

TOP SECRET

Form S. 11a
(Revised October, 1955)

Part No.

DEPARTMENT OF AIR

File Number

1/501/726

Date of Opening

13.4.56.

Other Files or Papers bearing on the same Subject

(To be passed by hand)

*upgraded to Top Secret
26/4/56*

William F. ...

SUBJECT

*Air Staff Evaluation of
Saunders' Roe - P.177.A.
Interceptor Fighter*

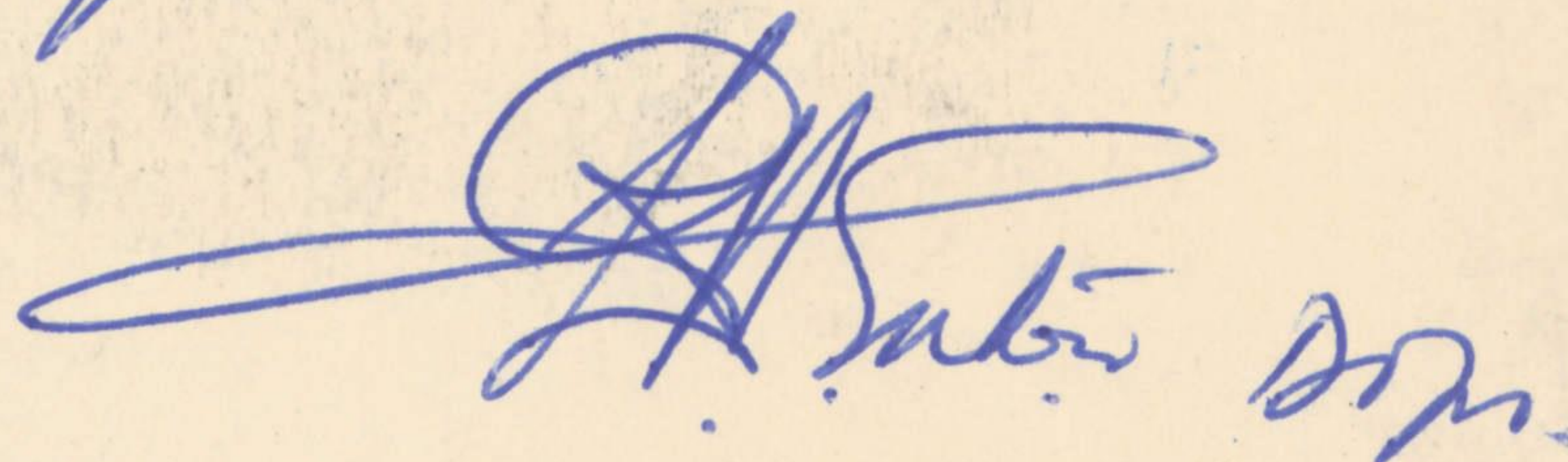
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<i>CADKAS</i>	<i>5A</i>	<i>9/5/56</i>									
<i>A. Sec (A)</i>	<i>10A</i>	<i>22/6/56</i>	<i>PO</i>								
<i>DCAS</i>	<i>6B 7A</i>	<i>22/7/56</i>									
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<i>D/Depner</i>	<i>file</i>	<i>23.5.56</i>									
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NOTE

This aircraft has investigated and evaluated by the 1954 Aircraft Mission - refer Part 2, Page 52 - "Report on Investigations in the United Kingdom and North America".

2 The aircraft, in prototype or final production configuration, does not meet Air Staff requirements.

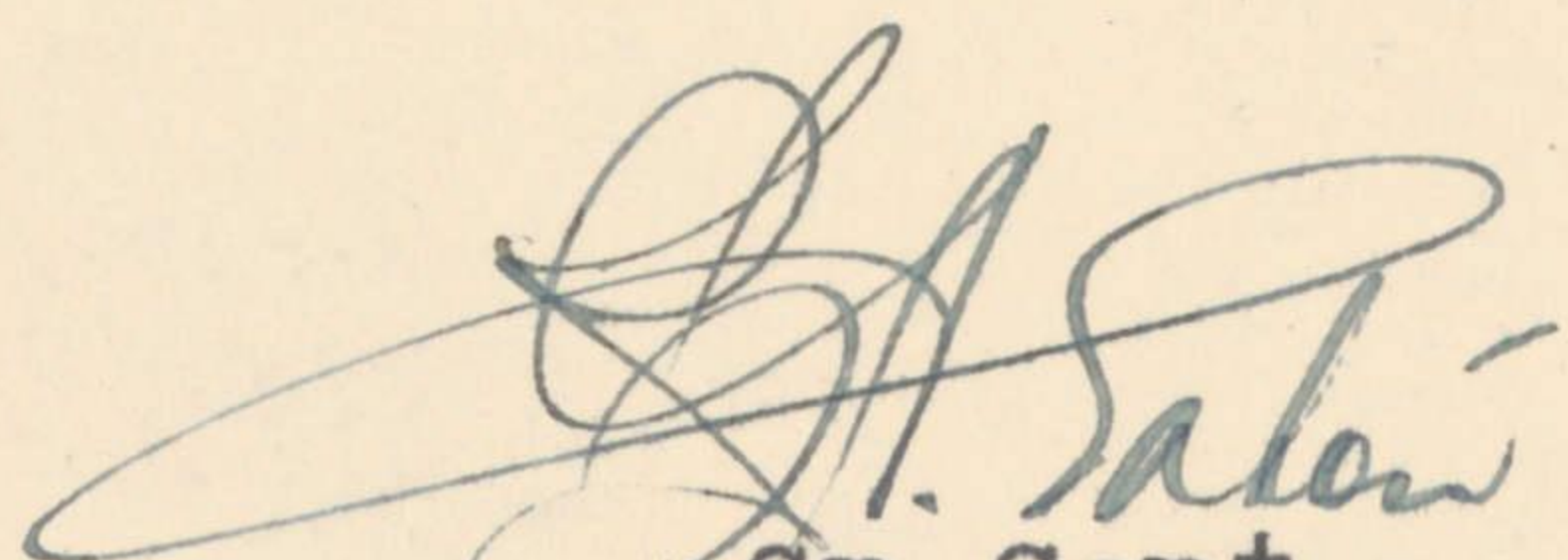
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2.

D.C.A.S.

1. The brochures attached to this file, forwarded by Overseas Headquarters London, Enclosure 11A refers, are identical with those received direct from the manufacturers.
2. The SR.177 High Altitude Fighter was evaluated as a result of those brochures. Enclosures 9A, 2A and Minute 1 refer.



Gp. Capt.
D. Ops.

27 Jul. 56

INSTRUCTIONS TO BE OBSERVED IN THE COMPILATION AND
USE OF FILES

1. When opening a new file, care must be taken to see that a file dealing with the subject is not already in existence and covers should be completed with details for which space is provided.
2. Papers are to be attached to the file cover by means of paper fasteners of appropriate size, and washers, when available, are also to be used. Insert paper fasteners through the front and back covers of the file at the point indicated thereon. A $\frac{1}{2}$ -in. fastener is to be used for minute sheets and a fastener of not more than one-and-a-half inches to attach enclosures. When there are as many enclosures on a file as can conveniently be fastened by a $1\frac{1}{2}$ -in. paper fastener, a new part should be opened.
3. Minute sheets are to be attached to the left-hand inside cover and enclosures to the right-hand side.
4. Minute sheets are to be used for correspondence between branches and sections. Correspondence from and to outside bodies is to appear as an enclosure. If the enclosure is in one part, its number will be followed by the letter "A", subsequent parts being lettered "B", "C", "D", &c.
5. Minute Number 1 is to be on the printed side of the minute sheet and is to face the cover on the minute side of the file.
6. Wherever possible minutes should be made on the file. If a loose minute is used the file number should be quoted and the minute attached to the file when available.
7. Minutes must be added in numerical order and both sides of the minute sheets are to be used.
8. Files must not be passed between Branches by hand without transit slips.
9. Notes of action taken may be entered on the minute sheets, otherwise unaddressed minutes will not be made.
10. Minutes may be noted by officers placing their initials over the reference to them at the minute head and such words as "agree" and "concur" may be used to obviate separate minutes by individual addressees. An officer's initials so placed will indicate concurrence with the minute.
11. In Column 1 on the cover is to be indicated the persons for whom minutes or enclosures are intended, the number of that minute or enclosure and the date it is passed out from the last person noting (or otherwise using) the file being indicated in Columns 2 and 3, respectively.
12. When the person indicated in Column 1 has taken the necessary action on the file, he (or his representative) will draw a line through the reference to him in Columns 1, 2 and 3 on the cover and will place his initials in Column 4, indicating that the necessary action has been taken. He will then indicate on the next line to whom the file is to pass: completing Columns 2 and 3.
13. File numbers are invariably to be inserted on minute sheets and enclosures.
14. When file covers or enclosures are damaged the necessary repairs are to be made before the file is passed on.

From:- Air Vice-Marshal C.D. Candy, O.B.E.

Ref: 1/501/726

12A

SECRET AND
PERSONAL

30th July, 1956.

Thank you for your D.O. letter 82/4/3/Air(1A)2530 dated 31st May, 1956, and its accompanying brochures which reached here on 18th July by sea mail.

2. There will be much of interest during the development of the S.R.177, the first of the mixed power family of fighters in the United Kingdom. I would therefore like you to keep me informed of progress as you have proposed in your paragraph 2.

3. I do not expect that there will be any further development concerning our proposals that the F.104 should replace the Avon/Sabre, until the details of the Defence Budget for this financial year are announced.

4. I agree with your view that in future you should send this type of material to me. I will arrange to keep C.A.S. appropriately informed.



Air Commodore N. Ford, O.B.E., A.F.C.
Overseas Headquarters
R.A.A.F.
Australia House
Strand
London, W.C.2
England

SECRET



//A

From:- Air Commodore N. Ford, O.B.E., A.F.C.

