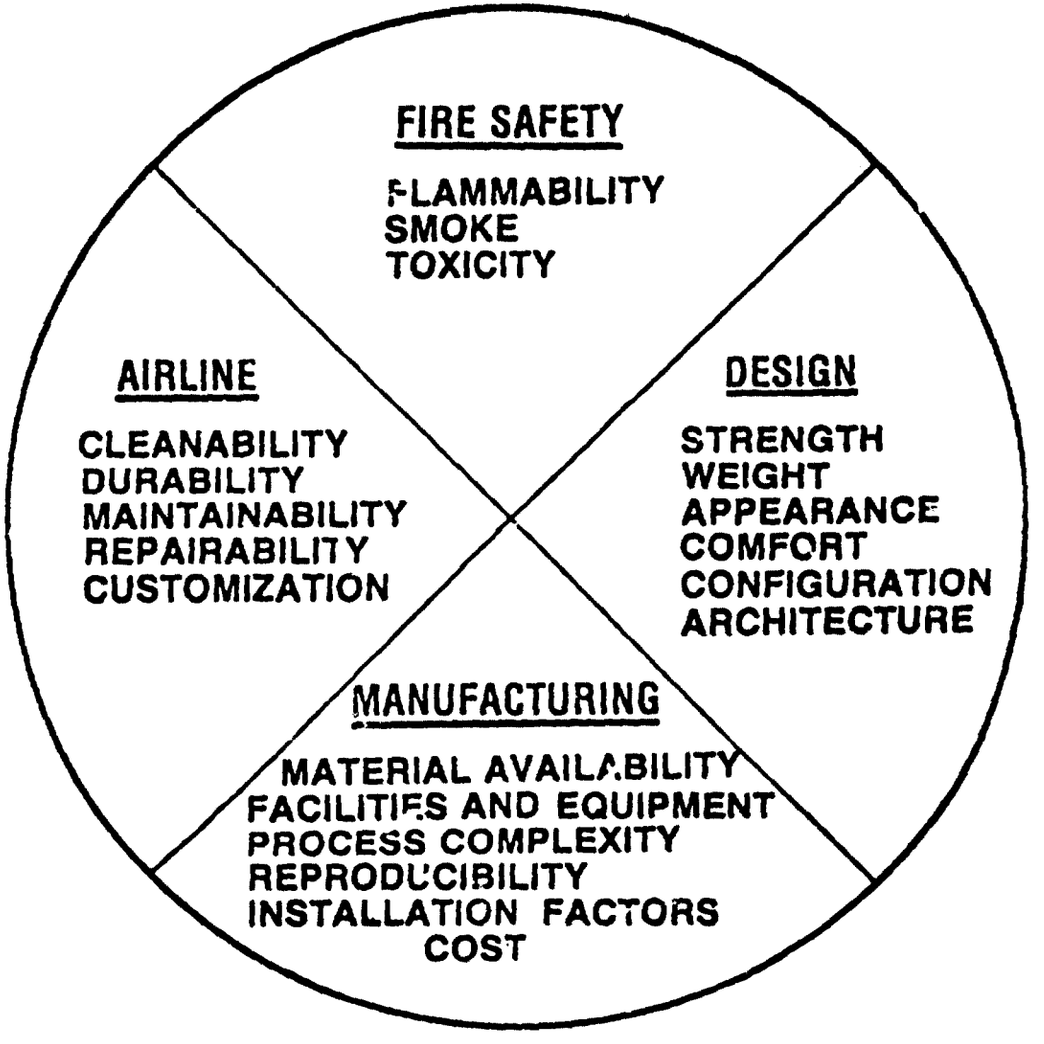
E. BARA

A REVIEW OF BOEING INTERIOR MATERIALS AND FIRE TEST METHODS DEVELOPMENT PROGRAMS

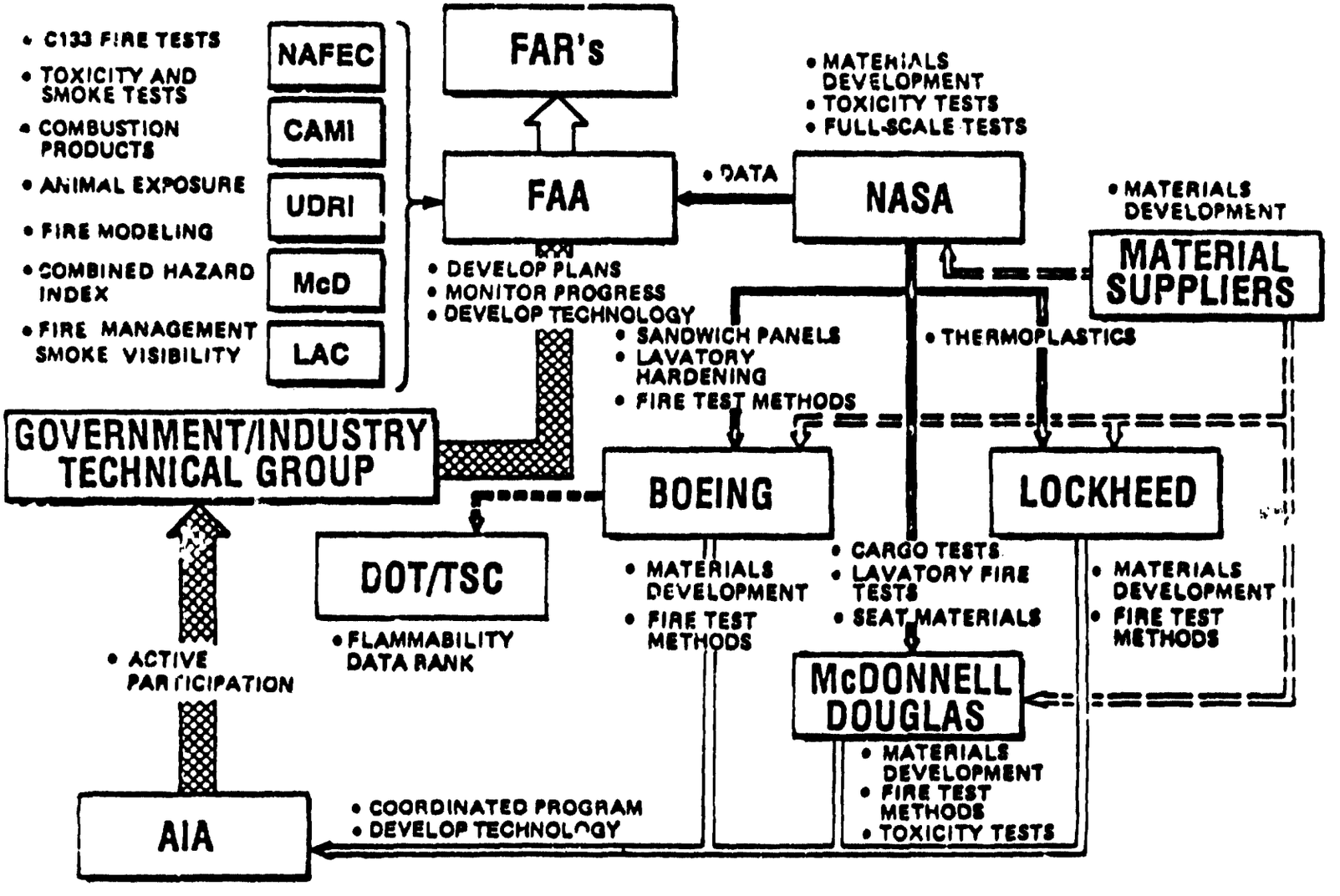
FEBRUARY 1979

TOTAL MATERIALS SYSTEMS REQUIREMENTS

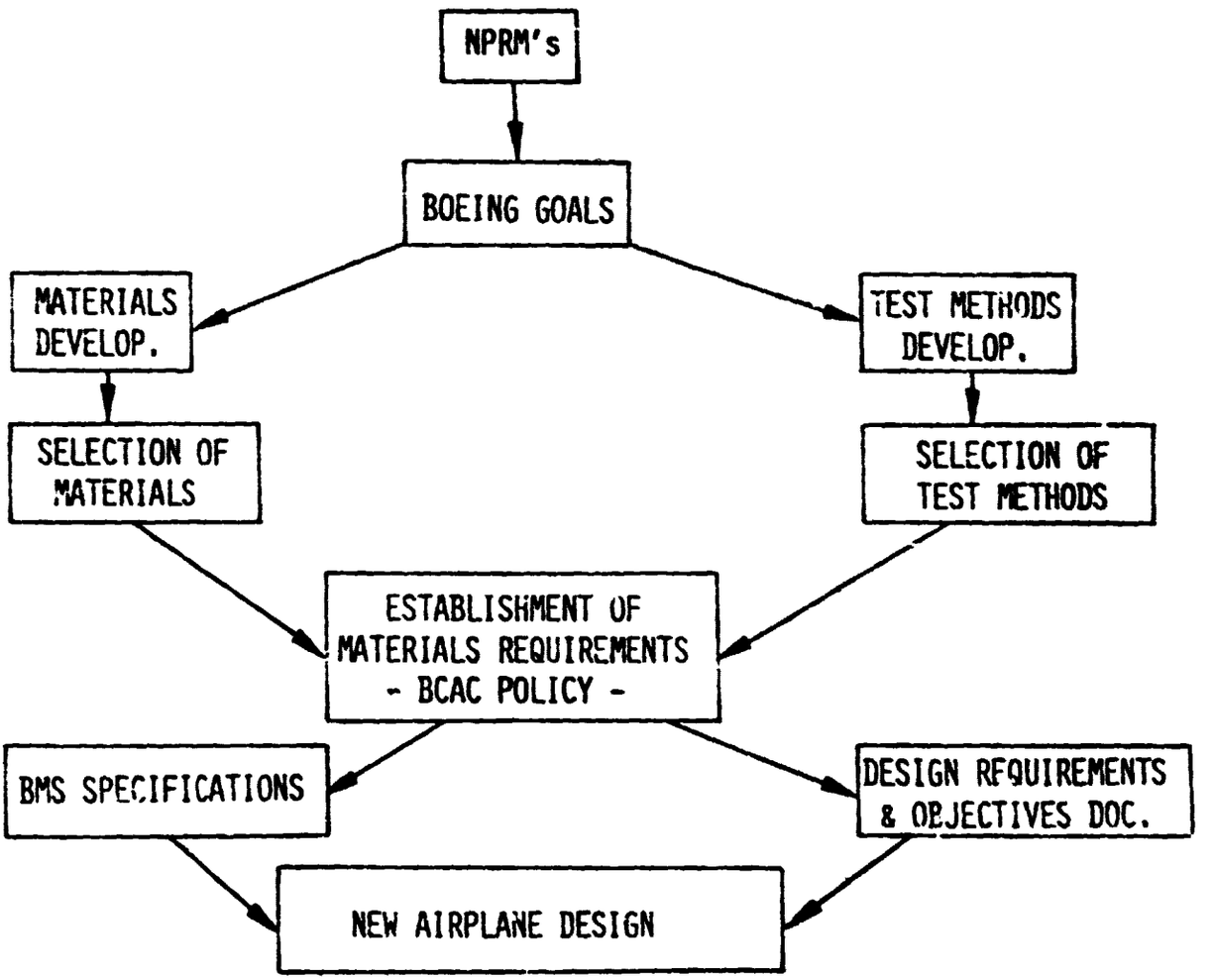


GOVERNMENT AND INDUSTRY PROGRAMS

