

EXHIBIT 117L

STATEMENT OF WORK

PROJECT 1794

PART 1. Engineering Program

1.1 The contractor shall conduct studies and test programs to supplement those completed during June 1956 under Contract AF33(600)-30161. The contractor shall also construct the test rigs, manufacture the models or other test items, provide instrumentation and furnish the facilities required to accomplish this program, except for certain Government furnished test 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.

1.1.1 The contractor shall conduct tests of wind tunnel models to more completely define the aircraft characteristics throughout Mach Nr range of 1 to 4.

1.1.2 The contractor shall conduct tests of wind tunnel models to determine aircraft characteristics in the transonic speed range.

1.1.3 The contractor shall conduct tests of subsonic wind tunnel models. The problems of trim and balance and the practical application of the jet flap principle shall receive particular emphasis.

1.1.4 The contractor shall conduct tests to investigate hover and transition to forward flight.

1.1.5 The contractor shall conduct studies and tests to investigate the air and exhaust gas flow internal to the aircraft to include:

1.1.5.1 Intake efficiency

1.1.5.2 Control system operation

1.1.5.3 Diffuser efficiency

1.1.5.4 Nozzle efficiency

1.1.5.5 Exhaust systems

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1.1.5.6 Control shutter tests

1.1.5.7 Overall system efficiency

1.1.6 The contractor shall accomplish the development and test of the propulsion system components required to achieve supersonic flight.

1.1.7 The contractor shall conduct studies and tests to determine the effect of operating temperatures on structural rigidity and aeroelastic characteristics of the aircraft.

1.1.8 The contractor shall conduct analyses and tests to investigate the flutter and vibration characteristics of the aircraft.

1.1.9 The contractor shall conduct analyses and tests to investigate the effect of noise on structure, equipment and personnel.

1.1.10 The contractor shall conduct an analysis of the propulsion system to include design point, off design point and transient operation. Operation of the propulsion system as a ramjet (in the "hot" condition) will be included, together with consideration of the effect on performance of the ducted fan system during this phase.

1.1.11 The contractor shall conduct design studies to apply the AVRO Aircraft vertical take-off design concept to the following weapon systems:

1.1.11.1 Reconnaissance

1.1.11.2 Interceptor

1.1.11.3 Tactical bomber

1.1.12 The contractor shall formulate a Weapon System Development Plan for the system under Part 1.1.11.1.

1.1.13 The contractor shall accomplish analytical studies of the effect of displacement of exhaust jets on the aerodynamic characteristics of the aircraft, will formulate test programs to investigate this phenomenon and will conduct such tests as are approved by the USAF.

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1.1.14 The contractor shall conduct studies to determine performance

de data and to determine limits on performance and physical parameters associated with the type of aircraft being investigated.

PART 2. Data

2.1 Program Planning Report

The contractor shall prepare and submit to the Commander, Detachment #1, Hq Air Research & Development Command, Attn: RDZSBA, Wright-Patterson AFB, Ohio, for approval, a Program Planning Report for the work required by Part 1. The Program Planning Report shall include a description of methodology, work definition, time scheduling, and cost and manhour data by sub-parts. Ten (10) copies of the Program Planning Report shall be furnished as soon as possible, but no later than

2.2. The contractor shall submit to Hq Air Research & Development Command, Attn: RDZSBA, for approval, detailed specifications of the tests to be accomplished on under Part 1. Test specifications will provide information/test objectives, facility requirements, model characteristics, test conditions, instrumentation requirements, data collection and reduction, etc. Test specifications will be furnished in accordance with the time schedule of the approved Program Planning Report.

2.3 Bi-Monthly Progress Report

The contractor shall furnish by the 20th day of the month following the reported two (2) month period, ten (10) copies of Bi-Monthly Progress Reports representing a summary of: Work performed, percentage of task accomplished, results obtained, problems encountered and the budgetary status of the program. Bi-Monthly Progress Reports will be delivered to Hq Air Research & Development Command, ATTN: RDZSBA. The first Bi-Monthly Progress Report will be due

2.4 Technical Report

2.4.1 The contractor shall furnish to Hq Air Research & Development Command, Attn: RDZSBA, twenty-five (25) copies of Technical Reports in accordance with

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the time schedule of the approved Program Planning Report, but in any event not later than 1 October 1958.