ROYAL AUSTRALIAN AIR FORCE,

OVERSEAS HEADQUARTERS,

AUSTRALIA HOUSE,

STRAND,

LONDON, W.C.2

Telephone: TEMPLE BAR 2435
REFERENCE 82/4/3/Air.(1A) 2530

31st May 1956

Dear Air Marshal,

I have enclosed brochures of the Saunders-Roe SR.177 high altitude interceptor which features mixed power turbo jet and rocket engines. This aircraft is proposed, rather belatedly by the U.K., as a choice preferable to the F.104 for the R.A.A.F. The Murdoch mission did not see this project, hence the brochure providing performance comparison with the F.104. Frankly I cannot subscribe to this approach for the simple reason that the aircraft are at opposite ends of a time scale, viz. F.104 in squadron service 1957/58 whereas the SR.177 might reach this category by 1960/61 if all goes well.

2. However, as this is virtually the first of the mixed power family of fighters in the U.K. likely to reach an operational capability it may well be the shape of the aircraft to succeed the F.104. For this reason I propose to watch its progress critically and to keep you informed. With this in mind Roberts and myself visited Saunders Roe at the beginning of this week.

3. As Saunders-Roe are comparative newcomers to the land-based fighter field the history of the SR.177 project will be of interest to you.

4. The Company, having failed to gain a Service interest in waterborne jet fighters, abandoned this field in 1950 and set about designing a land-based pure rocket-powered manned interceptor. Their design envisaged a trolley launched aircraft with supersonic capability and a post-combat glide descent and skid landing in any available field. Service interest did develop in this design and the Company were contracted to develop two aircraft with the addition of a small turbo-jet and an undercarriage to permit a power-assisted descent and return to base in the conventional manner.

5. This has materialised in two research and development aircraft known as SR.53. They are powered with the de Havilland Spectre Rocket Engine and Armstrong Siddeley Viper Jet Engine as the slave power. The first aircraft should fly in about eight week's time.

6. By this means the Company has developed a fighter 'know how' and should continue to gain a deal of experience particularly in the mixed power concept during the SR.53 trials. No doubt this has weighed heavily in their favour in gaining R.A.F. acceptance of the SR.177 project. We are reliably informed that a pre-production order of twenty-seven aircraft requires only Treasury approval.

Air Vice-Marshal C.D. Candy, O.B.E.
Deputy Chief of Air Staff,
Department of Air,
St.Kilda Road,
Melbourne, S.C.1., Vic.
Australia.

SECRET

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- 2 -

7. Assuming the pre-production order is obtained the Company hopes to fly the SR.177 during 1958 - the first five off will be used purely for aerodynamic and engine trials whilst the next four off will be devoted to trials of the weapons systems.

8. You will note two quite interesting features in the SR.177 design:-

- (a) A large reserve of available power for the critical manoeuvres of high altitude interception (by comparison with a jet powered aircraft) is achieved with the rocket motor.
- (b) A relatively low landing speed is achieved because the all-up-weight includes a high proportion (approximately 40%) of fuel which, after it is exhausted, results in a very good power/weight ratio and relatively low wing loading for the post-combat descent and landing.

9. The chief designer was very frank with us and I must say that he too does not subscribe to a comparison between the F.104 and the SR.177. However, he was told to do it by the Sales director.

10. Now that you have settled in I will, if you agree, send all such material as this to you. In the past I have sent it to C.A.S. but I feel that I may have been sending too much to him.

Yours sincerely
John

NOTE

This report should be read in conjunction with the O.H.O. report on the Centre Right Sub. Lecture Convention June 1956, para 10.

enc. 11 B (file 43/1/1089)

D.A.S. Dops

27/7

SECRET

POSTAL ADDRESS:
BOX 30 P.O. BANKSTOWN, N.S.W.

NP/16

10A
AIR MAIL

DE HAVILLAND AIRCRAFT PTY. LTD.

29th May, 1956.

Wing Commander C.A. Greenwood, O.B.E.,
Deputy Director of Operations,
R.A.A.F. Headquarters,
Victoria Barracks,
MELBOURNE. VIC.

Dear Cy,

Further to our talks last week, I have a letter from the de Havilland Engine Company stating that, together with Saunders Roe, they have completed a study of the aircraft we have been discussing and have given copies to Air Commodore Ford and Mr. Letcher, the Department of Defence Production representative.

The letter was written on the 18th May, so I presume the copies would have been handed over a day or two earlier.

Yours sincerely,

R. Kingsford-Smith

R. Kingsford-Smith.

MINUTE PAPER

/SP.

[This side only to be written on]

SUBJECT:

NOTE OF ACTION

1. Subsequent to the Air Staff Evaluation of the Saunders Roe P177N Interceptor Fighter contained at Enclosure 1A, a later brochure was received in the Directorate. From the information contained therein, certain amendments can be made to the Evaluation.
2. In the brochures originally perused no mention was made of the capability of the aircraft in the ground attack role. A brochure on a ground attack version of the P177 has been received from Overseas Headquarters for onforwarding to Sir Gordon Taylor, the Australian representative for Saunders Roe, in Sydney. Details of its performance in this role were extracted from the brochure and have been used as a basis for the following amendments to the original evaluation.
3. The evaluation at Enclosure 1A is amended as follows:-

Para.3 (a) Radius of Action

1. Interceptor - At Appendix "B" (amended) are figures showing radii of action capabilities for the aircraft under various combat conditions. These figures indicate that the operational radius of action for an actual interception can vary between 50 and 290 nautical miles as opposed to our requirement for 500 n.m. The ferry range is unchanged.
2. Ground Attack - At Appendix "C" (new appendix) are figures showing radii of action capabilities for the aircraft under various combat conditions. The figures show that the basic R.A.F. Specification cannot be met but by various alternatives a radius of action varying between 75-325 n.m. is possible.

Para.3 (b) Armament

The interceptor version is still fitted with two "Blue Jay" weapons or two rocket batteries on the wing tips. The ground attack version may fit 2 x 1000 lbs. bombs, 25 x 12 lb. rockets or 8 x 60 lb. rockets. No guns are fitted and this lack of conventional armament would appear to limit its flexibility in the ground attack role.

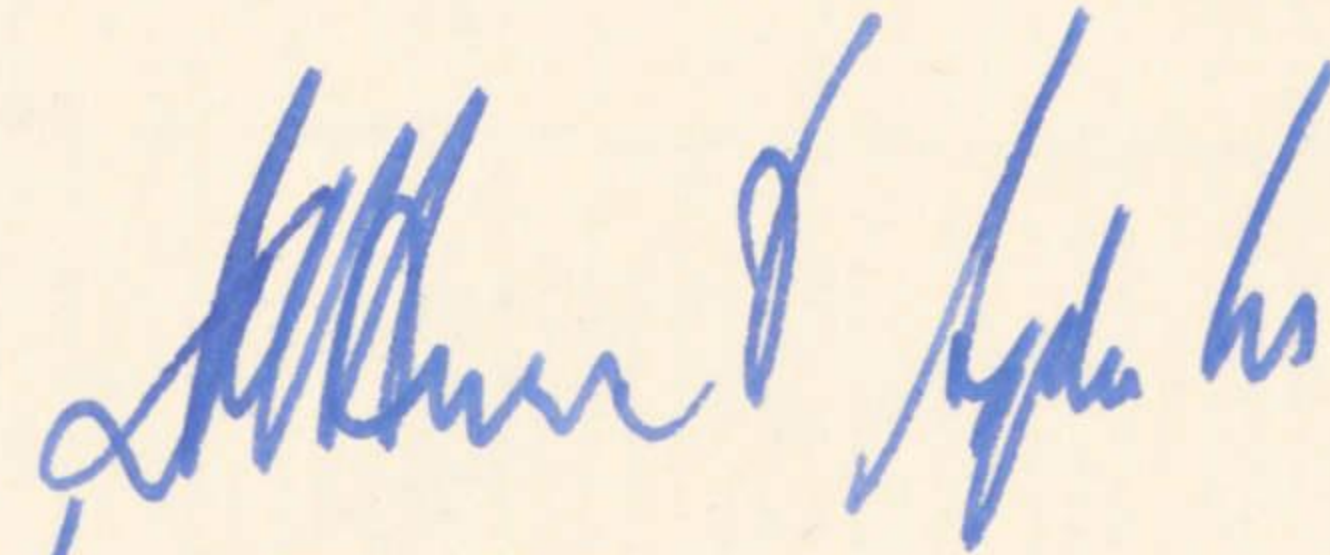
Para.3 (d) Radio Equipment

The later brochure reveals that twin V.H.F. sets are to be installed initially, these being replaced by U.H.F. and standby sets when available.

Para.5 Use on Existing Runways

Tyre pressures required for the present tyres fitted are 205 p.s.i. for the interceptor version and 240 p.s.i. for the ground attack version. With small modifications and the fitting of a slightly larger tyre these pressures can be reduced to 160 p.s.i. and 180 p.s.i. respectively. Incorporation of this modification may allow operation of the aircraft from existing runways with any damage caused thereby remaining within acceptable limits.

24 May 56


Wg.Cdr.
D/D.Ops.(O.R.)

