58-81
157475
6
N93-71881

ADVANCED MAIN COMBUSTION CHAMBER PROGRAM

ADVANCED MCC

PROGRAM OVERVIEW

ADVANCE CURRENT MANUFACTURING TECHNOLOGY FOR SPACE HARDWARE

DESIGN A MAIN COMBUSTION CHAMBER

- **INVESTMENT CASTINGS (LOW COST)**
  - ROBUST WITH 100% INSPECTABLE WELDS
  - CAPABLE OF UTILIZING ALTERNATE LINERS
    - VACUUM PLASMA SPRAY MATERIALS
    - PLATELET
- **USE SSME PROGRAM**
  - LARGE DATA BASE - NONCONFORMITIES,ETC
  - AVAILABLE TEST FACILITY - TTB
- **USE MSFC PERSONNEL FOR DESIGN EFFORT**
  - DESIGN
  - ANALYSIS
  - QUALITY
- **USE CONCURRENT ENGINEERING TECHNIQUES**

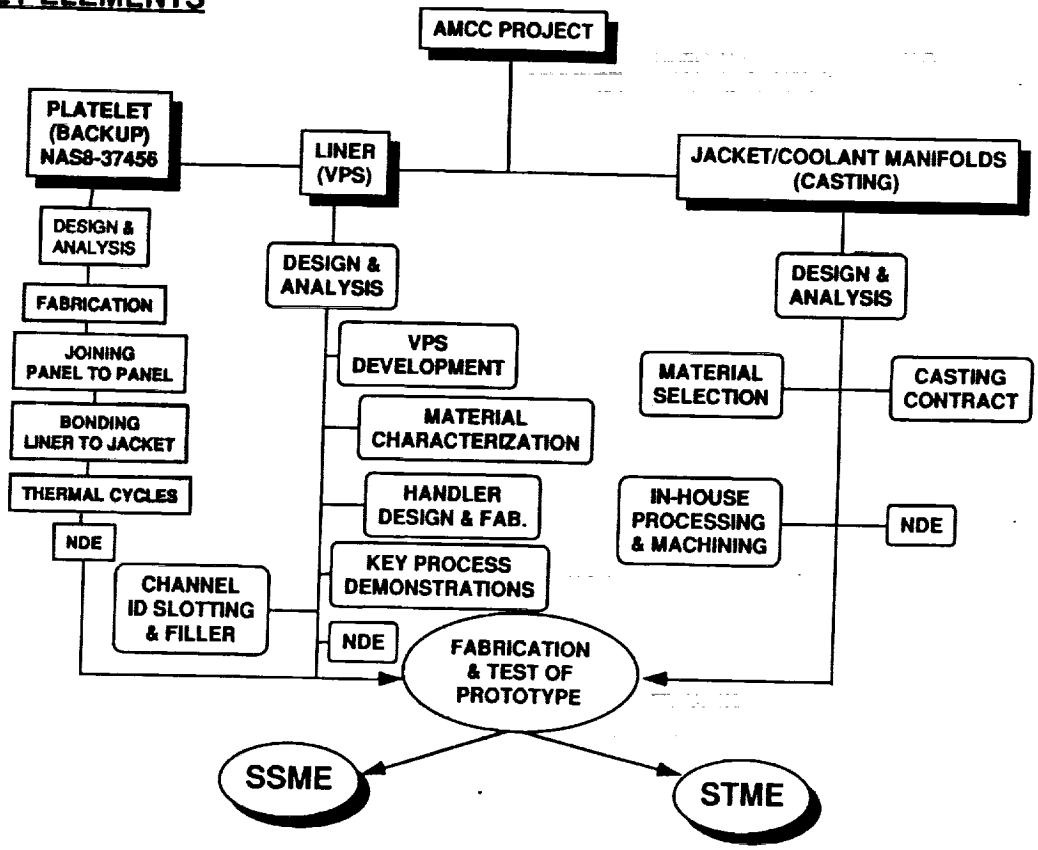
ADVANCED MCC

OBJECTIVES - DESIGN CRITERIA

DESIGN WILL BE:

- **INTERCHANGEABLE WITH SSME MAIN CHAMBER**
- **ROBUST DESIGN WITH 100% INSPECTABLE WELDS**
  - HYDROGEN EMBRITTLEMENT RESISTANT MATERIAL
    - NO COPPER COATINGS OR WELD OVERLAYS
  - FMEA/CIL FAILURE MODES REDUCED
  - INCREASED LINER THERMAL MARGIN
- **REDUCED FABRICATION COST** ($1 MILLION -vs- $3.2 MILLION)
- **REDUCED FABRICATION TIME** (50 WEEKS -vs- 150 WEEKS)