PRESENTED AT FAA HEARING NOVEMBER 1977



INTERIOR MATERIALS DEVELOPMENT



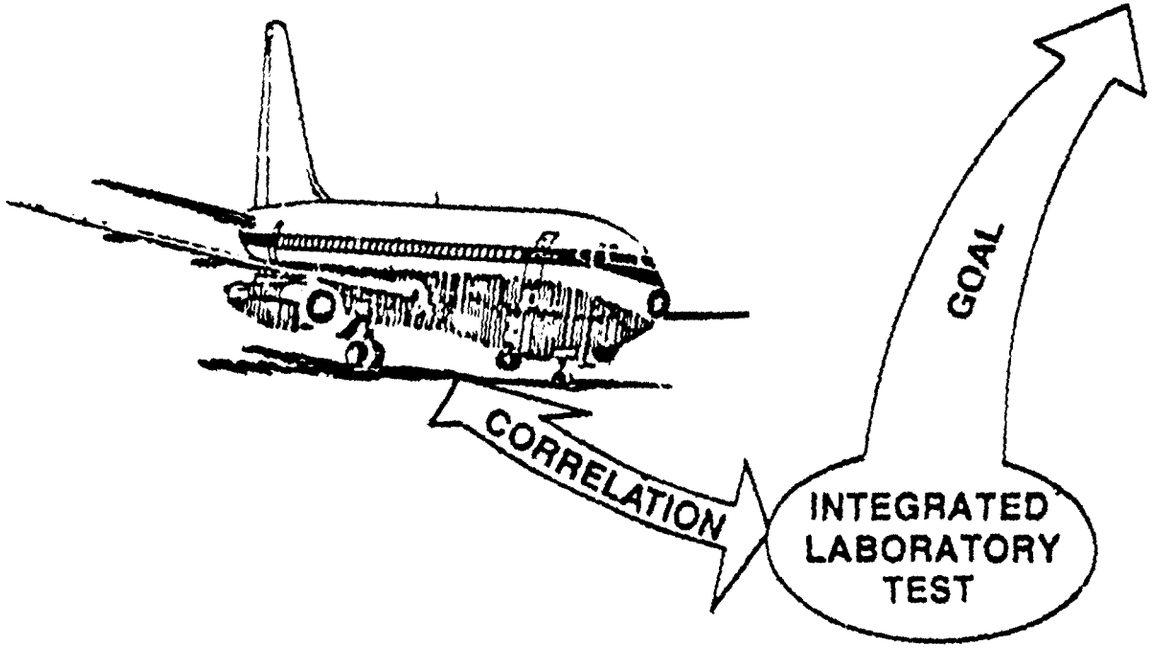
A NEW TEST METHODOLOGY CONCEPT

CABIN ENVIRONMENT TOLERANCE LIMITS

- TEMPERATURE
- VISIBILITY
- TOXIC GAS CONCENTRATION
- OTHERS

FUTURE MATERIALS

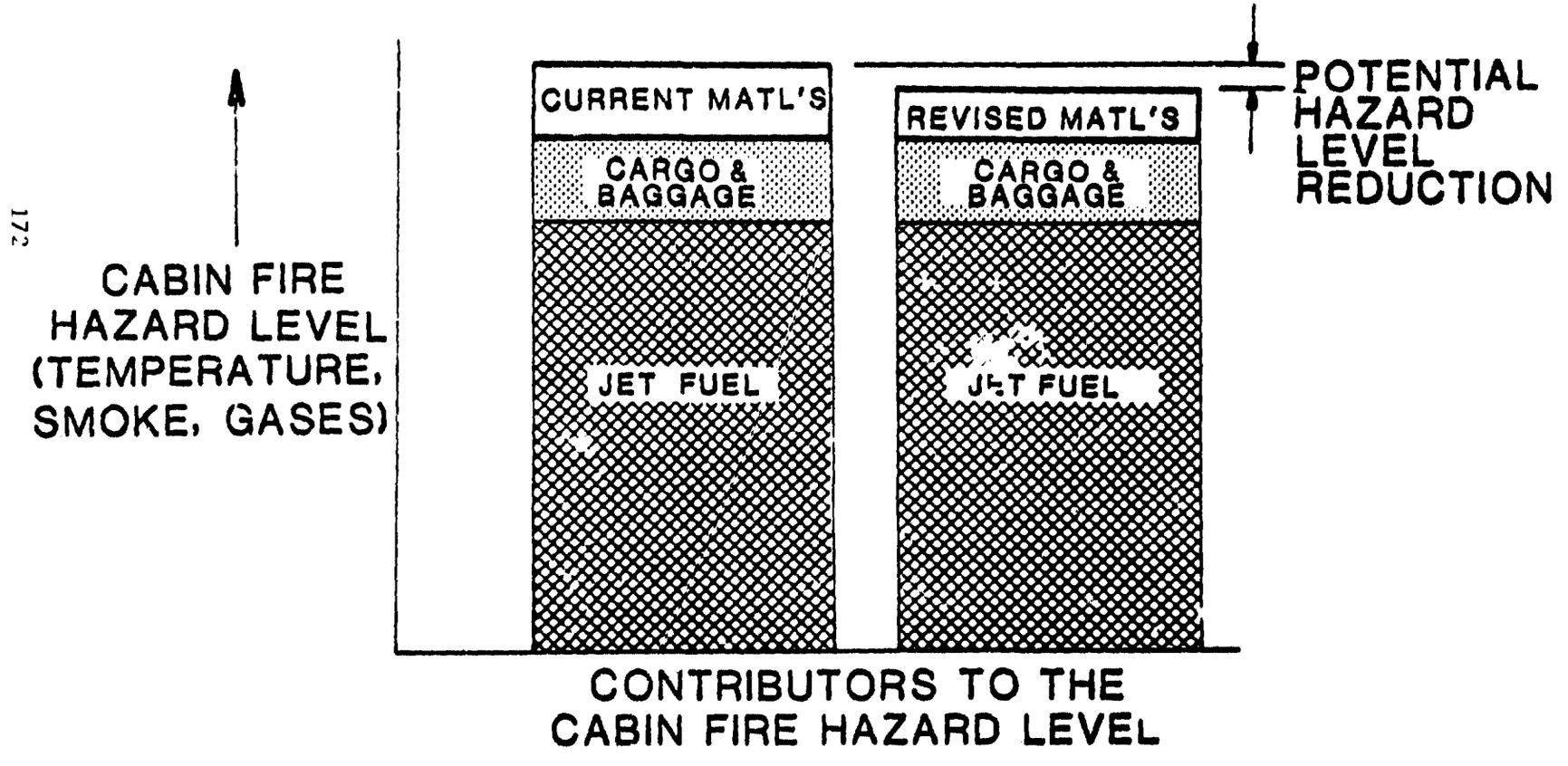