RADIUS OF ACTION FIGURES FOR SAUNDERS ROE P177

1. Interceptor Version

Conditions	Time in Minutes	Radius of Action
(a) <u>Normal Warning Time</u>		
T.O. and climb to 40,000 ft.	4.86	82-116 n.m.
High Subsonic Cruise (Mach = .80)	3.5	
Accelerate to M = 1.6 at 40,000 ft.	1.16	
Turn 180° and climb to 65,000 ft. at M = 1.6	1.525	
Maintain M = 1.6 at 65,000 ft.	1.80	
Descend to economical cruising altitude and return to marshalling point at M = .80	14.5	
Descent	5.0	
Sortie Total	32.345	
Stand Off	23.0	
TOTAL:	55.345	
(b) <u>Extended Warning Time</u>		
(Aircraft fitted with 2 x 150 gall. drop tanks)		
T.O. and climb to 40,000 ft.	5.94	290 n.m.
High subsonic cruise at 40,000 ft. (M = .80)	30.0	
Turn 180°, accelerate to M = 1.6 and climb to 65,000 ft.	2.75	
Maintain M = 1.6 at 65,000 ft.	1.50	
Descend to economical cruising altitude and return to marshalling point at M = .80.	31.0	
Descent	5.0	
Sortie Total	76.19	
Stand Off	23.0	
TOTAL:	99.19	
(c) <u>Short Warning Time - Case A - Acceleration to M = 1.6 at 65,000 ft.</u>		
T.O. and climb to 65,000 ft. - rocket on at bottom of climb	3.43	50-250 n.m.
Acceleration to M = 1.6 at 65,000 ft.	.645	
Total time to reach M = 1.6 at 65,000 ft.	4.075	
Cruise duration at M = 1.6	.60	
Return cruise to marshalling point at 40,000 ft. (M = .80)	60.00 (max)	

Y	Conditions	Time in Minutes	Radius of Action
	Descent	5.0	
	Sortie Total	69.675	
	Stand Off	23.0	
	TOTAL:	92.675	
(d)	<u>Short Warning Time - Case B - Acceleration to M = 1.6 at 40,000 ft.</u> T.O. and climb to 40,000 ft. - rocket on at bottom of climb Acceleration to M = 1.6 at 40,000 ft. Climb from 40,000 ft. to 65,000 ft. at M = 1.6 Total time to reach M = 1.6 at 65,000 ft. Cruise Duration at M = 1.6 Return cruise to marshalling point at 40,000 ft. (M = .80) Descent	2.372 .985 .730 4.987 .53 52.00 (max) 5.0	50-225 n.m.
	Sortie Total	61.617	
	Stand Off	23.0	
	TOTAL:	84.617	
(e)	<u>Performance with Reduced H.T.P. to Kerosene Ratio for the Training Role</u> T.O. and climb to 40,000 ft. Cruise at M = .80 at 40,000 ft. Climb from 40,000 ft. to 65,000 ft. Accelerate to M = 1.6 at 65,000 ft. Cruise at M = 1.6 at 65,000 ft. Return cruise to marshalling point Descent	4.78 25.0 1.07 .66 2.5 30.0 5.0	250 n.m.
	Sortie Total	69.01	
	Stand Off	23.0	
	TOTAL:	92.01	

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<p><u>Para.7.</u> Second Phase development. In this phase it will be required to attack enemy air bases, targets in the direct support programme and lines of communication in the tactical area.</p>	<p>Ground attack version can carry either - 2 x 1000 lb. bombs 24 x 12 lb. Rocket Projectiles or 8 x 60 lb. Rocket Projectiles No guns fitted.</p>	<p>Ground attack capabilities would appear limited to targets suitable for attack with bombs or R.P. only</p>
<p><u>Para.9.</u> Turn Round time. The aircraft should be designed to permit complete turn round within 10 minutes.</p>	<p>No details except "short notice".</p>	<p>Fuller details are required to be able to assess whether satisfactory.</p>
<p><u>Para.12.</u> Starter system. A self-contained system permitting 3 starts without re-priming is required.</p>	<p>A H.T.P. starter is used, the propellant being drawn from main tanks. No further details.</p>	<p>Further information required to know whether this system would satisfy the requirements.</p>
<p><u>Para.23.</u> Landing and Take-off. Capable of operating from a 6,000 ft. strip at sea-level at I.S.A. conditions.</p>	<p>Meets the requirement.</p>	
<p><u>Para.26.</u> Radius of action. Combat radius with normal armament should be 500 n.m. and preferably 750 n.m. This sortie should include 5 mins. at 55,000 ft. at M = 1.5.</p>	<p><u>Interceptor Version</u> Varies between 50-290 n.m. <u>Ground Attack Version</u> Varies between 75-325 n.m.</p>	<p>Does not meet the requirement.</p>
<p><u>Para.34.</u> Armour protection. Provision for protection of pilot from 30 m.m. fragments of H.E. shells from 20° cone astern.</p>	<p>Some armour protection installed in ground attack versions but no details.</p>	<p>May be satisfactory but further details required.</p>

SHORT NOTICE CONVERSION
ALTERNATIVE PERFORMANCE WITHOUT DROP TANKS

Performance to typical sortie presented on page 1, but with the 5 mins. combat period done without reheat.

A.U.W. with 2 x 1,000 lb. bombs 20,971 lb.
Max. kerosene fuel weight 5,221 lb.

	<u>Mach</u> <u>No.</u>	<u>Time</u> <u>mins.</u>	<u>Distance</u> <u>(N.Miles)</u>
(a) Take-off and accelerate to cruise speed; max. rating with reheat.	0.80	1.11	5
(b) Outward cruise to the target area; max. continuous rating.	0.80	8.5	74.5
(c) Reconnaissance in the target area; max. continuous rating.	0.80	5.0	0
(d) Return flight towards base; max. continuous rating.	0.80	5.0	44
(e) Combat period; max. rating without reheat.	0.93	5.0	0
(f) Return to base; max. continuous rating.	0.80	4.0	35.5

Total sortie time 28.61 mins.

Radius of action (a) + (b) 79.5 N.M.

(g) Fuel allowance remains for approach and landing etc. equivalent to 20 mins. stand-off.

All the above operations have been assumed to be carried out at sea level.

If the cruise out to the target (b) and the homeward cruise (f) are carried out at 10,000 ft. the radius of action can be increased by 6%

SHORT NOTICE CONVERSION
PERFORMANCE WITH 2 X 150 GALL. DROP TANKS

Performance to typical sortie presented on page 1.

A.U.W. with 2 x 1,000 lb. bombs 23,706 lb.
Max. kerosene fuel weight 7,531 lb.

	<u>Mach</u> <u>No.</u>	<u>Time</u> <u>(mins.)</u>	<u>Distance</u> <u>(N.Miles)</u>
(a) Take-off and accelerate to cruise speed; max. rating with reheat.	0.75	1.25	5.5
(b) Outward cruise to the target area; max. continuous rating.	0.75	8.5	70
(c) Reconnaissance in the target area; max. continuous rating.	0.75	5.0	0
		Drop tanks discarded	
(d) Return flight towards base; max. continuous rating.	0.80	5.0	44.0
(e) Combat period; max. rating with reheat.	0.97	5.0	0
(f) Return to base; max. continuous rating.	0.80	3.6	31.5

Total sortie time 28.35 mins.

Radius of action (a) + (b) 75.5 N.M.

(g) Fuel allowance remains for approach and landing etc. equivalent to 20 mins. stand-off.

All the above operations have been assumed to be carried out at sea level.

If the cruise out to the target (b) and the homeward cruise (f) are carried out at 10,000 ft. the radius of action can be increased by 6%.

SHORT NOTICE CONVERSION
ALTERNATIVE PERFORMANCE WITH 2 X 150 GALL. DROP TANKS

Performance to typical sortie presented on page 1, but with the 5 mins. combat period done without reheat.

A.U.W. with 2 x 1,000 lb. bombs 23,706 lb.
Max. kerosene fuel weight 7,531 lb.

	<u>Mach</u> <u>No.</u>	<u>Time</u> <u>(mins.)</u>	<u>Distance</u> <u>(N. Miles)</u>
(a) Take-off and accelerate to cruise speed; max. rating with reheat	0.75	1.25	5.5
(b) Outward cruise to the target area; max. continuous rating.	0.75	18.4	151.75
		Drop tanks discarded after 14.0 mins. cruise	
(c) Reconnaissance in the target area; max. continuous rating.	0.80	5.0	0
(d) Return flight towards base; max. continuous rating.	0.80	5.0	44.0
(e) Combat period; max. rating <u>no reheat.</u>	0.93	5.0	0
(f) Return to base	0.80	12.8	113.25

Total Sortie time

47.45 mins.

Radius of action (a) + (b)

157.25 N.M.

(g) Fuel allowances remain for approach and landing etc, equivalent to 20 mins. stand-off.

ALL KEROSENE LAYOUT
PERFORMANCE WITHOUT DROP TANKS

Performance to typical sortie presented on page 1.

A.U.W. with 2 x 1,000 lb. bombs. 25,680 lb.

Max. kerosene fuel weight 9,930 lb.

	<u>Mach No.</u>	<u>Time (mins.)</u>	<u>Distance (N.Miles)</u>
(a) Take-off and accelerate to cruise speed; max. rating with reheat.	0.80	1.35	6.0
(b) Outward cruise to the target area; max. continuous rating.	0.80	18.0	158.0
(c) Reconnaissance in the target area; max. continuous rating.	0.80	5.0	0
(d) Return flight towards base; max. continuous rating.	0.80	5.0	44.0
(e) Combat period; max. rating with reheat.	0.97	5.0	0
(f) Return to base; max. continuous rating.	0.80	13.6	120.0

Total sortie time

47.95 mins.

Radius of action (a) + (b)

164.0 N.M.

(g) Fuel allowance remains for approach and landing etc. equivalent to 20 mins. stand-off.

All the above operations have been assumed to be carried out at sea level.

If the cruise out to the target (b) and the homeward cruise (f) are carried out at 10,000 ft. the radius of action can be increased by 13%.

ALL-KEROSENE LAYOUT
ALTERNATIVE PERFORMANCE WITHOUT DROP TANKS

Performance to typical sortie presented on page 1, but with 5 mins. combat period done without reheat.

A.U.W. with 2 x 1,000 lb. bombs 25,680 lb.
Max. kerosene fuel weight 9,930 lb.

	<u>Mach No.</u>	<u>Time (mins.)</u>	<u>Distance (N.Miles)</u>
(a) Take-off and accelerate to cruise speed; max. rating with reheat.	0.80	1.35	6
(b) Outward cruise to the target area; max. continuous rating.	0.80	27.5	242
(c) Reconnaissance in the target area; max. continuous rating.	0.80	5.0	0
(d) Return flight towards base; max. continuous rating.	0.80	5.0	44
(e) Combat period; max. rating <u>no reheat</u>	0.93	5.0	0
(f) Return to base; max. continuous rating.	0.80	23.2	204

Total sortie time 67.05 mins.

Radius of action (a) + (b) 248 N.M.

(g) Fuel allowance remains for approach and landing etc. equivalent to 20 mins. stand-off.

ALL-KEROSENE LAYOUT
PERFORMANCE WITH 2 x 150 GALL. DROP TANKS

Performance to typical sortie presented on page 1.

