TL. 114-54/11

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8 November 1954

PROPOSED STATEMENT OF WORK - PROJECT NO. 1794

ITEM 1. ENGINEERING PROGRAM

a. The Contractor shall conduct analytical investigations and design studies to determine the performance capabilities and design features of a flat vertical take-off, supersonic aircraft based upon the principles essentially as described in A.V. Roe Canada Limited Brochure No. 1, "Project Y2 Flat Vertical Take-off Supersonic Gyroplane" dated June 1954, (Secret Title, Secret Report), and A.V. Roe Canada Limited Development Proposal "Project Y2" (Secret Title, Secret Report). The purpose of this investigation is to obtain sufficient analytical, design and test results to determine the practicability of developing a vertical take-off vehicle exploiting the Contractor's design principles.

b. Design configuration effort shall be confined to the minimum required for demonstration of principles in a practical application which will serve as a basis for further development. The major areas of investigation in order of priority will be:

(1) Air cushion effect

(2) Stability of multi-engine configuration

(3) Air intake and gas exhaust systems

(4) Aircraft performance, stability, and control

(5) Radial flow engine feasibility

c. The Contractor shall conduct special studies in the major AREAS of INVESTIGATION to include, but not be limited to:

(1) Air cushion effect

(a) Phenomenon

(b) Scale effect

(c) Effect of jet aspect ratio

(d) Effect of chord plane to ground angle

(e) Jet angle to ground

(f) Under surface contour

(g) Changes in planform

(16)

(2) Stability system of multi-engine configuration

(a) An analysis showing (1) control magnitude and response rates necessary for stabilization and control and (2) aircraft motions through the flight range.

(b) Using the most complete linearized equations of motion for the airframe, investigate stability augmentation about all three axes for the purpose of obtaining handling characteristics at least as good as those required by Specification MIL-F-8785(ASG). The results of these studies should provide:

1 Block diagrams of artificial stability systems to be employed.

2 Specifications of required component performance with regard to frequency characteristics, response rates, acceleration limits, deadspace, and backlash.

3 Expected handling qualities.

(3) Air intake and gas exhaust systems

(a) Efficiency of air intake system.

(b) Uniformity of flow at compressor entry.

(c) Effect of flow distortions on blade vibration and engine performance.

(d) Characteristics of exhaust gas systems.

(e) Thrust recovery.

(4) Aircraft performance, stability and control

(a) Performance, stability and control characteristics of hovering flight.

(b) Transition to horizontal flight after take-off and transition from horizontal to hovering flight over a desired point.

(c) Control effectiveness, forces and response rates for stabilization, trim and maneuver under all flight conditions.

(d) Provision of dynamic stability augmentation systems to provide satisfactory MIL-F 8785(ASG) handling characteristics with and without gyro stabilization.

(e) Aerodynamic characteristics for accurate prediction of performance, determination of thrust requirements and computation of performance on a basis comparable to the USAF aircraft.

(5) Radial flow engine feasibility

(a) Further basic investigation of radial flow engine possibilities including study of the effects of varying compression ratio and application of bypass or ducted fan principles to improve take-off efficiency.

(b) Air bearings capable of performance under the gas pressures, material stresses and high temperature distortion conditions existing in the full scale installations.

(c) Rotor balancing requirements and means of assuring acceptable vibrational levels under operating conditions.

(d) Combustion chamber characteristics.

(e) Scale effect of complete engine.

(f) Suitability of aircraft - engine structural material, scale and designs in view of high temperature and pressure effects resulting from use of outer skin to contain engine pressures.

ITEM 2. TESTING PROGRAM

a. The Contractor shall conduct tests to supplement and substantiate the analytical investigations and design studies accomplished under ITEM 1. The Contractor shall furnish the test apparatus, models, and facilities required to accomplish said tests outlined in paragraph c. below. Arrangements may be made by the USAF for use of Government owned facilities as approved by the Contracting Officer, Hq AMC, when deemed necessary for the advancement of the program and to be in the best interest of the USAF. (It is anticipated that NACA and AEDC provision of facilities in the engine development test programs will come within this category).

b. The Contractor shall formulate and submit for approval to the Contracting Office, Hq AMC, a wind tunnel test program to consist of, but not limited to, the tests outlined in paragraph c. below. Any proposed deviations from the approved program may be requested by teletype or telecon and will be reflected in a special section of the monthly progress reports. All supersonic and transonic wind tunnel testing at U. S. Government owned facilities will be furnished at no cost to the contractor. The Contractor shall conduct the wind tunnel testing program as finally approved by the Contracting Officer, Hq AMC.