SELECTION BASED ON PREDICTED MATERIAL PERFORMANCE IN CABIN FIRE ENVIRONMENT



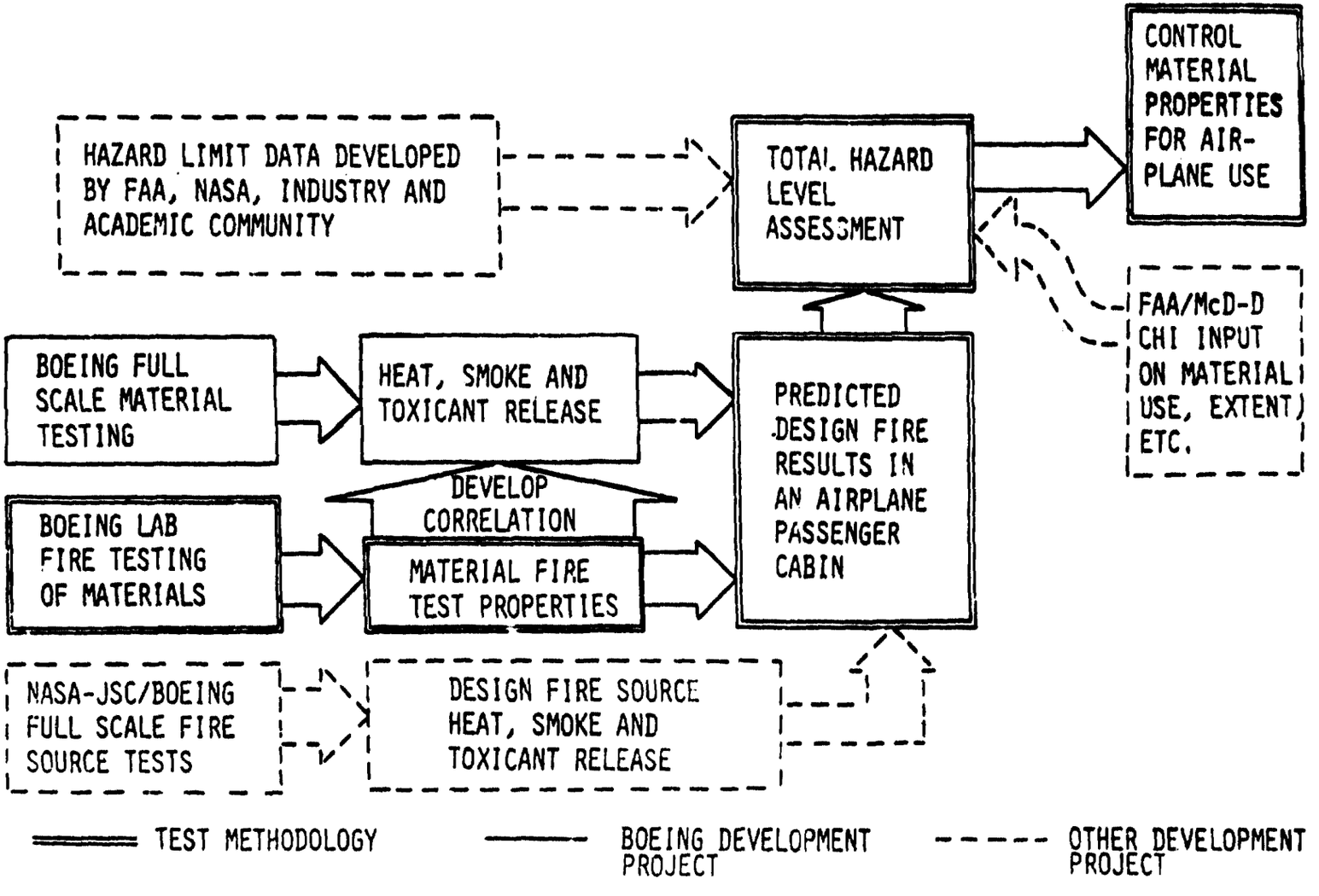
MATERIALS' PROPERTIES

- HEAT RELEASE
- SMOKE RELEASE
- TOXIC GAS EMISSION
- FLAMMABILITY
- OTHERS

POTENTIAL DECREASE IN FIRE HAZARD LEVEL
-POST CRASH FIRE-



BOEING FIRE TEST METHODOLOGY DEVELOPMENT



FIRE TEST METHODOLOGY PROGRESS