A.U.W. with 2 x 1,000 lb. bombs				28,415 lb.
Max. kerosene fuel weight				12,240 lb.
		<u>Mach</u>	<u>Time</u>	<u>Distance</u>
		<u>No.</u>	<u>(mins.)</u>	<u>(N.Miles)</u>
(a) Take-off and accelerate to cruise speed, max. rating with reheat.		0.80	2.0	9
(b) Outward cruise to the target area; max. continuous rating.	*	0.80	26.1	229.5
			Drop tanks discarded after 11 mins. cruising	
(c) Reconnaissance in the target area; max. continuous rating.		0.80	5.0	0
(d) Return flight towards base; max. continuous rating.		0.80	5.0	44.0
(e) Combat period; max. rating with reheat.		0.97	5.0	0
(f) Return to base; max. continuous rating		0.80	22.2	194.5

	Total sortie time		65.3 mins.	

	Radius of action (a) + (b)			238.5 N.M.

(g) Fuel allowance remains for approach and landing etc. equivalent to 20 mins. stand-off.

All the above operations have been assumed to be carried out at sea level.

If the cruise out to the target (b) and the homeward cruise (f) are carried out at 10,000 ft. the radius of action can be increased by 22%.

* Initial cruise speed with drop tanks on = 0.75 M.

ALL-KEROSENE LAYOUT
 ALTERNATIVE PERFORMANCE WITH 2 x 150 GALL. DROP TANKS

Performance to the typical sortie presented on page 1, but with the 5 mins. combat period done without reheat.

A.U.W. with 2 x 1,000 lb. bombs 28,415 lb.

Max. kerosene fuel weight 12,240 lb.

	<u>Mach.</u> <u>No.</u>	<u>Time</u> <u>(mins.)</u>	<u>Distance</u> <u>(N.Miles)</u>
(a) Take-off and accelerate to cruise speed; max. rating with reheat.	0.80	2.0	9
(b) Outward cruise to the target area; max. continuous rating *	0.80	35.6	313.5
		Drop tanks discarded after 11.0 mins. cruising.	
(c) Reconnaissance in the target area; max. continuous rating	0.80	5.0	0
(d) Return flight towards base; max. continuous rating	0.80	5.0	44.0
(e) Combat period; max. rating <u>no reheat.</u>	0.93	5.0	0
(f) Return to base; max. continuous rating.	0.80	31.65	278.5

Total sortie time

84.25 mins.

Radius of action (a) ÷ (b)

322.5 N.M.

(g) Fuel allowance remains for approach and landing etc. equivalent to 20 mins. stand-off.

* Initial cruise speed drop tanks on = 0.75 M.

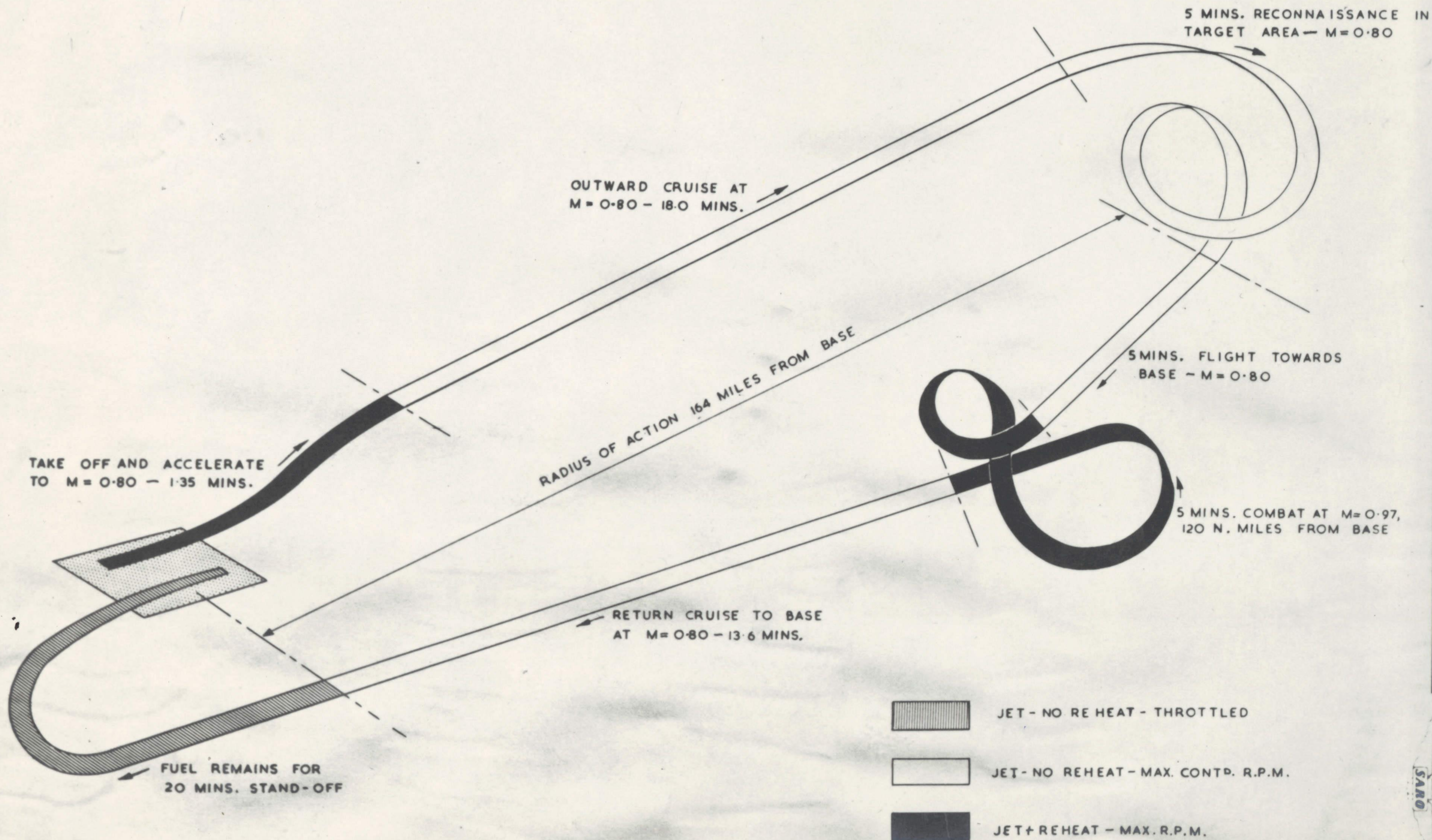
S.R.177 - ALL KEROSENE LAYOUT (9930 LB. FUEL) NO DROP TANKS

A.U.W. WITH 2x 1,000 LB BOMBS = 25,680 LB.
RADIUS OF ACTION = 164 N.MILES
TOTAL SORTIE FLYING TIME = 47.95 MINS + 20 MINS. STAND OFF
RADIUS OF ACTION IF COMBAT IS DONE WITH NO REHEAT = 248 N.MILES

SECRET

20A

GROUND ATTACK PERFORMANCE



S.R. 177

SECRET

T.P. 161

SANO

GA

COMMONWEALTH OF AUSTRALIA

1/501/726.
201/24/1829.

Telephone :
TEMPLE BAR 2435

ROYAL AUSTRALIAN AIR FORCE,
OVERSEAS HEADQUARTERS,
AUSTRALIA HOUSE,
STRAND,
LONDON, W.C.2

REFERENCE 2535/188/1/Tech (1A) 1527

RECEIVED
A.M. 18 APR 1956
P.M.
Central Registry

9th April 1956

Secretary,
Dept. of Air,
Victoria Barracks,
MELBOURNE, S.C. 1. VIC.,
AUSTRALIA.

Saunders Roe S.R. 177 Aircraft

The Ministry of Supply requests that the enclosed brochure, Copy No. 16 of Publication T.P.161 dated January, 1956 and entitled "S.R. 17 Capabilities in Ground Attack : An Assessment of the High Altitude Version in the Ground Attack Role", be passed to -

Sir Gordon Taylor,
141 York Street,
Sydney,
New South Wales.

Forwarded
18/4/56
Wing Commander
Wood

STATE OF TELECOMMUNICATIONS AND RADAR
S161
18 APR 1956
ORDERLY ROOM

F.J.P. Wood
(F.J.P. WOOD)
Wing Commander
For Air Officer Commanding

D of A
DTS

Encl :

7A



COMMONWEALTH OF AUSTRALIA

Mr Hicks, This is the paper left by error of M.O.S. could I have Murdoch's views briefly by Friday.

With the Compliments A.S.G.

of the

Minister for Air

and

Minister for Civil Aviation

Dear

Thank you

DCAS

W.H. 10/5/56 A.S.G.

File handed to Minister for him to see encl 2A W.H. 11/5/56

SECRET.

THE SAUNDERS ROE P.177D. FIGHTER AIRCRAFT.

The Saunders Roe P.177D Mixed Power Plant Aircraft is being developed to meet the requirements of the United Kingdom Air and Naval Staffs for a high altitude interceptor with some Night/Bad Weather capabilities. In this role it will carry two "Blue Jay" guided weapons as the main armament, with two special-to-type rocket batteries each carrying approximately 20 air-to-air un-guided rockets to O.R. 1126 as an alternative. No conventional gun armament is being provided.

2. The requirements of the two Services are being met from the same basic design. The Naval version will, however, be strengthened locally to meet catapult and deck landing requirements for Carrier operation, and a jet deflection installation will be developed for installation in production aircraft if this is found necessary. The Naval version will also be fitted with "blow down" flaps but this facility is not required to meet the Air Staff requirement.

3. The aircraft will be fitted with one "Gyron Junior" Gas turbine of 10,000 lbs. static thrust with a variable reheat installation giving up to 40% thrust increase and one De Havilland "Spectre" rocket motor rated at 8,000 lbs. sea level thrust which uses High Test Peroxide Oxidant. The machine is capable of speeds up to $M=2$. At a take-off weight of about 27,000 lbs. under I.C.A.N. conditions, the aircraft would meet normal take-off requirements on reheated gas turbine alone, and will climb to 40,000 feet under this power in approximately 5 minutes. The Air Staff requirement calls for an outward cruise endurance on normal internal fuel at $M=0.9$ at this altitude of 6 minutes, this being extendable to 20 minutes when using drop tanks at a cruising altitude of 36,000 feet. A Flight Refuelling Installation

/is

is also being developed. Rocket power will permit acceleration to $M=1.6$ in approximately 1.5 minutes and the aircraft will accelerate, turn 180 degrees and climb to 60,000 feet in 3.5 minutes, with a further 1 minute endurance at $M=1.6$ in a pursuit course attack. With normal internal fuel a radius of action of 100 nautical miles is obtainable, this being increased to 200 nautical miles with drop tanks. The Naval version has a comparable performance to meet Naval Staff requirements and will be capable of world wide operation. Normal catapulting and deck landing requirements will be met. The facility is also being provided to vary the proportions of kerosene and High Test Peroxide to meet training requirements and alternative sortie patterns, and in the all-kerosene role the aircraft will have a reinforcement range of approximately 2,000 miles. The operational potential of this aircraft may be appreciably increased over and above that quoted by the installation of a rocket of higher thrust than that now being installed.