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c. ~~The Contractor shall conduct tests to~~ The tests called for in paragraphs a. and b. above shall include, but not be limited to:

(1) Air cushion effect

(a) Static lift as a function of distance from the ground with rate of flow as a parameter.

(b) Scale effect.

(c) Effect of jet aspect ratio.

(d) Effect of chord plane to ground angle.

(e) Jet angle to ground.

(f) Under surface contour

(g) Changes in planform

(2) Stability of multi-engine configuration

Demonstration of a satisfactory means of providing stability during hovering, with and without ground cushion effect, and during all flight conditions.

(3) Air intake and gas exhaust systems

Determination of pressure recovery, distribution and losses associated with the air intake system at subsonic and supersonic speeds, as well as under static conditions, for a wide range of aircraft altitudes.

(4) Aircraft Performance, stability and control

Determination of the control, trim and maneuver characteristics under all flight conditions and six component aerodynamic data for subsonic and supersonic flight.

(5) Radial flow engine feasibility

(a) Air bearings capable of performance under the gas pressures, material stresses and high temperature distortion conditions existing in the full scale installations.

(b) Rotor balancing requirements and means of assuring acceptable vibrational levels under operating conditions.

(c) Combustion chamber characteristics including single chamber water flow tests, high altitude operating range, flame stability limits, scale effect, etc.

(d) Suitability of aircraft - engine structural material, seals and designs in view of high temperature and pressure effects resulting from use of outer skin to contain engine pressures.

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ITEM 3. DATA

a. Program Planning Reports.

The Contractor shall prepare and submit for approval to the Contracting Officer, Hq, AMC, a program planning report for the work called for under ITEMS 1 and 2. These reports shall include detailed test breakdown charts, time scheduling and cost data by sub-items. Twenty (20) copies of the planning reports shall be furnished as soon as possible but no later than two (2) months after date of contract. Proposed deviations from the approved program planning reports may be requested by teletype or telecon and will be reflected in a special section in the Monthly Progress Reports.

b. Monthly Progress Report

The Contractor shall furnish, by the fifteenth day of each month, twenty-five (25) copies of a progress report covering the activities of the previous month. However, the first progress report will not be required until the third month after the date of contract. These progress reports will include a summary of work performed, percentage of task accomplished, results obtained, problems encountered, proposed solutions to these problems, fund expenditures, and other pertinent information. Each of the major areas of investigations listed in ITEM 1, and 2, will be covered in each progress report. Progress reports shall also include a list of persons visiting the Contractor's facility, and/or Contractor's personnel visiting other agencies, in connection with this contract stating the places visited and subjects discussed.

c. Development Summary Report

The Contractor shall furnish twenty-five (25) copies of summary development reports at six months intervals from date of contract to include complete results of all work accomplished and which will be submitted not later than 7 months and 14 months after date of contract. These reports shall include, in addition to a general summary of activities and results, a summary of major problems in tabular form to include but not be limited to the following:

(1) A clear statement of the problem.

(2) A summary of existing factual and theoretical data concerning the problem.

(3) Deficiencies in existing information.

(4) Additional data required to resolve the problem.

(5) Current programs known to the contractor which are applicable to the solution to the problems involved and the extent to which they will contribute to the ultimate solution.

(6) New programs, or extension of existing programs, required to provide a solution to the problem.

(7) Recommended agencies, facilities and work statements required to implement new programs.

(8) Estimates of time, effort and funds required.

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d. Final Technical Report t Comdr, WADC, WPAFB, O (WCSB)

The Contractor shall furnish twenty-five (25) copies of ~~each final technical report.~~ A final technical report ~~shall be submitted~~ on each major area of investigation listed in ITEM 1,b. These reports shall be submitted individually as soon as completed, but not later than 14 months after date of contract. Each final technical report will include complete coverage of the applicable subject to include, but not be limited to:

(1) A clear statement of the problem area investigated, including its relationship to the function of the complete vehicle.

