

M-1 ENGINE PROGRAM

November 1, 1962	Contract management and administrative cognizance of the M-1 Engine Program transferred from George C. Marshall Space Flight Center, Huntsville, Alabama to Lewis Research Center, Cleveland, Ohio. Said program consisted of Letter Contract NAS8-4014 covering design, development, fabrication and test of a 1,200,000 pound thrust liquid-hydrogen, liquid-oxygen rocket engine, and Letter Contract NAS8-4015 covering design, engineering, acquisition and manufacture of related severable facilities required for performance of the program.
February 15 - 28, 1963	Definitive negotiation meetings conducted at Lewis Research Center during this period resulted in agreement on a cost-plus-fixed-fee contract for the R&D effort in the amount of \$190,075,635. including fixed fee of \$11,250,000., and on a cost contract for the related facilities effort in the amount of \$48,550,074. The proposed contracts provided for performance of a 60 month program through Preliminary Flight Rating Test of a 1,500,000 pound thrust engine.
March 11, 1963	Approved by Lewis Research Center Board of Contract Review.
March 28, 1963	Executed by Aerojet-General Corporation.
April 5, 1963	Executed by Contracting Officer, NASA-Lewis Research Center.
April 11, 1963	Pursuant to NASA PR 18-50.1, copies of the executed contracts and supporting data forwarded to the Director of Procurement and Supply, NASA Headquarters.
March 6, 1964	Proposal received from the Contractor considering the impact of anticipated budgetary funding limitations for the program.

March 24, 1964	Definitive contracts approved by NASA Headquarters and released simultaneously with amendments thereto which delineate the revised program occasioned by the funding limitation.
May 5 - 9, 1964	Negotiations conducted at Lewis Research Center resulted in agreement to increase the R&D contract in the amount of \$35,709,666., and to decrease the related facilities contract by the amount of \$3,321,074. to provide for equitable adjustment of the Change Order.
July 9, 1964	Executed by Contractor.
July 13, 1964	Executed by Contracting Officer, NASA-Lewis Research Center. Pursuant to NASA PR 18-50.1, Supplemental Agreements forwarded to NASA Headquarters for review and approval.
August 26, 1964	Approved by NASA Headquarters.
January 25, 1965	TWX from R. C. Seamans to Contractor stating that NASA FY 1966 budget does not contain funding for the M-1 Engine Program.
February 6 & 9, 1965	Stop Work Orders issued by Lewis Research Center to the Contractor suspending certain work for a ninety (90) day period, but continuing effort in five (5) major areas.
February 10, 1965	NASA Headquarters' TWX to Lewis Research Center advising Lewis Research Center to suspend all new major facility construction and to phase out the program in a way to provide maximum meaningful technological information.
February 11, 1965	Phase out plans presented to NASA Headquarters.
February 16, 1965	Technical direction letter issued to Contractor based upon oral concurrence of NASA Headquarters of phase out plans.

February 26, 1965	Lewis Research Center Contracting Officer's TWX to Contractor concurring in technical direction letter.
March 29, 1965	Negotiations conducted to provide two (2) modified M-1 fuel turbopumps for the PHOEBUS ground test nuclear reactor experiment resulted in agreement to increase R&D contract in the amount of \$336,054.
April 26, 1965	Supplemental Agreement approved by Lewis Research Center Board of Contract Review.
April 29, 1965	Executed by Contractor.
May 3, 1965	Executed by Contracting Officer, NASA-Lewis Research Center.
May 7, 1965	TWX sent by Lewis Research Center to the Contractor extending period of work suspension through October 31, 1965.
August 23, 1965	Lewis Research Center's notices of termination signed by Director, Lewis Research Center sent to Contractor effecting partial termination of essentially those areas under work suspension.
September 2, 1965	Initial termination conference conducted at Lewis Research Center with Contractor.
April 21 & 22, 1966	Negotiations conducted at the Contractor's Plant to continue and amplify tests being conducted on thrust chamber injectors to determine performance and stability characteristics resulted in agreement to increase R&D contract in the amount of \$1,579,482.
May 4, 1966	Supplemental Agreement approved by Lewis Research Center Board of Contract Review.
June 14, 1966	Executed by Contractor.