4. From manoeuvrability aspects the aircraft will be capable of a steady 2"G" turn at 60,000 feet and a Mach number limitation will be imposed at $M=2$ on account of kinetic heating effects on the aircraft structure. The Naval Staff also require the aircraft to be capable of flight at 75,000 feet for 1 minute, and a crash climb to 60,000 feet at a final speed of $M=1.6$ under combined gas turbine and rocket power will be possible within 4 minutes from pressing the starter buttons: in a Ground Attack role with external tanks the aircraft will have a maximum range of 320 nautical miles at sea level when carrying 2,000 lbs. of external stores, full normal strength factors being realised under these conditions.

5. The aircraft weapon system which is identical in
/both

both versions will consist of an integrated A123/Blue/Jay/Manoeuvre Holder - Automatic Pilot/O.R. 1108 Sight Installation. The radio fitted will be U.H.F. (ARC52) with Stand-by and Homing aids.

6. An order for 27 development batch aeroplanes to this specification is now being considered, the first of which is scheduled to fly in April 1958 and present plans indicate that C.A.^Ø release for the type for both the Royal Navy and the Royal Air Force should be given in mid-1960.

7. Unit cost is estimated at £150,000.

(Ø Note:- C.A. release is the final authorisation by the Controller, Air, of the Ministry of Supply for release of the aircraft to the Services after it has passed its acceptability tests by the Air Ministry).

OFFICE OF THE HIGH COMMISSIONER FOR THE
UNITED KINGDOM, CANBERRA.

7TH MAY, 1956.

SECRET.

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2. The requirements of the two Services are being met from the same basic design. The Naval version will, however, be strengthened locally to meet catapult and deck landing requirements for Carrier operation, and a jet deflection installation will be developed for installation in production aircraft if this is found necessary. The Naval version will also be fitted with "blow down" flaps but this facility is not required to meet the Air Staff requirement.

3. The aircraft will be fitted with one "Gyron Junior" Gas turbine of 10,000 lbs. static thrust with a variable reheat installation giving up to 40% thrust increase and one De Havilland "Spectre" rocket motor rated at 8,000 lbs. sea level thrust which uses High Test Peroxide Oxidant. The machine is capable of speeds up to M=2. At a take-off weight of about 27,000 lbs. under I.C.A.N. conditions, the aircraft would meet normal take-off requirements on reheated gas turbine alone, and will climb to 40,000 feet under this power in approximately 5 minutes. The Air Staff requirement calls for an outward cruise endurance on normal internal fuel at M=0.9 at this altitude of 6 minutes, this being extendable to 20 minutes when using drop tanks at a cruising altitude of 36,000 feet. A Flight Refuelling Installation

/is

is also being developed. Rocket power will permit acceleration to $M=1.6$ in approximately 1.5 minutes and the aircraft will accelerate, turn 180 degrees and climb to 60,000 feet in 3.5 minutes, with a further 1 minute endurance at $M=1.6$ in a pursuit course attack. With normal internal fuel a radius of action of 100 nautical miles is obtainable, this being increased to 200 nautical miles with drop tanks. The Naval version has a comparable performance to meet Naval Staff requirements and will be capable of world wide operation. Normal catapulting and deck landing requirements will be met. The facility is also being provided to vary the proportions of kerosene and High Test Peroxide to meet training requirements and alternative sortie patterns, and in the all-kerosene role the aircraft will have a reinforcement range of approximately 2,000 miles. The operational potential of this aircraft may be appreciably increased over and above that quoted by the installation of a rocket of higher thrust than that now being installed.

4. From manoeuvrability aspects the aircraft will be capable of a steady 2"G" turn at 60,000 feet and a Mach number limitation will be imposed at $M=2$ on account of kinetic heating effects on the aircraft structure. The Naval Staff also require the aircraft to be capable of flight at 75,000 feet for 1 minute, and a crash climb to 60,000 feet at a final speed of $M=1.6$ under combined gas turbine and rocket power will be possible within 4 minutes from pressing the starter buttons: in a Ground Attack role with external tanks the aircraft will have a maximum range of 320 nautical miles at sea level when carrying 2,000 lbs. of external stores, full normal strength factors being realised under these conditions.

5. The aircraft weapon system which is identical in
/both

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the aircraft to the Services after it has passed its
acceptability tests by the Air Ministry).

OFFICE OF THE HIGH COMMISSIONER FOR THE
UNITED KINGDOM, CANBERRA.

7TH MAY, 1956.

PRIME MINISTER'S DEPARTMENT.

MCT/CM

437/2^{6A}

The Secretary,
Department of Air,
MELBOURNE.

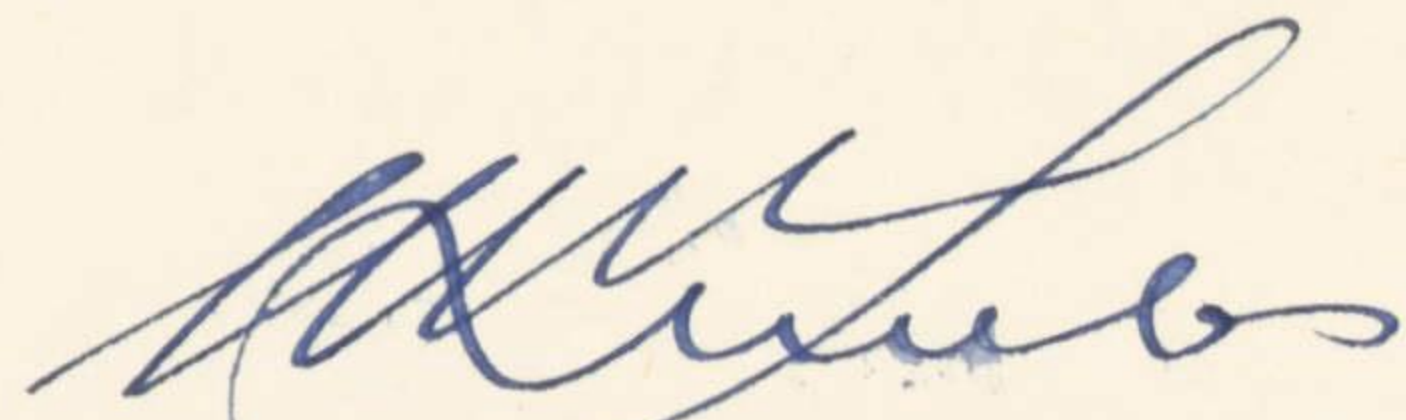
SECRET

attention must be paid.

Referred for your information.

DCAS

ASH 18/5/56



for. (A. S. Brown)
Secretary.

14 MAY 1956

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PRIME MINISTER'S DEPARTMENT

MR. BUNTING:

NOT ATTACHED
.....

Fingland called on me yesterday and mentioned that he understood that the Murdoch Mission to the United States had recommended the purchase of United States F.104 fighter aircraft. (Press cuttings and photos attached). He wondered whether the Government had taken an irrevocable decision to go ahead with the purchase of this aircraft.

I said that I was completely unaware of what action had been taken on the Murdoch report nor did I know whether this aircraft had been recommended.

Following this he asked me to pass on to the officers dealing with the subject the following information. The United Kingdom is on the point of taking a decision to go ahead with the Saunders/Roe P.177D fighter aircraft. It is perhaps more advanced than the F.104. It is capable of different performances on different fuels and it is being "built around" the "Blue Jay" guided weapon of which it will carry two as the main armament. More details are attached.

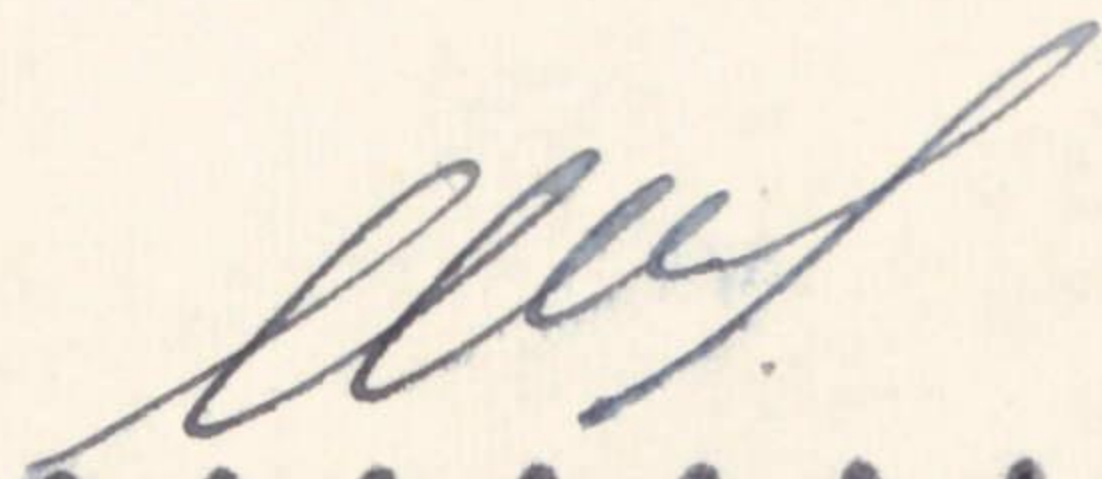
.....

He wished it to be understood that if a decision were to be taken in the United Kingdom to go ahead with the production of the aircraft it would be three to four years before they would become available.

Fingland was obviously speaking from instructions received by Cable from the United Kingdom and he suggested that if a decision had been taken to go ahead with the F.104 nothing more could be done. If, on the other hand, this had not been done he suggested that we might be prepared to examine the possibilities of the P.177D before taking a final decision.

The United Kingdom S.L.S. have been instructed to bring the advantages of the P.177D to the notice of the Department of Defence and the Department of Air, Melbourne,. I said that I would convey his message to you.

