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OTV PROPULSION TECHNOLOGY PROGRAMMATIC OVERVIEW

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To meet the propulsion needs for future Orbit Transfer Vehicles (OTV), NASA has established the Advanced OTV Propulsion Technology Program. An overview of this program is presented.

For the 1990's and beyond it is envisioned that an advanced OTV will be an integral part of the National Space Transportation System (fig. 1), carrying men and cargo between low Earth orbit and geosynchronous orbit as well as performing planetary transfers and delivering large acceleration limited space structures to high Earth orbits. This OTV will be driven by the need to achieve significant reductions in the operational costs for orbit transfer.

To support this scenario, the Advanced OTV Propulsion Technology Program was initiated in 1981. Its objective (fig. 2) is to establish an advanced propulsion technology base for an OTV for the mid 1990's. The program supports technology for three unique engine concepts. Efforts are being conducted in generic technologies which benefit all three concepts as well as specific technology which benefits only one of the concepts.

Figure 3 shows the program goals and requirements. These goals have been established as technology challenges to generate options and tradeoffs although they may not be achievable singularly or concurrently.

NASA Lewis Researach Center has responsibility (fig. 4) for the overall accomplishment of the program's objective, under the cognizance of the Transportation Systems Office of the Office of Aeronautics and Space Technology and with assistance from other NASA Centers. An Advisory Committee has been established to provide technical support to the Program Managers at Lewis Research Center and Marshall Space Flight Center. The overall management structure is shown in figure 5.

The program elements (fig. 6) include concept and technology definition to identify propulsion innovations and subcomponent research to explore and validate their potential benefits. Approximately one-half of the program resources support the three engine manufacturers and the remainder supports university grants, in-house work at NASA Centers, and generic research with industry.

An expansion of the program is being proposed for 1986 (fig. 7) by NASA OAST to enable validation of component and systems level engine capabilities in a realistic operating environment. Support for this research engine proposal has been established through a series of reviews (fig. 8) with government and industry. The total program (fig. 9) will extend into 1992 with approximately one-quarter of the additional resources supporting component evaluation at NASA Centers and the remainder being expended by the three engine manufacturers for hardware, software, and testing of the components and integrated research engines. This expansion of the program to include research engines is designed to be a precursor to a development program (fig. 10) and will allow the latest technology to be incorporated in the advanced engine while providing a low risk, minimum cost development program.

