Top SECRET

Form S. 11b
(Sept., 1949)

DEPARTMENT OF AIR

Part No. 2 RP

File Number
1-501-667

Date of Opening
2.6.52.

Other Files or Papers bearing on the same Subject

BRANCH OR SECTION
ORIGINATING FILE: AS BEEN EXAMINED FOR RECLASSIFICATION
Date 17/Sept/53
SIG
RANK

SECRET

SUBJECT
MANNED ROCKET INTERCEPTOR.
Appreciation of to decide if a RAAF Requirement.
1952-53

1 Referred to for action or information	2 Minute or enclosure for attention	3 Date on which file is passed out of Branch	4 Initials (See Instruction No. 12)
~~DOPS~~	~~1 & 3~~	~~7/9/53~~	~~NAP~~
~~CAS~~	~~file~~	~~[illegible]~~	
~~DOPS~~	~~50~~	~~25/2/53~~	~~NAP~~
DCAS	1	19 Sep	
~~R/Rec 6~~	~~1~~	~~22/9~~	
PA	file	1/9	

Declassification Authority — Defence Records

This Record: 1/501/667 has been reviewed and is declassified.

Authority: Security — Department of Defence Canberra.

FILE REF: DM93/11648

DATE: 24Sep93 DP

National Archives of Australia

NAA: A1196, 1/501/667

XC 21
Revis[redacted]p 84

Department of Defence

DOWNGRADING/DECLASSIFICATION OF CLASSIFIED DOCUMENTS

SECTION 1 – REQUEST FOR DOWNGRADING OF CLASSIFIED DOCUMENTS

To:	From:

(Tick appropriate box)

☑ The document(s) listed below are considered to be overclassified and it is requested that their classification be reviewed.

If downgrading/declassification is agreed, please state new classification in (g); otherwise insert 'Nil Change'.

☐ These records are 25 years old and should be dealt with in accordance with DI(G)ADMIN 27/2 *(see Section 2 below).*

Serial	Reference No *(eg File No)*	Description and Title *(eg Letter, Report, File, etc)*	Date Range/ Date of Origin	Present Classification	Proposed Classification	Revised Classification
(a)	(b)	(c)	(d)	(e)	(f)	(g)
A1196	1-501-667	Manned Rocket Interceptor Appreciation of, to decide if a RAAF requirement	1952-1953	Secret	UC	UC

D Frey ..... D Frey ..... ASOS ..... Ref No DM93-11648
(Signature) *(Printed Name)* *(Rank/Designation)* 24 Sep 93 *(Date)*

SECTION 2 – NOTIFICATION OF DECLASSIFICATION OF CLASSIFIED ARCHIVAL DOCUMENTS
(For records older than 25 years)

To:

CEOAHS

The records described in Section 1.

a. ☑ have reached the age of 30 years and are hereby declassified in accordance with section 31 of the Archives Act 1983

☐ are not yet 30 years old, but have been examined and declassified

☐ are not yet 30 years old but have been examined and assessed as suitable for declassification, but not until they enter the open period. Once these records enter the open period they may be automatically declassified without further examination

b. comprises x ..... cm *(x thickness of document)*

c. the original of this form has been affixed to the records concerned

SECTION 3 – AUTHORITY TO DOWNGRADE/DECLASSIFY CLASSIFIED DOCUMENTS

To:	From:

(Tick appropriate box)

☑ Please note that the document(s) listed above are now graded as shown in column (g) above

☐ Other addressees of the document(s) listed above have been informed of the revised classification

☑ A copy has been sent to the OIC of the registry responsible for controlling the record

☑ A copy of this form has been forwarded to CEOAHS, Department of Defence, Russell Offices, Canberra ACT

☑ The declassification action indicated above has been approved by me, being an officer authorised to declassify archival records in Annex C to DI(G) ADMIN 27/2 Navy ADMIN 8–3, Army ADMIN 4–1, Air ADMIN 11–10 of 3 October 1984.

Declassification/Downgrading Authority

D Frey ..... D. Frey ..... ASOS ..... 24 Sep 93 ..... DM93-11648
(Signature) *(Printed Name)* *(Appointment)* *(Date)* *(File Ref No)*

Stock No 7530–66–109–3939

National Archives of Australia NAA: A1196, 1/501/667

MINUTE SHEET

Reference 1/501/667

46

D.C.A.S.

Not required
Ltr. 22/9

1. Reference your loose minute at Encl. 1A.

2. In view of your approval of the paper on "the Fighter Aircraft required by the R.A.A.F. as a replacement for the RA7 Sabre" (copy at encl.6A), do you still require an appreciation on the value of the Rocket Interceptor to the R.A.A.F.?