(I believe Errol will mention it to Mr. Townley today.)

.....

 (M. C. Timbs).

9th May, 1956.

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2. The requirements of the two Services are being met from the same basic design. The Naval version will, however, be strengthened locally to meet catapult and deck landing requirements for Carrier operation, and a jet deflection installation will be developed for installation in production aircraft if this is found necessary. The Naval version will also be fitted with "blow down" flaps but this facility is not required to meet the Air Staff requirement.

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/is

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4. From manoeuvrability aspects the aircraft will be capable of a steady 2"G" turn at 60,000 feet and a Mach number limitation will be imposed at $M=2$ on account of kinetic heating effects on the aircraft structure. The Naval Staff also require the aircraft to be capable of flight at 75,000 feet for 1 minute, and a crash climb to 60,000 feet at a final speed of $M=1.6$ under combined gas turbine and rocket power will be possible within 4 minutes from pressing the starter buttons: in a Ground Attack role with external tanks the aircraft will have a maximum range of 320 nautical miles at sea level when carrying 2,000 lbs. of external stores, full normal strength factors being realised under these conditions.

5. The aircraft weapon system which is identical in
/both

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Installation. The radio fitted will be U.H.F. (ARC52)
with Stand-by and Homing aids.

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acceptability tests by the Air Ministry).

OFFICE OF THE HIGH COMMISSIONER FOR THE
UNITED KINGDOM, CANBERRA.

7TH MAY, 1956.

5a.

TELEPHONE MXY 440
236
EXT.
TELEGRAMS: UKSLIA MELBOURNE

SECRET

UNITED KINGDOM SERVICE LIAISON STAFF
ROOM 139 "A" BLOCK
VICTORIA BARRACKS
MELBOURNE, S.C.1
1/501/726

RECEIVED
A.M. 3 May 1956
P.M.
Central Registry

9th May, 1956

PKS
DOP OR
13/4/56

UKSLS(AIR)/29/Air
Sir,

SAUNDERS ROE P.177D

I have the honour to inform you that the United Kingdom authorities are about to make a decision on the adoption of a replacement fighter aircraft for the Royal Air Force and it is expected that this decision will be in favour of a new aircraft, the Saunders Roe P.177D.

2. As the new aircraft has some features which may be of special interest to Australia, namely its weapon system and reinforcement range, and as it is understood that the Royal Australian Air Force is also considering a replacement fighter aircraft, the High Commissioner for the United Kingdom has instructed me to make available full details to the Department of Air in the hope that they may prove of value to the Royal Australian Air Force in arriving at a final decision.

3. The Saunders Roe P.177D Mixed Power Plant Aircraft is being developed to meet the requirements of the British Air and Naval Staffs for a high altitude interceptor with some Night/Bad Weather capabilities. In this role it will carry two Blue Jay guided weapons as the main armament, with two special-to-type rocket batteries each carrying approximately 20 air-to-air un-guided rockets as an alternative. No conventional gun armament is being provided. The Blue Jay weapon system is of particular interest since this weapon, which is shortly to undergo acceptance trials at Woomera, is unlikely to be fitted to any aircraft not designed to carry it, because of the difficulties and expense of installation.

4. The requirements of the two Services are being met from the same basic design. The naval version will, however, be strengthened locally to meet catapult and deck landing requirements for Carrier operation and a jet deflection installation will be developed for installation in production aircraft if this is found necessary. The Naval version will also be fitted with "blow down" flaps but this facility is not required to meet the Air Staff requirement.

/2.

The Secretary,
Department of Air,
Victoria Barracks,
Melbourne.

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- 2 -

5. The aircraft will be fitted with one Gyron Junior Gas turbine of 10,000 lbs. static thrust with a variable reheat installation giving up to 40% thrust increase and one De Havilland Spectre rocket motor rated at 8,000 lbs. sea level thrust, which uses High Test Peroxide Oxidant. The machine is capable of speeds up to Mach 2. At a take off weight of about 27,000 lbs., under I.C.A.N. conditions, the aircraft would meet normal take-off requirements on reheated gas turbine alone, and will climb to 40,000 feet under this power in approximately 5 minutes. The Air Staff requirement calls for an outward cruise endurance, on normal internal fuel at M equals 0.9 at this altitude, of 6 minutes, this being extendable to 20 minutes when using drop tanks at a cruising altitude of 36,000 feet. A Flight Refuelling Installation is also being developed. Rocket power will permit acceleration to M equals 1.6 in approximately 1.5 minutes and the aircraft will accelerate, turn 180 degrees and climb to 60,000 feet in 3.5 minutes, with a further 1 minute endurance at M equals 1.6 in a pursuit course attack. With normal internal fuel, a radius of action of 100 N.M. is obtainable, this being increased to 200 N.M. with drop tanks. The Naval version has a comparable performance to meet Naval Staff requirements and will be capable of world wide operation. Normal catapulting and deck landing requirements will be met. The facility is also being provided to vary the proportions of kerosene and High Test Peroxide to meet training requirements and alternative sortie patterns and in the all-kerosene role the aircraft will have a reinforcement range of approximately 2,000 miles. The operational potential of this aircraft may be appreciably increased over and above that quoted by the installation of a rocket of higher thrust than that now being installed.

6. From manoeuvrability aspects the aircraft will be capable of a steady 2'G' turn at 60,000 feet and a Mach number limitation will be imposed at M equals 2.0 on account of kinetic heating effects on the aircraft structure. The Naval Staff also require the aircraft to be capable of flight at 75,000 feet for 1 minute, and a crash climb to 60,000 feet at a final speed of M equals 1.6 under combined gas turbine and rocket power will be possible within 4 minutes from pressing the starter buttons: in a Ground Attack role with external tanks the aircraft will have a maximum range of 320 N.M. at sea level when carrying 2,000 lbs. of external stores, full normal strength factors being realised under these conditions.

7. The aircraft weapon system which is identical in both versions will consist of an integrated Al23/Blue Jay/Manoeuvre Holder - Automatic

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/3.

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- 3 -

Pilot/O.R. 1108 Sight Installation. The radio fitted will be U.H.F. (ARC 52) with Stand-by and Homing aids.

8. An order for 27 development batch aeroplanes to this specification is now being considered, the first of which is scheduled to fly in April 1958 and present plans indicate that C.A. release for the type for both the Royal Navy and the Royal Air Force should given in mid-1960.

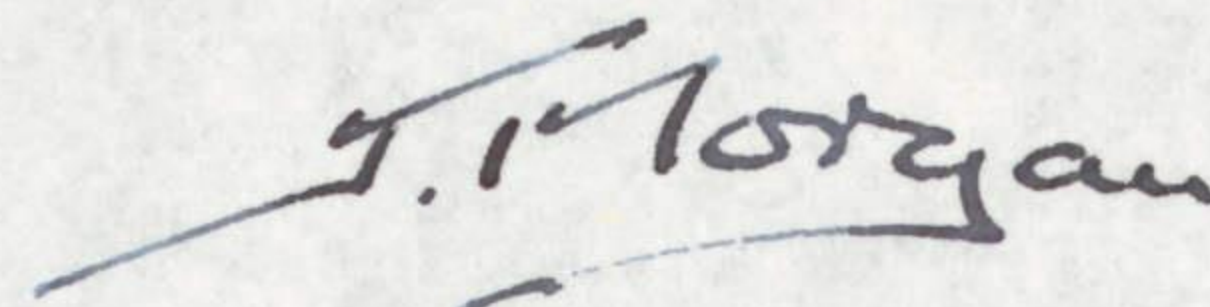
? // 9. Unit cost is estimated at £150,000.

10. It may be of interest to know that the details quoted above are also being released in Canberra, on the political level, by the High Commissioner's Office.

I have the honour to be,

Sir,

Your obedient Servant,



(J. MORGAN)

Wing Commander

for Group Captain

SENIOR AIR ADVISER TO THE

UNITED KINGDOM HIGH COMMISSIONER

SECRET

TOP SECRET

49

MELBOURNE
TELECOMMUNICATIONS UNIT
22 APR 1956
OFFICE

MESSAGE FORM

223/4

FROM RAAFOHQ

TO DEPT OF AIR

RECEIVED BY
SECURE MEANS

X TOPSEC X A633 APR 21 CCIGSEC FOR CAS FROM AOC. AM INFORMED BY DEPARTMENT
OF DEFENCE PRODUCTION REPRESENTATIVE THAT MINISTRY OF SUPPLY ARE
SIGNALLING UK HIGH COMMISSIONER CANBERRA THIS WEEKEND TELLING HIM
TO BRING TO NOTICE OF AUSTRALIAN GOVERNMENT SAUNDERS ROE SR177 FIGHTER
MOD
RAF OR301 AS POSSIBLE COMPETITOR WITH F104. PROTOTYPE OF SR177
TO BE FLOWN SHORTLY. THOUGHT YOU SHOULD BE INFORMED OF THIS APPROACH
TO GOVERNMENT

KW FOR DCO

PRIORITY

DTG 210200Z

THI 220800Z

CAS seen luff
23/4/56

D. ORS.

TOP SECRET PRIORITY

AIR MAIL

POSTAL ADDRESS:
BOX 30 P.O. BANKSTOWN N.S.W.
NP/16

DE HAVILLAND AIRCRAFT PTY. LTD.

17th April, 1956.

Air Marshal Sir John P.J. McCauley, K.B.E., C.B.,
Chief of Air Staff,
Royal Australian Air Force,
Victoria Barracks,
St. Kilda Road,
MELBOURNE. VIC.

Dear Sir John,

This short note is to thank you for the serious consideration you gave to the project I discussed with you last week and to apologise for presenting rather inadequate details.

Our information indicates that longer ranges are possible but, unfortunately, all the studies in the brochure which your staff examined, are compiled to meet the United Kingdom requirement of a maximum rate of climb for interceptor duties.

In correspondence with England we have stressed that the manufacturer should pay more attention to local Australian needs in setting out performance capabilities and, as soon as any more data comes to hand, we shall make it available to you.

Yours sincerely,

R. Kingsford-Smith

R. Kingsford-Smith.

WJG.