2.4.2 The Technical Reports shall present the results of the study and test programs required by Part 1 and shall include, but not be limited to:

- 2.4.2.1 A clear statement of the purpose of the study.
- 2.4.2.2 A description of the method of approach to solution of the problem.
- 2.4.2.3 A statement of assumptions made with an evaluation of validity.
- 2.4.2.4 A presentation of results obtained.
- 2.4.2.5 An evaluation and interpretation of these results.
- 2.4.2.6 Performance trade data shall include the factors of speed, range, altitude, aircraft weight, aircraft size and payload, together with a discussion of limits on these factors.
- 2.4.2.7 Design Information
 - 2.4.2.7.1 Plot of area distribution out at $M=1$
 - 2.4.2.7.2 Tabulation of wetted areas
 - 2.4.2.7.3 Zero lift drag buildup, components and total.
 - 2.4.2.7.4 Plot of dC_D/dC_L^2 vs M
 - 2.4.2.7.5 Plot of a.c. travel vs M
 - 2.4.2.7.6 Plot of C.G. travel and analysis of effects.
 - 2.4.2.7.7 Variation of dC_L/da vs M
 - 2.4.2.7.8 Low speed airplane efficiency factor "e"

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- 2.4.2.7.9 Take-off, landing and transition calculations.
- 2.4.2.7.10 Plot of C_L vs M
- 2.4.2.7.11 Mission profiles showing altitude vs distance
- 2.4.2.7.12 Group weight statement and weight substantiation report.
- 2.4.2.7.13 V-n diagram with gust considerations
- 2.4.2.7.14 Three-view drawings and inboard profiles with section views as required by Part 1.1.11.
- 2.4.2.8 Preliminary specifications for subsystems or components to be produced by the prime contractor, by associate contractors or the Government under provisions of AF Regulation 70-9.
- 2.4.2.9 General specifications for new or improved materials including requirements dates and estimates of their availability.
- 2.4.2.10 The Weapon System Development Plan required by Part 1.1.7 shall include the following portions as specified in ARDC Manual 80-4 dated 1 July 1955:
 - 2.4.2.10.1 General Design Specification
 - 2.4.2.10.2 Description
 - 2.4.2.10.3 Schedules
 - 2.4.2.10.4 Test Annex
 - 2.4.2.10.5 Test and Test Support Aircraft Annex
 - 2.4.2.10.6 Materiel Annex

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2.4.2.10.7 Facilities Annex

2.4.2.10.8 Personnel & Training Annex

2.4.2.10.9 Test Item Annex

2.4.2.10.10 Cost Estimate Recapitulation

2.4.2.11 Factual data, in terms of facilities, equipment and personnel, as to the ability of AVRO Aircraft Limited to accomplish the Weapon System Development. The influence of other programs at AVRO Aircraft, current or contemplated, will be considered.

2.5 The contractor shall furnish to Hq Air Research & Development Command, Attn: RDZSBA, one (1) 1/40 scale demonstration model of the AVRO VTOL aircraft which may be disassembled to disclose the interior arrangement of the vehicle and which will illustrate the principles of operation.

PART 3. Project Review

The contractor shall present a review of the status of the program to representatives of the USAF and other interested organizations approved by the USAF at six (6) month intervals during the course of this contract with locations and dates to be mutually established by the Contracting Officer and the contractor. The purpose of the project review will be to show results accomplished, describe current status, discuss major problems encountered, and to determine direction of future effort.

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579 M
28 August

ACTION REQUEST AND COMMENT SHEET

To WCLSM 1-2-1-562	From WCLSD-2 WCLSO-1	Date 21 Aug 56
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The following data are in--from EVALUATION AND REQUIREMENTS SECTION for necessary action by your branch:

It is requested that your comments on the enclosed Project 1794 work statement be sent to this office.

RDO or SEO No. 1794	Priority 1-C	Project Engineer H. E. A. Hake
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To WCLSO-1	From WCLSM-2	Date 28 Aug 56
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Airplane or Missile No. Proj 1794	Prepared by R. Ling R08
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Report No. S.O. RA-56-43	Dated 15 Aug 56	Branch Chief Em. Polk
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COMMENTS
The Work Statement is satisfactory to this office.