- ESTABLISHED DESIGN FIRE SOURCES (NASA CONTRACT NAS9-15168)

- SELECTED OSU APPARATUS AS POSSIBLE TEST METHOD FOR PREDICTION OF HEAT AND SMOKE IN AN AIRPLANE FIRE (REQUIRES FURTHER REFINEMENT)

- NEED MAJOR EFFORTS IN TOXICANT MEASUREMENT AND TOXICITY LIMITS

FLAMMABILITY, SMOKE AND TOXICITY GOALS

FLAMMABILITY

- FAR 25.583 AMMENDMENT 25-32
- FLAME SPREAD INDEX MAXIMUM 25
  - APPARATUS-ASTM E 162

SMOKE

NBS CHAMBER, 2.5 WATTS CM^2 HEAT FLUX:

4.0 MINUTES

- LARGE AREA, D_S MAXIMUM 50
- SMALL AREA, D_S MAXIMUM 200

TOXICITY

NBS SMOKE CHAMBER

GAS EMISSION (PPM) TIME	CO	HCN	HF	HCl	SO_2	NO_2
1.5 MINUTES	3000	100	150	50	30	50
4.0 MINUTES	3500	150	150	500	100	100

SCOPE - MAJOR MATERIALS SYSTEMS

DECORATIVE SANDWICH PANELS	FLEXIBLE DUCTS AND TUBING
COMPRESSION MOLDED FG.	FIBERGLASS LAMINATES
THERMOPLASTICS	FLEXIBLE FOAMS
TRANSPARENCIES	CARPETS AND UNDERLAYS
INSULATION AND COVERINGS	RIGID FOAMS
SANDWICH AIR DUCTS	CARGO LINING
UPHOLSTERY FABRICS	