AIR STAFF EVALUATION OF SAUNDERS ROE
PI77N INTERCEPTOR FIGHTER

- APPENDICES:
- "A" - Comparison of Saunders Roe PI77N Interceptor Fighter with R.A.A.F. Air Staff Requirement OR/AIR.34 (Issue 2).
 - "B" - Radii of Action Figures for the Saunders Roe PI77N Interceptor Fighter

INTRODUCTION

1. An evaluation has been made of the Saunders Roe PI77N against the requirements of the existing R.A.A.F. Air Staff Requirement OR/AIR.34 (Issue 2) for a fighter aircraft to replace the Sabre.

2. The resulting evaluation was based on information contained in the Interim Brochure supplied by Saunders Roe through De Havilland Aircraft (Aust.). It should be stressed that the information contained in this brochure appears to be extremely sketchy. The aeroplane is still very much in the early design proposal stage. If and when it is built, the actual performance figures could therefore vary greatly from those presented in the brochure. The F138D, which is aerodynamically similar, should fly within a month to two months. This should establish performance figures which may be a more accurate guide to the performance of the PI77N.

COMPARISON WITH AIR STAFF REQUIREMENT
OR/AIR.34

3. At Appendix "A" is a comparison between the PI77 and OR/AIR.34. It appears that the aircraft was designed to meet a naval specification for an interceptor fighter for carrier operation and falls short of our requirements mainly for the following reasons:-

- (a) Radius of Action. At Appendix "B" are figures showing radii of action capabilities for the aircraft under various combat conditions. These figures indicate that the operational radius of action for an actual interception is limited to 200 n.m. as opposed to our requirement for 500 n.m. The aircraft could be ferried over 1800 n.m. by dropping external tanks. This ferry range is satisfactory.

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- (b) Armament. OR/AIR.34 specifies that the aircraft must be adaptable to the ground attack role. The Pl77N has no guns fitted although it may be possible to use wing tip rocket batteries in this role. These batteries could only be used successfully against "soft skinned" targets.
- (c) Navigation Equipment. The aircraft does not meet the requirement for en route navigation equipment, e.g. equipment incorporating the Doppler Principle and also a radio compass.
- (d) Radio Equipment. OR/AIR.34 requires dual U.H.F. R/T. The only equipment contained in the Pl77N is single installation V.H.F. *Dual UHF in 177D.*
- (e) Availability. Target date for replacement of the Sabre is mid-1958. Advice is to the effect that if orders are placed for the Pl77N line production would commence about 1960.

EQUIPMENT CONSIDERATIONS

4. As the Pl77 has a mixed power plant the following considerations also arise:-

- (a) Aircraft. Spares and handling equipment not common to existing types.
- (b) Turbojet. This is a new type but with the present level of turbojet experience in the R.A.A.F., short conversion courses for maintenance personnel should satisfactorily overcome this problem.
- (c) Rocket:-
- (i) Entirely new equipment necessitating additional range of spares and specialised handling equipment.
- (ii) Requires two types of fuel - High Test Peroxide and Rocket Kerosene - as a mixture. Both of these fuels are not presently stocked by the R.A.A.F..
- (iii) Facilities for training technical musterings in operation and maintenance of such equipment are not available within the Service at present. A nucleus of personnel would therefore have to be send overseas for training.

USE ON EXISTING RUNWAYS

5. Tyre pressure of the Pl77N is 250 lbs. p.s.i. Existing R.A.A.F. runways are stressed for use by aircraft with tyre pressures up to 150 lbs. p.s.i. Normal use

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NAA: A1196, 1/501/726

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3.

of the P177N on present runways would necessitate replacement of runways or cause rapid deterioration with high repair costs.

LOCAL MANUFACTURE

6. A.M.T.S. state that the limited construction details available indicate there would be few technical problems in manufacturing the aircraft locally. The main limitations would be economic i.e. cost of retooling and the time factor.

Conclusion

7. Present information indicates that the aeroplane has been designed basically as a high altitude interceptor fighter capable of gaining and maintaining air superiority over a local area; operations which require the aircraft to take-off and destroy the enemy and then immediately land. It's climb, speed and handling characteristics more than fulfil our requirement. Our present planning requires Sabre replacement aircraft to operate over large areas and also to be capable of escorting bombers in attacks against enemy sources of air power. On the information available, this aircraft has insufficient operational range to be satisfactory in the escort role. Additionally, the aircraft is in the early design stage, no prototype has yet flown. To obtain delivery by 1961 (estimated) at the earliest, it would be necessary to place a pre-production order for a completely untried aircraft. It therefore could not possibly meet our requirement for a replacement aircraft for the Sabre by 1958.

Greenwood

Wg. Cdr.
D/D. Ops. (O.R.)

12 Apr. 56

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Appendix "A" to an
Air Staff Evaluation
of Saunders Roe P177N
Interceptor Fighter
dated 12th April, 1956

COMPARISON OF SAUNDERS ROE P177N INTERCEPTOR
FIGHTER WITH R.A.A.F. AIR STAFF REQUIREMENT
OR/AIR.34 (ISSUE 2)

Extracts from OR/AIR.34	Saunders Roe P177N	Comments
<u>Para.4.</u> Role of the Aircraft. The maintenance of air superiority.	High altitude interceptor powered by one D.H. Gyron Junior turbo-jet with reheat and one D.H. "Spectre" rocket motor.	Should be capable of fulfilling this requirement over a local area.
<u>Para.5.</u> Offensive Action. The aircraft will be required to attack and destroy all types of enemy aircraft and to escort bombers in attacks against enemy sources of air power on the ground.	(a) High rate of climb and operational ceiling. (b) Bomber escort range would appear small.	From the present information the range for escort of bombers would prevent the aircraft fulfilling this requirement over distances in excess of 200 nm from base.
<u>Para.6.</u> Defence of Base Area. In this role the aircraft will be required to destroy all types of attacking aircraft and guided missiles.	High rate of climb, radar and guided weapon fitment should provide good capability in this role.	Appears satisfactory.
<u>Para.7.</u> Second Phase development. In this phase it will be required to attack enemy air bases, targets in the direct support programme, and lines of communication in the tactical area.	No gun armament fitted but may be possible to use rocket batteries fitted to wing-tips.	Present armament equipment makes this aircraft unsatisfactory in the direct or close support role, except against soft skinned targets.
<u>Para.9.</u> Turn Round Time. The aircraft should be designed to permit complete turn round within 10 minutes.	No details.	-
<u>Para.10.</u> Undercarriage. A self centring steerable nose wheel type is required.	Steerable through 60° castorable through 360°.	Appears satisfactory.

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Extracts from OR/AIR.34	Saunders Roe P177N	Comments
<p><u>Para.11.</u> Brake System Toe Pedal type plus a parking brake. A parachute brake is acceptable for emergency use.</p>	<p>No details except that parking brake fitted.</p>	<p>-</p>
<p><u>Para.12.</u> Starter System. A self contained system permitting 3 start without re priming is required.</p>	<p>Unknown.</p>	<p>-</p>
<p><u>Para.13.</u> Emergency Jettison. Immediate jettison of all or individual stores is required.</p>	<p>Means of jettison of external stores fitted.</p>	<p>Appears satisfactory.</p>
<p><u>Para.14.</u> Fuel System. Pressure refuelling of internal and drop tanks is required, plus provision for flight refuelling. Self sealing tanks not required, but in the event of damage tanks should be designed to permit the loss of not more than 20% of remaining fuel. Purging by inert gas is desirable.</p>	<p>Limited information. From diagrams it appears possible that pressure refuelling is used. Provision for three types of fuel would appear to complicate flight refuelling.</p>	<p>Would appear to be satisfactory. As flight refuelling is usually required to extend the range there would therefore be no requirement to flight refuel the aircraft with rocket fuel.</p>
<p><u>Para.15.</u> Automatic Pilot. Lightweight automatic type required.</p>	<p>Fitted</p>	<p>Appears satisfactory.</p>
<p><u>Para.16.</u> Zero Reader. Latest version of Zero Reader Flight Director incorporating combined indicator is required.</p>	<p>Rudimentary flight director instrument fitted.</p>	<p>May require alteration.</p>
<p><u>Para.17.</u> Powered Controls. Power operated controls for the tail unit and artificial feel is required.</p>	<p>Powered controls to be fitted but exact system not yet decided.</p>	<p>Appears satisfactory.</p>
<p><u>Para.18.</u> Air Brakes. Powerful quick acting air brakes are required throughout entire speed range. They must not offset trim etc.</p>	<p>Fitted at rear fuselage but no details.</p>	<p>Appears satisfactory.</p>
<p><u>Para.20.</u> Speed. Capable of M = 1.5 and preferably M = 2.0 at 60,000 ft.</p>	<p>Meets our requirement. Capable of acceleration to M = 2.0 at 70,000 ft.</p>	<p>Satisfactory</p>

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Extracts from OR/AIR.34	Saunders Roe P177N	Comments
<p><u>Para.21.</u> Height. Capable of 1000 FPM at 60,000 ft.</p>	Meets the requirement.	Satisfactory.
<p><u>Para.22.</u> Rate of Climb. Time to 50,000 at normal A.U.W. not to exceed 5 minutes.</p>	Meets the requirement but necessitates use of rocket for at least part of climb.	Satisfactory.
<p><u>Para.23.</u> Landing and Take Off. Capable of operating from a 6000 ft. strip at sea level under I.S.A. conditions.</p>	Information only provided for catapulted take off and landings using arrester gear.	Since this information pertains to aircraft carrier operation it is not possible to assess runway length requirements.
<p><u>Para.24.</u> Manouverability. Aircraft to be capable of rate of roll = 200°/sec. and of sustaining a turn of 1.5G at 60,000 ft. at M = 1.3.</p>	(a) Roll not stated. (b) 2.31G at M = 1.4 at 60,000 ft.	Manouvreability appears satisfactory.
<p><u>Para.25.</u> Endurance. The aircraft must be capable of :-</p> <p>(a) Taxi, take off and accelerate.</p> <p>(b) Climb to 50,000 and cruise at M = .9 for 30 mins.</p> <p>(c) Climb to 60,000 ft. and fly at M = 1.5 for 5 mins.</p> <p>(d) Descend to 50,000 ft. and return to base at economical cruise.</p> <p>(e) Descend and land with sufficient fuel for overshoot and landing.</p>	The figures available indicate that the maximum sortie time for the P177 is 41 mins. This is approximately half the time required by the Air Staff Requirement.	Unsatisfactory.
<p><u>Para.26.</u> Radius of Action. Combat radius with normal armament should be 500 n.m. and preferably 750 n.m. This sortie should include 5 mins. at 55,000 ft. at M = 1.5.</p>	From information available combat radius of action varies between 180/200 nautical miles under these conditions.	Does not meet the requirement.
<p><u>Para.27.</u> A.U.W. Overall size and weight should be kept to a minimum.</p>	<p><u>lbs</u></p> <p>24,755 - Int. fuel 26,430 - 2x100 drop tanks 27,200 - 2x150 28,530 - 2x200</p>	-

