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NASA Contract NAS 5-302

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By authority of F.D. No. 11652
Changed by M. Hubbard Date 7/20/73

PROJECT APOLLO

*A Feasibility Study of an Advanced
Manned Spacecraft and System*

FINAL REPORT

VOLUME IV. ON-BOARD PROPULSION

Book 2 — Appendix P-A

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~~Decomposition year~~
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GENERAL  ELECTRIC

MISSILE AND SPACE VEHICLE DEPARTMENT

A Department Of The Defense Electronics Division

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II, General Summary of Related Technical Experience (cont.)

C. CONTROLLABLE THRUST ENGINES

The XLR73 is a hot-gas, turbine-driven engine designed as a prime power plant, but also suitable for assisted-takeoff, super-performance, or missile applications. The design objectives of this program, which was terminated at the convenience of the government in 1955, include a nominal thrust of 7,500 lb and controllable thrust over a range from 5,000 to 10,000 lb, a specific impulse of 225 lb-sec/lb, and a firing duration of 300 sec.

The AJ23-25 rocket engine has a controllable thrust range from 3,000 to 10,000 lb at sea level and is capable of an unlimited number of starts. The propellants, high-test peroxide and JP-5 are delivered to the combustion chamber by a turbopump driven by an HTP monopropellant steam generator. This unit has a regeneratively cooled (peroxide) tubular thrust chamber. Termination of this effort early in 1959 was at the convenience of the government.

The XLR113 rocket engine, developed under an Air Force contract, has been shown capable of starting, running, and shutting down at any thrust level between 47,000 and 175,000 lb. Thrust can be varied at a rate in excess of 100,000 lb/sec. The maximum specific impulse at maximum thrust level was 245 lb-sec/lb. The engine was operated with N_2O_4 /UDMH propellants at a mixture ratio of 2.1 and at chamber pressures varying from 236 to 595 psia.

The principles and techniques developed for the XLR113 engine are fully applicable to controllable-thrust flight engines. The system developed is simple, lacking the complicated controls ordinarily associated with continuously variable thrust control.