KEY ELEMENTS



ADVANCED TECHNOLOGIES

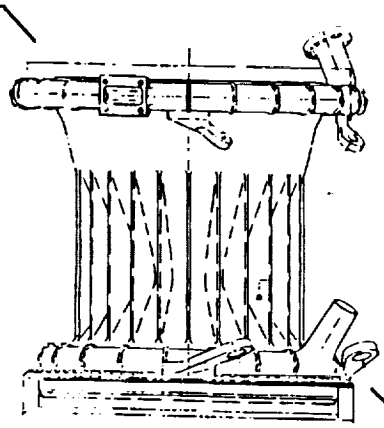
ADVANCED COMBUSTION CHAMBER PROGRAM

(1) **METHODOLOGY**
(LOWER COST)
HARDWARE PROGRAM

(2) **FABRICATION TECHNIQUE**
(OUTSIDE-IN)

(3) **CASTINGS**
NEAR-NET STRUCTURAL

(4) **ADVANCED MATERIALS**
(NASA-23)
(GLIDCOP)



(5&6) **LINER DESIGNS**
VPS PLATELET

(7) **ADVANCED COOLING**
(HIGH ASPECT CHANNELS)
- PLATELET
- EDM CHANNELS

ADVANCED MCC

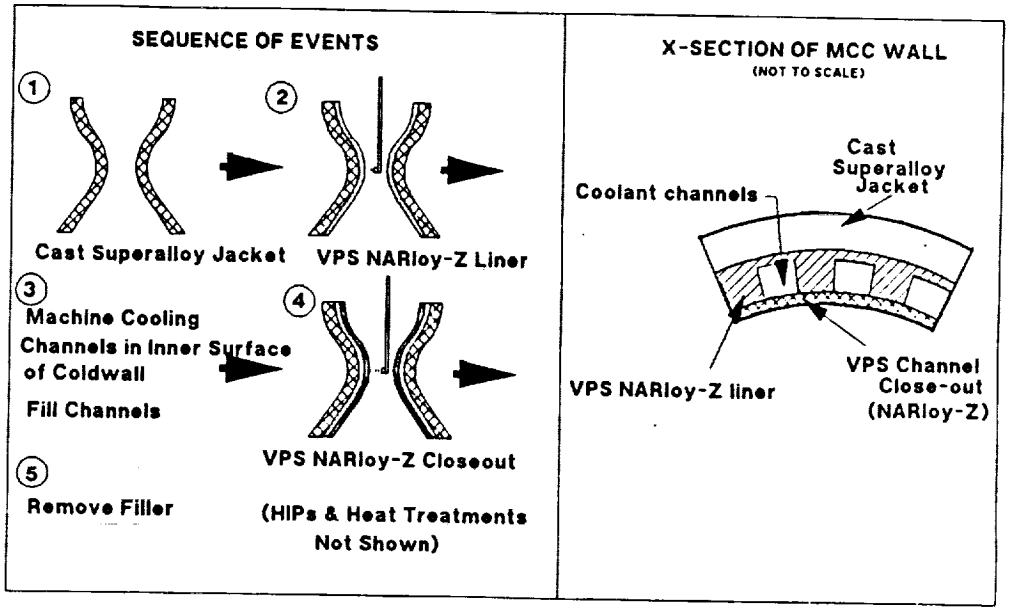
"NEW " APPROACH TO TECHNOLOGY / HARDWARE PROGRAMS

- **INHOUSE - PROOF OF CONCEPT**
  - TQM - DETERMINE PRIORITY, APPROACH, LAY OUT OF PROGRAM
  - DESIGN / ANALYSIS / MANUFACTURING - CONCURRENT ENGINEERING
  - FABRICATION - PRODUCIBILITY FACILITY
  - TEST
- **CONTRACTOR - PRODUCTION**
  - FABRICATION OF ADDITIONAL UNITS
  - DEVELOPMENT & CERTIFICATION
  - MAINTAINABILITY & REFURBISHMENT
- **DEMONSTRATE "SOLUTION" IS VALID**
  - QUALITY PRODUCT
  - COST SAVING IN TIMELY MANNER
  - TRAINING - CONFIDENCE THROUGH ACCOMPLISHMENT
  - TEAMWORK - DEVELOPMENT OF NECESSARY INTER-LABORATORIES COOPERATION