Extracts from OR/AIR.34	Saunders Roe P177N	Comments
<u>Para.28.</u> Pilot Station. The best possible view and comfort is essential.	Forward view would appear adequate but limited rear view and no upward view.	Severely restricted in view.
<u>Para.29.</u> Pressurisation. Cabin to be pressurised to a differential pressure of 4 lbs. P.S.I. at 60,000 with pressure failure warning is required.	Has pressurisation.	Vague design details provided do not permit comparison with requirement.
<u>Para.30.</u> Cockpit Conditioning. Cockpit conditioning must incorporate cooling and heating in the air and on the ground.	Cockpit is conditioned.	Insufficient details available to comment.
<u>Para.31.</u> Emergency Exit. As automatic ejection system with dinghy and survival pack incorporated is required.	Martin Baker Lightweight Ejector Seat.	Appears satisfactory.
<u>Para.32.</u> De-Icing & De-misting. De-icing and de-misting of windscreen and canopy is required plus air intake de-icings.	No information.	-
<u>Para.33.</u> Oxygen. Oxygen for max. endurance at max. altitude is required.	No details of oxygen system except that Mk.18 Regulator is fitted.	-
<u>Para.34.</u> Armour Protection. Provision for protection of pilot from 30 mm fragments of HE shells from a 20° cone astern.	No information.	-
<u>Para.35.</u> Cockpit Lighting. An indirect red lighting system with emergency lighting is required.	No information.	-
<u>Para.36.</u> Pressure Suit/Anti G Suit. Provision for wearing of current partial pressure suits, pressure suits and anti-G suits is required.	Anti-G measures fitted but no details.	-

Extracts from OR/AIR.34	Saunders Roe PL77N	Comments
<p>Para.37. Flight Instruments. Following instruments are required:-</p> <ul style="list-style-type: none"> (a) Combined airspeed and mach number indicator. (b) Zero Reader (Combined Indicator). (c) A.H. (d) Rate of Climb. (e) Sensitive pressure altimeter. (f) B. & T. indicator. (g) Accelerometer. (h) Stop Clock. (i) Compass repeater. (j) Cabin altimeter. 	<p>Types of instruments to fulfill these functions are fitted.</p>	<p>Appears satisfactory.</p>
<p>Para.38. Engine Instruments.</p> <ul style="list-style-type: none"> (a) R.P.M. counter. (b) J.P.T. Gauge. (c) Oil gauge. (d) Fuel flow meter. 	<p>Standard instruments fitted.</p>	<p>Appears satisfactory</p>
<p>Armament requirement is as under:-</p> <ul style="list-style-type: none"> (a) Four guns of a type to provide the greatest number of lethal hits. This involves high rate of fire, high muzzle velocity (3000 FPS) and high H.E. content. (b) Four guns plus a minimum of two and preferably four air-to-air homing weapons (these weapons may be Blue Jay - Red Dean, Falcon or Velvet Glove). (c) Four guns plus provision for carriage of current air-to-air (unguided) rockets, and multiple launching battery/s as required by OR/ARM. 28. (d) Four guns plus 2x1000 lb. M.C. or geletral bombs. (e) Four guns plus max. number of rockets. 	<p>2x Blue Jay or Rocket Batteries fitted on Wing tips.</p> <p>No guns.</p>	<p>Present armament makes the aircraft unsatisfactory for use in the ground attack role.</p>

Extracts from OR/AIR.34	Saunders Roe P177N	Comments
<u>Para.40.</u> Time of Fire. Sufficient ammunition for 8-10 secs firing is required.	See above.	Unsatisfactory.
<u>Para.41.</u> Fire Control System. A gyro type gunsight with ranging facilities and an "E" type fire control system is required. (The fire control system should comprise a lock follow radar, and a computer associated with the Auto Pilot). A lightweight search radar is also required. Heating for guns and ammunition is also required.	(a) Al-20 Search Radar for Blue Jay plus reflector sight for use if Al20 fails. (b) GGS Mk.8 for use with rocket batteries.	The system may not be completely satisfactory. From the information available there is doubt as to whether a lock follow system is available.
<u>Para.43.</u> Navigation Equipment. Navigation equipment should consist of:- (a) Remote indicating compass comprising of a sensitive magnetic element monitoring a gyro unit. (b) Standby compass. (c) AN/ARN-21. (d) En route navigation equipment incorporating Dappler principle. (e) Automatic radio compass.	(a) Heading indicator fitted but no details. (b) E2 Compass. (c) TACAN. (d) No information. (e) No information.	On information available the aircraft does not meet our requirements.
<u>Para.44.</u> Radio Dual UHF R/T (AN/ARC-34) with facilities for data transmission is required.	TR1936 single installation VHF.	Does not meet the requirement of double installation UHF.
<u>Para.45.</u> Identification. I.F.F. Mk.10 (AN/APX-6) F.I.S. Fighter Identification System.	I.F.F. with S.I.F.	Appears satisfactory.
<u>Para.46.</u> Target Date. The replacement fighter is required for service use progressively from mid 1958.	Understood aircraft in production approx. 1960/61.	Not satisfactory.

RADIUS OF ACTION FIGURES FOR THE SAUNDERS ROE P177N
INTERCEPTOR FIGHTER

Conditions	Time in Minutes	Radius of Action
(a) T.O. and climb to 60,000 ft. Rocket on at 40,000 ft. (Drop tanks discarded on climb)	6.68	200 n.m.
Accelerate to M = 1.4 at 60,000 ft.	.75	
Cruise Duration at M = 1.4 at 60,000 ft.	3.0	
180° turn at M = 1.4	1.03	
Combat Duration at M = 1.4 at 60,000 ft.	3.04	
Return cruise to marshalling point at 40,000 ft. at M = .8	13.0	
Descent	5.0	
Sortie Total	32.5	
Stand-off	23.0	
TOTAL:	55.5	
(b) T.O. and climb to 60,000 ft. Rocket on at T.O.	2.65	180 n.m.
Accelerate to M = 1.4 at 60,000 ft.	.625	
Cruise duration at M = 1.4 at 60,000 ft.	4.34	
Return cruise at M = .8 at 40,000 ft.	20.0	
Descent	5.0	
Sortie Total	32.615	
Stand-off	23.0	
TOTAL:	55.615	
(c) T.O. and climb to 60,000 ft. Rocket on at 20,000 ft. (Drop tanks discarded during climb)	4.65	200 n.m.
Accelerate to M = 1.4 at 60,000 ft.	.72	
Cruise Duration at M = 1.4 at 60,000 ft.	7.87	
Return cruise at M = .8 at 40,000 ft.	23.0	
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Conditions	Time in Minutes	Radius of Action
Descent	5.0	
Sortie Total	<u>41.24</u>	
Stand-off	23.0	
TOTAL:	<u>64.24</u>	
(d) T.O. and climb to 40,000 ft. Rocket on at 20,000 ft. (Drop tanks discarded during climb)	3.66	200 n.m.
Cruise at M = .8 at 40,000 ft.	10.0	
Climb to 60,000 ft. with maximum thrust	.90	
Accelerate to M = 1.4 at 60,000 ft.	.70	
180° turn at M = 1.4 at 60,000 ft.	1.06	
Combat at M = 1.4 at 60,000 ft.	3.96	
Return cruise at M = .8 at 40,000 ft.	15.0	
Descent	5.0	
Sortie Total	<u>35.28</u>	
Stand-off	23.0	
TOTAL:	<u>58.28</u>	
(e) With Reduced H.T.P. to kerosene ratio for training role		280/290 n.m.
T.O. and climb to 40,000 ft. on jet plus reheat	4.73	
Cruise at M = .8 at 40,000 ft.	30.0	
Climb to 60,000 ft. using maximum thrust	.804	
Cruise at M = 1.4 at 60,000 ft.	3.71	
Return cruise at M = .8 at 40,000 ft.	32.0	
Descent	5.0	
Sortie Total	<u>76.874</u>	
Stand-off	23.00	
TOTAL:	<u>99.874</u>	

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Conditions	Time in Minutes	Radius of Action
<p>(f) With all kerosene for training role</p> <p>T.O. and climb to 40,000 ft. on jet plus reheat</p> <p>Endurance at M = .8 at 40,000 ft. on jet alone</p> <p>Descent</p> <p style="text-align: right;">Sortie Total</p> <p>s Stand Off</p> <p style="text-align: right;">TOTAL:</p>	<p>4.36</p> <p>169.0</p> <p>5.0</p> <hr/> <p>178.36</p> <p>23.0</p> <hr/> <p>201.36</p>	<p>650 n.m.</p>
<p><u>Interchange of Cruising Duration at M = .8 and Combat Duration at M = .97</u></p> <p>In the above case 1 min. of combat on jet plus reheat at M = .97 is equal to 5 min. cruising at M = .8 on jet alone.</p> <p>In this example drop tanks are not fitted and provision of drop tanks would increase radius of action by approx. 100-200 n.m.</p> <p>Ferry range under these conditions would be in order of 1300-1800 n.m. depending on fuel carried.</p>		

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DEPARTMENT OF AIR.

MINUTE PAPER.

(This side only to be written on.)

D.4678/9.45.—C.5025.

Subject:

D.Ops. (O.R.)

1. C.A.S. has directed that you make an evaluation of the performance of the P.177, the brochure of which I understand D.Ops. has passed to you by hand.

2. You may consider it desirable to seek the assistance of a member of A.M.T.S's Branch in your study, the results of which C.A.S. wishes by Friday, 13th April.

6 Apr. 56

Muller
Wg. Cdr.
S.O. C.A.S.

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