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HRW 582 W.
23 Aug 56

~~SECRET~~

ACTION REQUEST AND COMMENT SHEET

To WCLSW-1 WCLSW-1	From WCLSD-2 WCLSO-1	Date 21 Aug 56
The following data are in--from EVALUATION AND REQUIREMENTS SECTION for necessary action by your branch:		
<i>It is requested that your comments on the enclosed Project 1794 work statement be sent to this office.</i>		
RDO or SEO No. 1794	Priority I-C	Project Engineer H. E. A. Hiber
To WCLSD-2 WCLSO-1	From WCLSW-1	Date 18 September 1956
Airplane or Missile No. Project 1794	Prepared by R. F. Hansen	
Report No.	Dated	Branch Chief

COMMENTS

(u) Refer to attached WCLSW disposition form dated 18 Sept 1956
Subject, (u) Comments on Work Statement.

When this document is withdrawn or
returned, the classification of SECRET on this
document will be canceled (if appropriate)
(in accordance with per)

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580 Y
28 Aug 12

To WCLSY 1-2-3-4-5-6-7	From WCLSD-2 WCLSO-1	Date 21 Aug 56
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It is requested that your comments on the enclosed Project 1774 work statement be sent to this office.

RDO or SEO No. 1794	Priority 1-C	Project Engineer <i>A. E. A. Huber</i>
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To	From	Date
WCLSO-1		

Airplane or Missile No.	Prepared by
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Report No.	Dated	Branch Chief
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COMMENTS

When indicated(s) _____ (are) withdrawn or not
attached, the classification of SECRET on this
_____ will be canceled (or ~~downgraded~~
APR 1961 and _____) in accordance with PRC

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WADC-C Form 322
(17 Jul 53)

Replaces WCN Form 104 1st Jan 52
which may be used.

es. FCN Form 104 1st Jan 52
may be used.

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Reg 76 8-578 J
Due 28 Aug 56

ACTION REQUEST AND COMMENT SHEET

To <u>WCLSJ</u>	From <u>WCLSD-2</u>	Date <u>21 Aug 56</u>
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The following data are in--from EVALUATION AND REQUIREMENTS SECTION for necessary action by your branch:

It is requested that your comments on the enclosed Project 1794 work statement be sent to this office

RDO or SEO No. <u>1794</u>	Priority <u>I-C</u>	Project Engineer <u>H. E. A. Baker</u>
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To <u>WCLSO-1</u>	From <u>WCLSTI</u>	Date <u>27 Aug 56</u>
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Airplane or Missile No. <u>1794</u>	Prepared by <u>C. V. Maynard</u>
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Report No. <u>Exhibit I</u> <u>Work Statement</u>	Dated	Branch Chief <u>[Signature]</u>
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COMMENTS

Par 1.1.1 It is recommended that the aircraft design studies include a preliminary study of the escape system to be provided on this type aircraft.

Par 1.1.7 add - "also determine the maximum temperature which fasteners will be required to withstand." H. E. Barclay

[Signature]

When inclosures (are) withdrawn or not attached, the classification of SECRET on this A/R will be canceled (as appropriate) in accordance with par

56WCLS-7731

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ACTION REQUEST • EVALUATIONS AND REQUIREMENTS • OPERATIONS OFFICE

T. WCLS **M** 2 3 4 5 6 7

FROM WCLS**D**-1

DUE DATE **28 Aug 56**

DATE **23 Aug 56**

The following data are available for necessary action by your branch:

Review of Work Statement

Account No. **1794**

WCLSO Project Engineer

Ed E. A. Weber

COMMENTS

TO WCLSO-1 To: WCLSD-1

FROM PROJ: WCLSD-1

DATE **24 AUG 56**

Aircraft or Missile Designation **1794**

Prepared by

Lt H. H. H. H.

Report No.

Revised

Branch Chief

Em. P. H.

Recommend landing gear data be added to the design info (2.4.2.7):

- a) Location of landing gear with respect to CG.
- b) Wheel Size
- c) Tire Size & Ply Rating

Recommend "ground flotation" requirement be established

- a) For landing on unprepared soil fields, the requirement should be defined as minimum "K" value for soil
- b) For landing on landing mats black top or concrete, define requirement in V.C.T. values (Refer to H.I.A.D. Vol II, 3.4.4.)
- c) If A/C will operate from ~~any~~ ^{heavy} concrete platforms or runways, state max. concrete thickness permissible.