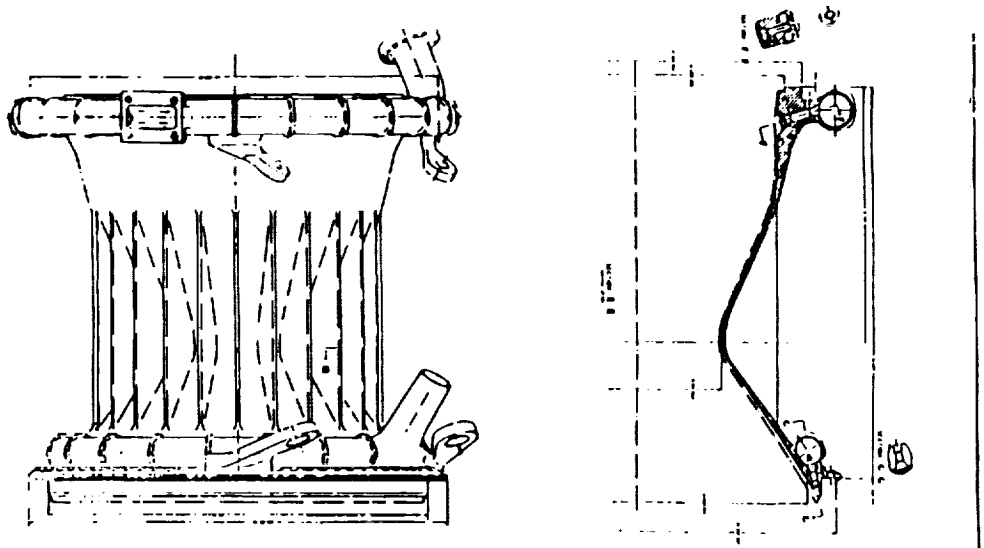
ADVANCED MCC

FABRICATION APPROACH

"OUTSIDE - IN"



ADVANCED MCC



AMCC Conceptual Drawing.

ADVANCED MCC

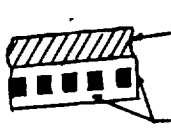
ROOM TEMPERATURE DESIGN ALLOWABLE

		ULT (ksi)	YIELD (ksi)	ELONG. (%)
JBK-75	STD.	105	75	8
	NON-CRIT.	90	65	6
NASA-23		140	110	6

ADVANCED MCC

FABRICATION SEQUENCE

BASELINE - VPS



1. CAST MANIFOLDS/JACKET
2. VACUUM PLASMA SPRAY ID (NARLOY-Z
3. SLOT CHANNELS
4. FILL CHANNELS
5. VPS NARLOY LINER
6. CLEAN CHANNELS
7. INSPECT CHANNEL CLEANLINESS & WALL THICKNESS
8. FINISH WALL TO PRINT
9. PROOF

PLATELET

ELIMINATE 2,3,4,5,6,7,8

ADD LINER FITUP

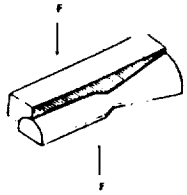
ADD JOINING SEGMENTS (LASER WELDS)

ADD BONDING LINER / JAC.

ADVANCED MCC

Cast Structural Jacket And Platelet Liners Simplify SSME MCC Fabrication

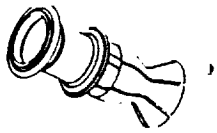
Fabricate Platelet Panels



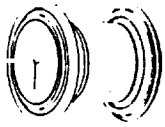
Form Panels To Contour

Trim Panel Edges By Wire EDM

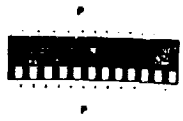
Prepare Structural Jacket Casting



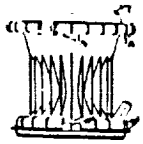
Assemble Liners Within Casting



Laser Weld Panel Seams



Diffusion Bond Liners To Structural Jacket



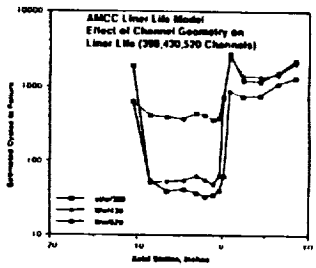
Final Machine Chamber And Proof Test

ADVANCED MCC

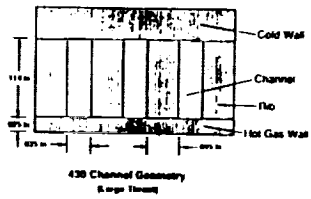
ISSUE: THRUST CHAMBER LIFE IMPROVEMENT

THEORETICAL GAIN WITH **HIGH ASPECT** COOLANT CHANNELS

- LeRC IN-HOUSE PROGRAM
- THERMAL / STRUCTURAL ANALYSIS



PROBLEM : BEYOND CURRENT MANUFACTURING CAPABILITY



SOLUTION: MSFC DEVELOPMENT OF THIN HIGH ASPECT CHANNELS BY **EDM**

(DEMONSTRATED ON TEST SAMPLES)