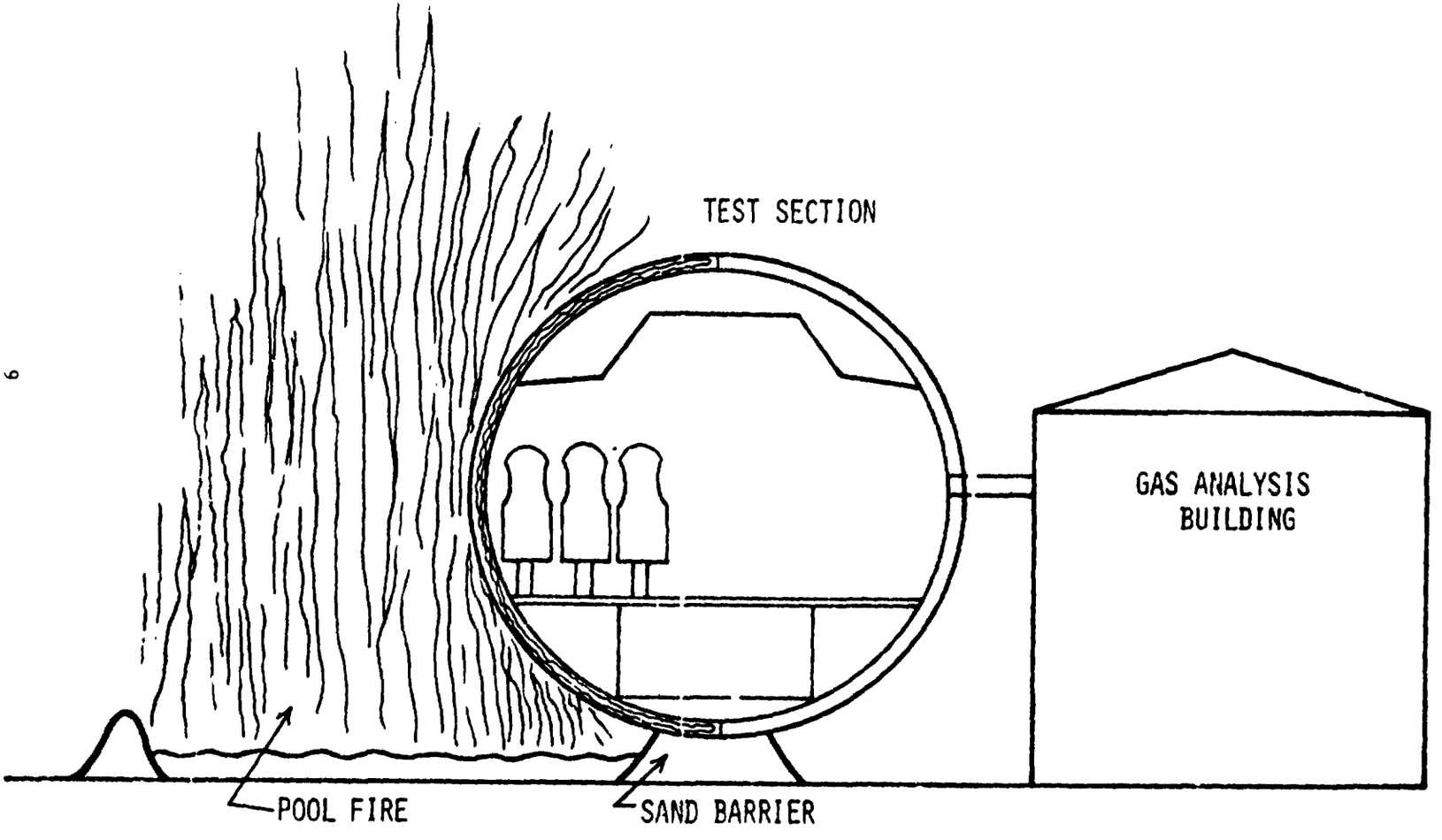
- FABRICATION AND ASSEMBLY OF COMPLETE PANEL BY AIR RESEARCH
- SELECT POOL SIZE FROM PREVIOUS TESTS
- INSTRUMENT AND INSTALL PANEL AT 45° ANGLE
- PROTECT PERIPHERY OF TEST PANEL TO PREVENT FIRE ON BACK SIDE OF PANEL
- MAXIMUM OF THREE CONFIGURATIONS

## PHASE III - FULL SCALE TESTS

APPROACH

- REFURBISH 20 FOOT SECTION OF 737 WITH SELECTED MATERIALS (AIR RESEARCH)
- USE EXISTING SITE OF 737 AND GAS ANALYSIS SHACK (NO PERSONNEL IN SHACK DURING TEST)
- PREPARE POOL WITH BANK SAND DIKES ADJACENT TO TEST SECTION (ALPHA CONSTRUCTION)
- BUILD SAND BULKHEAD UNDER CENTER LINE OF FUSELAGE FULL LENGTH TO RESTRICT FIRE TO ONE SIDE OF FUSELAGE (ALPHA CONSTRUCTION)
- PROVIDE PROTECTION TO GAS ANALYSIS SHACK IF INDICATED FROM PHASE I FIRE GEOMETRY (INSULATED BULKHEAD, WATER SPRAY, FIRE DEPARTMENT STANDBY)

FULL SCALE TEST CONFIGURATION



## FULL SCALE TEST SCHEDULE

- FULL SCALE TEST OBJECTIVES SUGGEST SECOND TEST (LOW SMOKE, TEMPS>5 MIN, VERSUS FIRE IN CABIN OPENING)
- FIRST FULL SCALE TEST SCHEDULED FOR SEPTEMBER 1980
- REFURBISHMENT FOR SECOND TEST WOULD TAKE AN ADDITIONAL 6 MONTHS (COMPATIBLE W/SCHEDULE PRESENTED 4/78)
- PACING ITEM IS INITIATION OF AIR RESEARCH CONTRACT

SCHEDULE RESPONSIBILITY _____

STATUS RESPONSIBILITY _____

# MILESTONE SCHEDULE

RTOP NO.: 510

RTOP TITLE: FIRE RESISTANT MATERIALS ENG.

4 LEVEL

ORIGINAL MANAGER'S APPROVAL _____ (DATE)

LAST SCHEDULE CHANGE _____ (DATE) (NO.) (INITIALS)

STATUS AS OF _____ (DATE) (INITIALS)

| | MILESTONES | CY 19 79 | | | | | | | | | | | | CY 19 80 | | | | | | | | | | | | CY 19 81 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| 1 | AIR RESEARCH CONTRACT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | POOL FIRE TESTS (PHASE I) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | FABRICATION OF TEST PANELS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | ASSEMBLE, INSTRUMENT, AND TEST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | OF 10' X 10' PANELS (PHASE II) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | REFURBISH 737 (AIR RESEARCH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | -PROCURFMENT OF GFE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | -PROCUREMENT OF CFE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | -FABRICATION AND INSTALL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | FULL SCALE TEST (1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | -INSTRUMENT & CHECKOUT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | -CONDUCT TEST (PHASE III) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | SECOND FULL SCALE TEST (DOOR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | OPEN) (PHASE III) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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NOTES:

FIRE BARRIER DECISION DATE

FINAL DECISION DATE

TASK NUMBER

TITLE

CURRENT NUMBER/CODE

RESEARCH AND TECHNOLOGY OBJECTIVE AND PLAN (CONTINUATION SHEET)

MSC Form 300A (Feb 71) NASA — MSC