INTEGRATED SPACE TRANSPORTATION

1990's SCENARIO

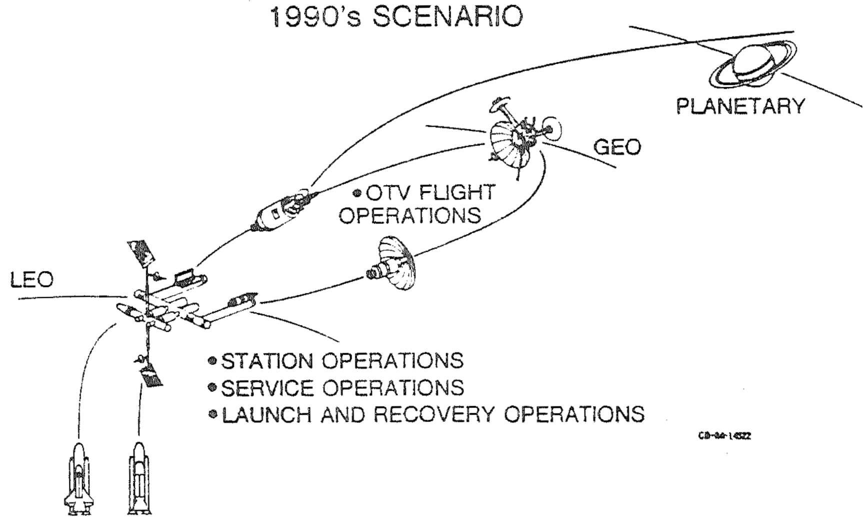


Figure 1

ADVANCED ORBITAL TRANSFER PROPULSION

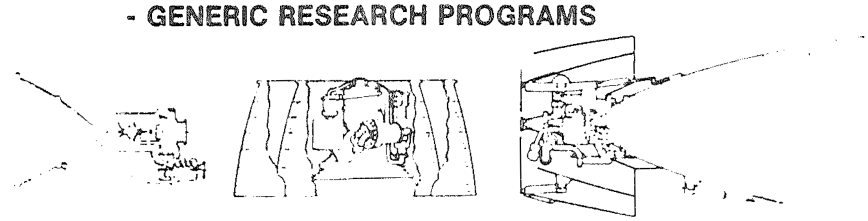
OBJECTIVE

TO ESTABLISH THE TECHNOLOGY BASE FOR A HIGHLY VERSATILE, SPACE BASABLE, REUSABLE, MAN RATABLE ENGINE FOR ORBITAL TRANSFER VEHICLES FOR MID-1990's IOC

APPROACH

MULTI-ELEMENT PROGRAMS SUPPORTING TECHNOLOGIES FOR UNIQUE OTV ENGINE CONCEPTS AT AEROJET, PRATT & WHITNEY, AND ROCKETDYNE

- CONCEPT SPECIFIC PROGRAMS
- GENERIC RESEARCH PROGRAMS



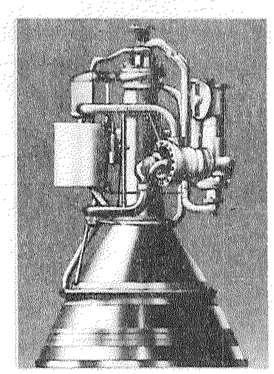
- PROPULSION/VEHICLE ANALYSIS
- THRUST CHAMBERS
- TURBOMACHINERY
- HEALTH MONITORING
- NOZZLES
- CONTROLS

Figure 2

OTV PROPULSION SYSTEM CHALLENGES

GOALS

VACUUM SPECIFIC IMPULSE lbf-sec/lbm	520
VACUUM THROTTLE RATIO	30:1
NET POSITIVE SUCTION HEAD, lbf-ft/lbm	0
WEIGHT, lbm	360
LENGTH (STOWED), INCH	40
RELIABILITY	1.0
SERVICE LIFE	
BETWEEN OVERHAULS, CYCLES/hr	500/20
SERVICE FREE, CYCLES/hr	100/4



REQUIREMENTS

PROPELLANTS	HYDROGEN/OXYGEN
TOTAL VACUUM THRUST, lbf	10,000 - 25, 000
ENGINE MIXTURE RATIO	6 ± 1

CD-83-13874

Figure 3

MANAGEMENT

- NASA OAST - TRANSPORTATION SYSTEMS OFFICE
- LeRC LEAD CENTER
- LeRC AND MSFC ARE FIELD CENTERS RESPONSIBLE FOR PROGRAM TASKS
- ADVISORY COMMITTEE FROM LeRC, LaRC, MSFC, & AFRPL