July 29, 1966	Executed by Contracting Officer, NASA-Lewis Research Center.
August 11, 1966	Contractor submitted fee adjustment proposal for the partially terminated R&D contract, and a termination settlement proposal for the related facilities contract.
October 7, 1966	Contracting Officer, Lewis Research Center, made a findings of fact with respect to the proposed termination settlement and determined that such costs were unallowable.
October 20, 1966	Contractor appealed to the NASA Board of Contract Appeals from the finding of fact and final decision of the Contracting Officer.
November 7, 8 & 9, 1966	Negotiations conducted at Contractor's Plant to conduct injector performance tests with short baffles resulted in agreement to increase R&D contract in the amount of \$965,000.
December 21, 1966	Supplemental Agreement approved by Lewis Research Center Board of Contract Review.
December 27, 1966	Executed by Contractor.
December 29, 1966	Executed by Contracting Officer, NASA-Lewis Research Center.

H. E. Hinckley
Procurement Specialist

MAJOR MILEPOST OF M-1 ROCKET ENGINE PROJECT

1. Start of Project. April 1962
(Letter Contract to AGC)
2. Start Gas Generator. May 1963
Assembly Testing
3. First Test of Uncooled June 1964
Thrust Chamber Assembly
(Test Stand Failure)
4. Start of Liquid O₂ Turbopump January 1965
Assembly Testing
5. Start of Liquid H₂ Turbopump. May 1965
Assembly Testing
6. Restart of Uncooled Thrust May 1966
Chamber Assembly Testing

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Actual
Performance
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End of M-1 Phaseout Plan IV

Upon completion of M-1 Phaseout Plan IV the following two thrust chamber test programs were run:

Extension of Thrust Chamber. July 1966 - November 1966
Assembly Testing Program

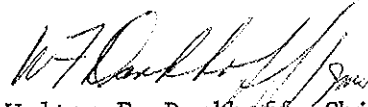
Modified Injector Testing Program. December 1966 - June 1967

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7. Start Engine Firings. May 1966
(Would have slipped about one year if Project continued)
 8. First Engine Altitude Test. July 1968
 9. First Engine Full Deviation Test. September 1969
 10. Complete Preliminary Flight Rating Test June 1971
(Completion of first R&D contract with AGC)
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Scheduled
Performance
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Note:

Transfer of responsibility of M-1 Project from OMSF to OART was formally accomplished in November 1963.


Walter F. Dankhoff, Chief
Technical Management Systems Office

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M-1 ENGINE PHASE-OUT

As discussed in prior years' testimony, the M-1 engine, an upper stage engine for post-Apollo vehicles, was terminated in favor of work on advanced engine concepts at a lower funding level. The results of the phase-out program and the status of the termination and disposition effort will be summarized briefly.

Previously, a phase-out plan was described which performed tests on certain major components in order to extract technical verification of design and fabrication concepts and procedures. This plan utilized \$2M of the FY66 authorization money in addition to funds remaining from FY65. The purpose of these tests has been realized and the results have been highly satisfactory. The initial versions of both the liquid oxygen and the liquid hydrogen turbopumps have been tested with a prototype gas generator drive in a series of tests intended to define the performance characteristics over a wide range of conditions. These tests were highly successful and results have been added to the technological storehouse in a series of unclassified reports.

In addition, the injector performance has been established in a tightly run program requiring maximum cooperation between Lewis Research Center and Aerojet-General Corporation, the contractor.

As a result of this careful pre-establishment of design approach, the first full-scale injector design, tested last year was highly successful. Important results on scaling criteria were also obtained and can lead the way to improved injectors with less development time.

The M-1 phase-out program is nearly complete. Sixty-three out of a total of 65 reports have been published in an effort to make available to others all the useful information generated by the program. A few more stability tests were performed with the combustion chamber baffles removed. These tests were completed in the spring of 1967.

Lastly, the job of disposing of the M-1 facilities, special test equipment, and hardware continues. To date, the job is about 90% completed - that is, the ultimate destination of 90% of the disposable hardware has been decided.

Item 50
Updated 7/26/67
XC/Close

Final settlement of fee and certain contractor termination claims has not been achieved at this time. A general guideline has been accepted by the contractor on this settlement. Adequate funds from prior year authorizations have been held in escrow to cover fully all contingencies.

M-1 Funding Allocations
(in millions)

	<u>R&D</u>	<u>CofF</u>	<u>Total</u>	
Total Funds	96.35	32.75	128.10	} See Note 2
Planned Expenditure (Note 1)	96.21	30.24	126.45	

Note 1: 99% expended as of December 31, 1966.

Note 2: The \$1.65M difference between total funds and planned expenditures is being held as a reserve for closeout negotiations with the contractor.

7/26/67