(2) A description of the method of approach to solution of the problems involved.

(3) A presentation of analytical, design and test results achieved, including an evaluation and interpretation of these results.

(4) Deficiencies in existing information.

(5) Additional data required to resolve the remaining problems.

(6) New programs, or extension of existing programs, required to provide solutions to remaining problems.

(7) Estimates of additional time, effort and funds required.

~~e. Delivery of Reports~~

~~The copies of reports required by ITEM 3,a. thru 3,e. will be furnished to Commanding General, AMC. Attention: MCPHBF. Sufficient copies of all reports will also be forwarded by the Contractor to the Defense Research Board of the Government of Canada to meet their requirements and those of the Royal Canadian Air Force.~~

~~4. Presentation of Results~~

Note: the presentation of analytical studies will be in sufficient detail and will contain sufficient explanation, e.g. definition of symbols, statement of assumptions, etc., to be comprehensible to a graduate engineer. Design studies will be in sufficient detail to meet the same criteria. Presentation of calculated and test results will be in the form of tables, charts, graphs, etc. most suitable for evaluation of the principles characteristics involved. Graphs presenting curves defined by calculated or test data will include the data which determined the curves. The NACA Standard Atmosphere will be used as a basis for studies and tests. Final presentation of results will employ, where possible, symbols, units, and methods standard within the USAF, i.e. where differences exist, Canadian practice will be interpreted to American practice for presentation of results. The provisions of this ~~Item~~ paragraph apply to the analytical investigations, design studies, and test ~~programs~~ accomplished covered under ITEMS 1 and 2 ~~and the reports~~ furnished ~~covered under ITEM 3,a-b~~

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(16)

Project Review

The Contractor shall present a review of the project status to representatives of Hq WADC and other interested USAF organizations approved by the USAF, at 3 months intervals during the course of this contract. Locations and dates for these presentations will be mutually established by the contracting officer and the contractor. The purpose of the presentations will be to show results accomplished, current status, direction of future effort and summaries of major problems encountered.

Hq AMC Form 25A
(3 Nov 47)
Supersedes Hq AMC Form 70-13-2, which will be used.

Air Force-WPAFB-L-31 JAN 51 50[illegible]

No. 89221

PURCHASE REQUEST

Submitted to: Date of Initiation: 6 December 1954

Section 1.

ITEM	QUANTITY	UNIT	ESTIMATED UNIT PRICE	DESCRIPTION OF SUPPLIES OR SERVICE TO BE PURCHASED	UNIT PRICE	ACTUAL TOTAL PRICE
				Preliminary Study and Development of Project No. 1794. REF: Proposed Statement of Work Project No. 1794. dated 8 November 1954. (Secret Document)		

Classification changed to UNCLASSIFIED by authority of: Hq USAF (AFSDC-S[illegible]) [illegible] dated 8 July 1960 to basic letter from W[illegible] dated 17 June 1960, subject: Downgrading [illegible] U.S. Army (VZ-9AV) AVROCAR Program [illegible] Unclassified, AF33(600)37496."

Signature Capt. R. O. Smith Jr.

Date 12 April 1961

IF ENCLOSURES ARE WITHDRAWN (OR NOT ATTACHED) THE CLASSIFICATION [illegible] CORRESPONDENCE WILL BE CANCELLED IN ACCORDANCE WITH [illegible] AFR 205-1.

TOTAL ESTIMATED COST	EXP. ORD. NO. / PROJECT NO.	ITEM NUMBER	PROP. CLASS	TOTAL ACTUAL COST
$ 1,000,000	1794		02	$

Section 2.

DELIVER TO:

DESIRED DELIVERY SCHEDULE—MAXIMUM ACCEPTABLE EXTENSION OF DESIRED DELIVERY SCHEDULE 3 MONTHS

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
1956	195	See proposed statement of work								

F. O. B. POINT

POINT OF INSPECTION

Section 3.