The "flotation" will have to be related to the mission of the A/C, and the configurations employed. Define the requirement in also the proper category of the previous three listed above.

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ACTION REQUEST • EVALUATIONS AND REQUIREMENTS • OPERATIONS OFFICE

0 WCLS ~~M~~ 2 3 4 5 6 7

FROM WCLSO-1

DUE DATE 28 Aug 56

DATE 23 Aug 56

The following data are available for necessary action by your branch:

PROJECT 1794 WORK STATEMENT

Account No. 1794

WCLSO Project Engineer

Lt E. A. Weber

COMMENTS

TO WCLSD-1

FROM WCLSM-11

DATE 28 Aug 1956

Aircraft or Missile Designation

Prepared by DB Tremblay

Report No.

Revised

Branch Chief JDM-K. Major

Study results should include ~~landing~~
the braking requirements and the proposed braking
system. It should also include as much landing
data as possible. The results of the study should
also include enough data to evaluate the ground
landing and taxi characteristics.

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ACTION REQUEST • EVALUATIONS AND REQUIREMENTS • OPERATIONS OFFICE

TO WCLSM1 2 3 4 5 6 7

FROM WCLSD-1

DUE DATE 28Aug56

DATE 23Aug56

The following data are available for necessary action by your branch:

Account No. 1794

WCLSO Project Engineer Lt E. A. Weber

COMMENTS

TO WCLSO-1

FROM

M-12

DATE

27 Aug 56

Aircraft or Missile Designation

Prepared by

Laundry

vlt

Report No.

Revised

Branch Chief

Em Folk

The Project 1794 Work Statement contains no
landing gear requirements. Addition of specific
landing gear requirements ~~is~~ considered unnecessary.

(Continue on blank sheet)

ACTION REQUEST • EVALUATIONS AND REQUIREMENTS • OPERATIONS OFFICE

TO WCLS ML 2 3 4 5 6 7	FROM WCLS-1	DUE DATE 28 Aug 56	DATE 23 Aug 56
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The following data are available for necessary action by your branch:

Account No. 1794	WCLSO Project Engineer Lt E. A. Weber
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COMMENTS

TO WCLS-1	FROM WCLSM-4	DATE 28 AUG 56
Aircraft or Missile Designation 1794	Prepared by LT. L.F. YANN	
Report No. EXHIBIT "I"	Revised	Branch Chief Em Kalk

Comments submitted by WCLSM-4 on 10 July 56 are still applicable. att

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ORDER NR RA-56-43

5. The Directorate staff agencies and the Laboratories are requested to:
- (a) Review the inclosed Work Statement and recommend changes to the tests and analyses prescribed to insure accomplishment of the objective defined in paragraph 4 above.
 - (b) Review the requirements for data to be submitted by the contractor to insure adequate coverage and proper form for evaluation purposes and other laboratory uses. RDZSBA should be advised of any recommendation for change in data requirements.
 - (c) Prepare Development Requirements for the various subsystems involved in the different weapon system applications as contained in paragraph 1.1.11 of the Work Statement. The purpose of this laboratory generated information is to guide the contractor in accomplishment of the Work specified.

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ACTION REQUEST EVALUATIONS AND REQUIREMENTS - OPERATIONS OFFICE

WCLS 1 2 3 4 5 6 7

FROM WCLSO-1

DUE DATE -

DATE

The following data are available for necessary action by your branch:

Aircraft No.

WCLSO Project Engineer

COMMENTS

TO

FROM WCLSY-1

DATE 24 Aug 56

Aircraft or Missile Designation

Project 1794

Prepared by

L+RH Runkle
Lt H Katz

Report No.

Revised

Branch Chief

8/28/56
H A Magrath

Exhibit "I", statement of Work, Project 1794, is in general satisfactory from the
flutter standpoint.

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ACTION REQUEST EVALUATIONS AND REQUIREMENTS - OPERATIONS OFFICE

WCLS 1 2 3 4 5 6 7

FROM WCLSD-1

DUE DATE

DATE

The following data are available for necessary action by your branch:

Action No.