Figure 4

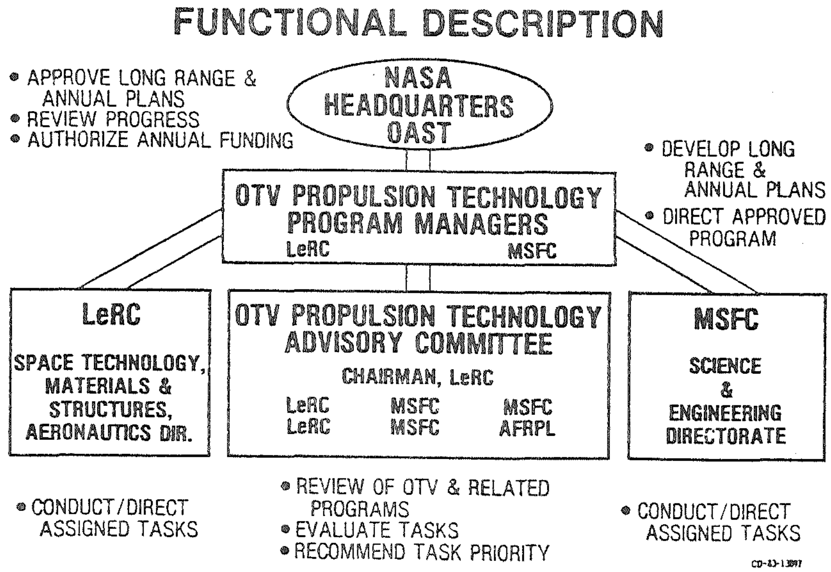


Figure 5

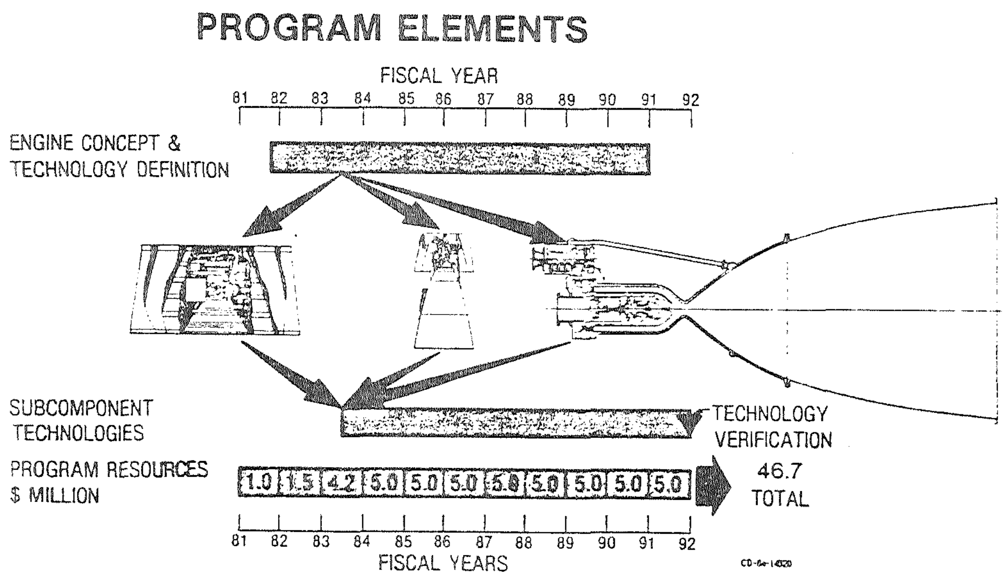


Figure 6

RESEARCH ENGINE INITIATIVE

OBJECTIVE

TO VALIDATE COMPONENT AND SYSTEMS LEVEL PERFORMANCE/ CAPABILITY FOR A HIGHLY VERSATILE OTV ENGINE WITH IOC IN THE MID 1990's

APPROACH

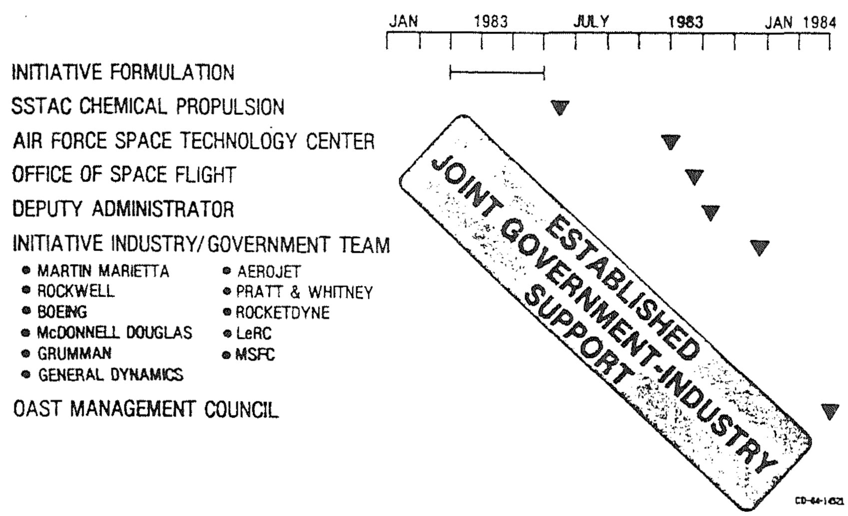
EVALUATE WITH EACH ENGINE MANUFACTURER SUBCOMPONENTS, COMPONENTS, AND SYSTEM LEVEL INTERACTIONS FOR RESPECTIVE ENGINE CONCEPTS