REMARKS: (Reference Subject by number in space below and list all exhibits and attachments)
1. Recommended Source 2. Sole Source 3. Should Serial Number Be Assigned 4. G. F. P. 5. Tools, patterns, etc. to be loaned by Gov't. 6. Authority 7. General Remarks

2. A.V. Roe Canada Ltd. This is a USAF directed project involving a propriety proposal made by A.V. Roe Canada Ltd.

7. a. No cost proposal on contemplated work is available from the contractor at this time.

b. This contract is to provide for analytical investigating design studies and substantiating tests to determine practicability of aircraft proposed.

Section 4.

INITIATION: Upon due inquiry made it was found that the articles enumerated hereon could not be procured from any other branch of The Government without transfer of funds, or the immediate need of these supplies or the remoteness of this Station from point of supply precludes their purchase from any other branch of the Government.

APPROVED BY: (A) SYMBOL DATE

APPROVED BY: [illegible], Col, USAF, Chief, [illegible] Div., Directorate of [illegible] SYMBOL [illegible] DATE

INITIATED BY: William R. [illegible], Maj, USAF

PHONE [illegible] SYMBOL [illegible]

APPROVED BY: (C) SYMBOL DATE

APPROVED BY: SYMBOL DATE

APPROVAL OF FUNDS: The supplies and services to be obtained by this instrument are authorized by, are for the purpose set forth in and are chargeabl[e] allotment(s):

The available balance of which is sufficient to cover the cost in an amount not to exceed $

Actual cost approved for $

[illegible], Chief, Fiscal Branch, Budget & Accounting Div., [illegible] (E)

(F)

BUDGET AND FISCAL OFFICER DATE BUDGET AND FISCAL OFFICER DATE INITIATING ACTIVITY D[ATE]

Section 5.

VENDOR'S NAME AND ADDRESS

NOT ON UNAPPROVED LIST (initial and date)

CONTRACT NUMBER

(2)

SECRET

3 JAN 1955

CONFERENCE REPORT

1. A presentation on Project 1794 was given to Brigidier General H. E. Watson, ATI, and approximately 25 members of his staff on 30 December 1954. The presentation was given by Major W. R. Stephens, Project Officer, under the supervision of Colonel J. C. Maxwell, Chief, Bombardment Aircraft Division.

2. The information presented was well received and General Watson demonstrated a great deal of personal interest. His comments, following the presentation, which indicated further action were as follows:

a. The term "Flying Saucer" should in no way be associated with the project.

b. A factual ATIC report on the project should be prepared to counteract the article appearing in the Air Intelligence Digest, page 6, Vol. 7, No. 12 of December 1954. WCSB cooperation in the preparation of this report was requested.

c. Closer laison between ATIC and WADC should be established to provide mutually benifitial exchange of information.

W. R. Stephens, Maj. USAF.

W. R. Stephens
Major, USAF

Wendy.
JCM
RAS

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[redacted]

55WCS-249-1

CONFIDENTIAL

HEADQUARTERS
AIR RESEARCH & DEVELOPMENT COMMAND
POST OFFICE BOX 1395
BALTIMORE 3, MARYLAND

AMENDMENT TO TECHNICAL REQUIREMENT

AMENDMENT NO.1
TO: TR No. 54
17 January 1955

1744

1. Technical Requirement No. 54 dated 26 October 1954 is amended as follows:

a. Add to paragraph III. 3.

"In this connection there is a requirement for reducing the length of runway required or even eliminating the need for runways for certain applications." (Confidential)

b. Add paragraph IV. 4. f.

"An integrated program is required to provide a vertical take-off vehicle. Appropriate contractors should be guided into the study of important problem areas of jet control, stability, and performance." (Confidential)

2. Development plans will be revised in accordance with the above information, and will be forwarded to Headquarters ARDC, Attention: RDTDPA, for approval. (Unclassified)

BY ORDER OF THE COMMANDER:

John R. V. Strahan, Col.

DON R. OSTRANDER
Brigadier General, USAF
Director of Development

UNITED STATES AIR FORCE
HEADQUARTERS AIR RESEARCH & DEVELOPMENT COMMAND
OFFICIAL | AUTHENTICATION
WB

W. J. THOMAS
Colonel, USAF
Chief, Technical Programming Office

This Document classified
Confidential in accordance
with paragraph 25c, AFR 205-1

[redacted]

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