WCLSD Project Engineer

COMMENTS

TO

WCLSD-2

FROM

WCLSY-5

DATE

24 Aug 56

Aircraft or Missile Designation

AVRO VTOL

Prepared by

Ralph WCLSY-5 24 Aug 56
Lt R A John

Report No.

NTW

Revised

24 Jun 56

Branch Chief

Ch. H. Ryan
H A Magrath 24 Aug 56

1. The referenced report is a preliminary work statement covering the test program and design studies for the AVRO VTOL aircraft. Paragraph 1.19 states the contractor shall conduct an analysis and tests to investigate the effect of noise on structure, equipment, and personnel.

2. The acoustical noise study program is satisfactory. It is recommended that this program be conducted as soon as possible so design changes can be made if the noise levels are excessive.

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SECRET

ACTION REQUEST EVALUATIONS AND REQUIREMENTS - OPERATIONS OFFICE

WCLS 1 2 3 4 5 6 7	FROM WCLSD-1	DUE DATE	DATE
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The following data are available for necessary action by your branch:

Request No.	WCLSO Project Engineer
-------------	------------------------

COMMENTS

WCLSD-2	FROM WCLSY-6	DATE 24 Aug 56	
Aircraft or Missile Designation		Prepared by	<i>R N Bingman</i> R N Bingman
Project 1794		Branch Chief	<i>H A Magrath</i> H A Magrath
Request No.	Revised		

1. The work statement for USAF Continuation in project 1794 with AVRO Aircraft has been reviewed from the vibration standpoint. Based on the earlier review of Final Development Summary Report I. D. No. 56-RDZ-19954, covering work on the subject project from 2 April through 30 May, it was recommended that in the event the Air Force anticipate further development of this VTOL aircraft, a special program be initiated to study the vibration aspects of the aircraft including vibrations which may be excited as a consequence of the complex propulsion system duct configurations.

2. Part 1.1.8 of the work statement states, "The Contractor shall conduct analyses and tests to investigate the flutter and vibration characteristics of the aircraft." It is recommended that the following be also added to part 1.1.8: "The analyses and tests shall include effects of forced vibration due to the propulsion system and duct system on structure, equipment and personnel."

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56 WCLS 7733

COMMENT SHEET

Follow 6-578

Due Date 26 Aug 56

Page No. 1

TO: WCLST 5 FROM: WCLST-2

FOR: NEWKAMP ONLY

AIRPLANE MODEL _____

RECEIVED BY _____

AIRPLANE SPEC. NO. _____

PREPARED BY MAJ. J.A. MACDONALD WCLST-5 27 AUG 56 WJW

DATED 21 Aug 56

BRANCH CHIEF [Signature]

NO 1794 Priority 1-4

It is requested that your comments on the inclosed Project 1794 work statement be sent to this office. IS E. A. Weber, WCLST-2

(I have the classified inclosure)

The enclosed report has insufficient information for the Crew Station Design Sect. to make comments upon at this time, however the contractor is requested to furnish all drawings pertaining to cockpit arrangement and instrument presentation ^{per HHC requests} to this section for approval.

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COMMENT SHEET

Follow 6-575

Per Sec 28 Aug 56

Page No.

TO: WELSH 4 FROM: WULSD-2

FOR: DOCKHART, CHIEF

AIRPLANE MODEL _____

RECEIVED BY JA

AIRPLANE SPEC. NO. _____

PREPARED BY OK HODGELL

DATED 21 Aug 56

BRANCH CHIEF [Signature]

ADP 1794 Priority 1-0

It is requested that your comments on the inclosed Project 1794 work statement be sent to this office. Lt E. A. Weber, WULSD-2

I have classified enclosure

NO COMMENTS

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COMMENT SHEET

Follow-up 8-578

Due Date 28 Aug 56

Peg No. 76

TO: ~~XXXXXXXX~~ WCLSTJ 3

FROM: WCLSD-2

FOR: ~~XXXXXXXXXXXX~~

AIRPLANE MODEL _____

RECEIVED BY _____

AIRPLANE SPEC. NO. _____

PREPARED BY _____

DATED 21 Aug 56

BRANCH CHIEF *ABM*

RDO 1794

Priority 1-C

It is requested that your comments on the inclosed Project 1794 work statement be sent to this office. Lt E. A. Weber, WCLSD-2

(J1 has the ^{classified} enclosure)

Par 1.1.10 It is recommended that the aircraft design studies include a preliminary study of fuel stowage compartment temperature which will be experienced and determine method of isolation or insulation to provide fuel stowage under suitable conditions of temperature.