SCOPE - SECONDARY MATERIALS SYSTEMS

HIGH PRESSURE LAMINATES

COATED FABRICS

DRAPERY FABRICS

FLOOR COVERINGS

ELASTOMERS

SEALANTS AND ADHESIVES

ADVANCED COMPOSITES

FLOOR PANELS

POTTING COMPOUNDS

METAL LAMINATES

NEW MATERIAL/CURRENT MATERIAL COMPARISONS (EXAMPLES)

	SMOKE RELEASE			FLAME SPREAD & HEAT RELEASE				TOXICITY
	NBS D_s ①	OSU D_s ②	F.S. * 10^2 lb ③	ASTM E-162 Q	ASTM E-162 I_s ④	OSU J/CM^2 ⑤	F.S. * 10^6 J ⑥	NBS GOAL ⑦
FLEXIBLE DUCTING								
CURRENT	35.9	37	-	1.5	43	250	-	PASS
NEW	9.3	17	-	1.65	5	91	-	PASS
COMPRESSION MOLDED F.G.								
CURRENT	235-295	143-254	9.4	4-6	11-15	605-1404	2.0	PASS
NEW	8-109	6-58	5.8	2-5	3-15	476-767	1.2	PASS
THERMOPLASTICS								
CURRENT	130	462	18.3	5	24	1986	4.9	PASS
NEW	1-11	56-136	3.0	1.6-6.6	1.6-24	754-874	1.1	PASS
F.G. LAMINATES								
CURRENT	46.0	49.4	-	1.6	1.6	171	-	PASS
NEW	0.2	0.2	-	1.3	1.3	125	-	PASS
SIDEWALLS								
CURRENT (LAMINATED/ SANDWICH PANELS)	70-90	82-90	17-25	2 -3	28-50	471-698	1.8-2.0	PASS
NEW (SANDWICH PANELS)	49	47	PLANNED	1.6	7.2	344	PLANNED	PASS

① GOAL ≤ 50 @ 2.5 W/CM^2 @ 4 MIN. ② 5 W/CM^2 @ 90 SEC. ③ POST-CRASH @ 90 SEC.

④ GOAL ≤ 25 ⑤ 5 W/CM^2 @ 215 SEC. ⑥ POST-CRASH @ 215 SEC. ⑦ @ 2.5 W/CM^2 @ 4 MIN.

* SIMULATED FULL SCALE TEST DATA

PROGRESS IN MATERIALS DEVELOPMENT

- DEVELOPMENT OF MATERIALS TO GOALS IS NEARLY COMPLETE
- MAJOR LINING MATERIALS EVALUATED TO DATE FOR NEW AIRPLANE USE SHOW FIRE PROPERTY IMPROVEMENTS IN FULL SCALE AND LABORATORY TESTS
- THE REDUCTION IN AIRPLANE FIRE HAZARD IF NEW MATERIALS ARE USED IS NOT DEFINED

GOVERNMENTAL REGULATIONS

- RATIONAL BASIS NOT YET ESTABLISHED FOR ADDITIONAL REGULATION

    - CORRELATION OF LAB TEST TO AIRPLANE FIRE RESULTS APPEARS POSSIBLE- BUT METHODOLOGY YEARS AWAY

    - REDUCTION IN MATERIAL CONTRIBUTION TO AIRPLANE FIRE HAZARD CAN NOT BE APPRAISED YET

SAFER COMMITTEE SHOULD BE MADE OPERATIVE

- COORDINATION ON NATIONAL LEVEL NEEDED FOR REASEARCH AND REGULATIONS

- SAFER STEERING GROUP MEMBERS MUST BE TECHNICALLY KNOWLEDGEABLE AND CAPABLE OF COMMITTING RESEARCH