PAYOFF

ASSESSMENT OF INTEGRATED ENGINE CONCEPTS IN REALISTIC OPERATING ENVIRONMENT

Figure 7

BACKGROUND & REVIEWS



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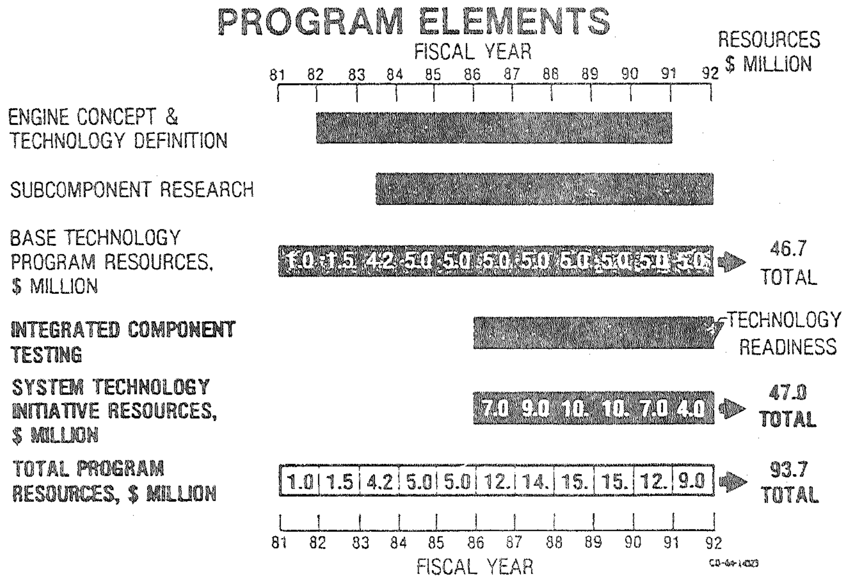

Figure 9

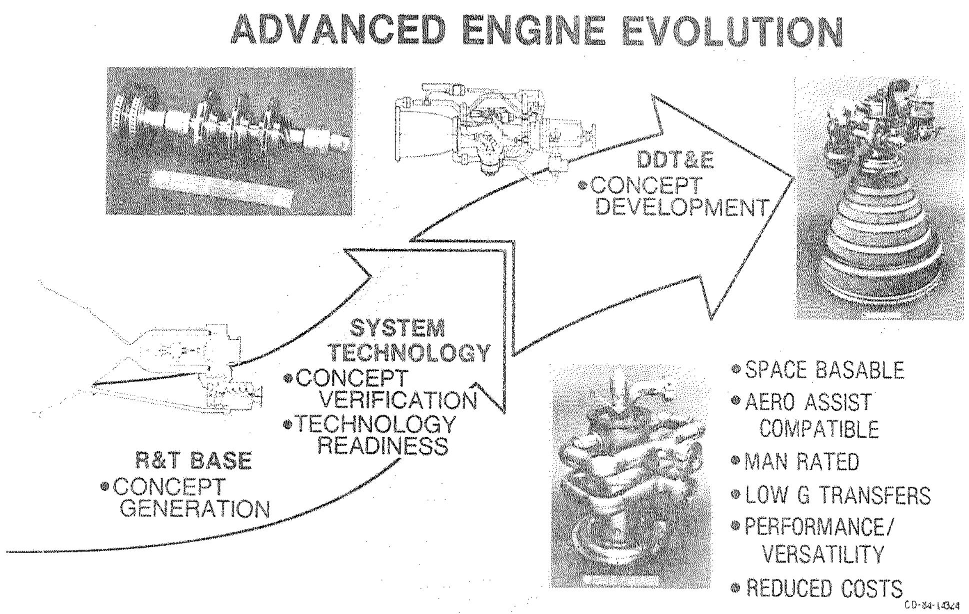

Figure 10