RC Briggs test WCLSD-2

Satisfactory per # 1.1.7

J. L. Richards-1-3 28 Aug 56

JWR

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(U) Review of Work Statement

RDZSBA

WCISD-2

31 Aug 56

ATTN: Major W. R. Stephens

Lt Weber/mjh
34273/B52

1. In reply to Suborder Nr RDZSBA RA-56-49 dated 15 August 1956, requesting a review of the proposed Project 1794 Statement of Work, the following comments are submitted by the Aircraft Laboratory.

2. As a result of the recent evaluation of the AVRO Project, so many areas of doubt in the development of such a configuration exist that it appears untimely to study this in specific weapons systems. So many basic concepts of the design remain to be proven that it should not be considered as a combat vehicle at this time.

3. It is believed that this Statement of Work is too general in the following areas. Under paragraph 1.1.11, it should be stated that the contractor should present sign information as defined in MIL-D-8034 and MIL-D-17984 when applying this VTOL design concept to the weapon systems which are listed. Thus the data will be presented so that it will be comparable to data submitted by other contractors. Submission of the performance data should be in accordance with MIL-C-5011A.

4. Under paragraph 2.4.2.7, a requirement for substantiation of the various drag factors, as well as thrust, should be included.

5. The contractor should be furnished with detailed requirements for the three weapon systems applications contained in paragraph 1.1.11 of the Work Statement. Volumes and weights of necessary armament and electronic equipment should also be spelled out as much as possible.

6. It is recommended that the study under paragraph 1.1.10 include a determination of the maximum fuel stowage compartment temperature. A method of isolation or insulation should be devised to provide fuel stowage under suitable conditions of temperature.

7. There should be some portion of the study devoted to escape systems in the aircraft. Also, it should be determined whether or not the aircraft will be stable enough to permit the pilot to escape in event of power plant failure at high Mach numbers.

H. P. R. H. W. S. O.

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Office of Record

•(U) Review of Work Statement

8. It is recommended that the contractor initiate a study to determine what kind of a surface would be required for this aircraft to land on. Reference should be made to HIAD, Volume I, Section 3.4.4. Also, the contractor should make a study of ground handling requirements and use these requirements in designing the landing gear.

9. Paragraph 1.1.7 should be changed to include the effect of "operating temperatures, including those due to aerodynamic heating on the thermal stresses, strength, structural rigidity and aeroelastic characteristics of the aircraft."

10. Based on the earlier review of Final Development Summary Report I. D. Nr 56RDZ-19954, covering work on the subject project from 2 April through 30 May, it was recommended that in the event the Air Force anticipates further development of this aircraft, a special program be initiated to study the vibration aspects of the aircraft including vibrations which may be excited as a consequence of the complex propulsion system duct configurations.

11. Part 1.1.8 of the work statement states, "The Contractor shall conduct analyses and tests to investigate the flutter and vibration characteristics of the aircraft." It is recommended that the following be also added to part 1.1.8: "The analyses and tests shall include effects of forced vibration due to the propulsion system and duct system on structure, equipment and personnel."

1 Incl

SO Nr RDZSHA RA-56-43,15Aug56(3)

HENRY T. ROHL
Chief, Fighter Development Section
Design Branch
Aircraft Laboratory

When inclosure 7 is last withdrawn or not
attached, the classification of SECRET on this
D/F will be canceled for change to
SECRET in accordance with PAR 37H
AFM 205-1 dated 1955

E.A. Weber WCLSD-2 31 Aug 56
H.T. Rohl WCLSD-2 31 Aug 56
H. Anderson WCLSR 31 Aug 56
J.H. Harrington WCLSS 31 Aug 56
E. J. Page WCLSH 31 Aug 56
L. Maguire WCLSY 31 Aug 56
M. J. Smith WCLSS 31 Aug 56

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