3. For your information the latest R.A.F. O.R. on the Rocket Propelled Interceptor is at Encl.7A.

Gp.Capt.
A/Cdre Ops.

17 Sep.53

R.A.A.F. Form A 60
(May, 1936)

[OVER

National Archives of Australia
NAA: A1196, 1/501/667

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.

National Archives of Australia NAA: A1196, 1/501/667

1/501/633 (25A)

SECRET

7A 45

SECRET

C.43840/51/Part 2/O.R.1(b)

AIR STAFF REQUIREMENT NO. O.R./301 (ISSUE 2)
ROCKET PROPELLED INTERCEPTOR

INTRODUCTION

1. Current day interceptor projects are expected to be adequate in performance to match the enemy threat in normal circumstances, but may be unable to destroy enemy aircraft carrying out special operations at exceptional heights.

2. An aircraft to fulfil this requirement must have an outstanding ceiling and altitude performance. So far as is known at present, these characteristics can be provided only by rocket propulsion and, although aware of the probable operating limitations of this method, the Air Staff consider that the promise of tactical advantage more than outweighs other considerations.

REQUIREMENT

3. The Air Staff require a single seater rocket propelled interceptor built to satisfy the broad requirement that follows.

GENERAL DESIGN CONSIDERATIONS

4. In order to facilitate ease and speed of production, the aircraft and its equipment are to be as simple as possible.

5. In the first instance, operation in temperate climates only is envisaged. Should world wide operation be required later, a separate requirement will be stated.

6. Although the Air Staff would consider any proposal for unconventional methods of take-off if great advantages were gained thereby, conventional operation with a normal undercarriage would be preferred, since this would not only reduce the amount of auxiliary equipment required but would facilitate ground handling and assist turn-round.

7. Should unconventional take-offs have to be accepted in order to get the necessary performance, any specialist equipment involved, such as catapults, launching ramps, or trolleys, must be designed concurrently with the aircraft and must feature ease of transport and assembly.

8. For conventional operation the aircraft will normally be used from 2,000 yards standard fighter runways, but it is desirable that it should be able to operate from runways or prepared strips 1,500 yards or less.

9. Because it is not intended to land the aircraft under rocket power, and because all available rocket fuel is likely to be consumed in climb and flight at altitude, a small auxiliary turbine engine is to be provided which will enable the aircraft to return to base and land under its own power. The maximum thrust of the auxiliary engine is to be sufficient to recover from a baulked landing by climbing away with wheels and flaps down, with armament fitted, but with all rocket fuel consumed.

10. Neither the aircraft nor its rocket motor is to be regarded as expendable in any way.

/PERFORMANCE

SECRET

National Archives of Australia NAA: A1196, 1/501/667

PERFORMANCE

General

11. Justification for this project depends mainly on the aircraft's ability to reach an exceptionally high altitude very quickly and there develop sufficient speed for long enough to intercept and destroy a fast flying enemy. Height, rate of climb, speed (and acceleration) are therefore of prime importance, and it is essential that the first should be considerably better than that expected in contemporary conventional fighter projects.

Ceiling

12. A sub-sonic cruising ceiling of at least 75,000 feet is required.

Rate of Climb

13. The aircraft should be able to reach 60,000 feet from rest at sea level in $2\frac{1}{2}$ to 3 minutes using maximum power.

Speed

14. Because this aircraft is required for high altitude interception, and all possible weight saving is essential, the Air Staff is prepared to accept a design limitation of M = .95 below 20,000.ft. Above 20,000 however, the design limitation is to increase progressively so that at 42,000 ft. the limitation has risen to M = 2.0, and remains constant at M = 2.0 above 42,000 ft. The aim is that an aircraft of this type should be capable of supersonic speed at all heights above 30,000 ft. while carrying its armament. The greatest practicable degree of thrust control by throttling is required.

Endurance

15. The endurance should be sufficient to provide a sortie as follows:-

(a) Take-off and climb to 60,000 ft.

(b) 7 minutes cruise at 60,000 ft. at not less than M = 0.8 in steady level flight.

(c) 2 minutes combat at 60,000 ft. at M = 0.95 in steady level flight.

(d) Descent from altitude followed by cruise on the auxiliary power at 5,000 ft. for 10 minutes.

(e) Approach and landing, followed by recovery from a baulked landing and a second circuit and landing.

16. Provision shall be made for extra fuel to increase the cruise time of paragraph 15(b) above by 3 minutes.

17. It is accepted that if maximum thrust is used in obtaining supersonic flight for combat, or if the aircraft is used above 60,000 ft., the above endurance figures will be reduced.

Manoeuvrability

18. A high degree of manoeuvrability is required at all heights, particularly above 50,000 ft. A rate of roll of 200 degrees per second is to be the aim.

Take-off

19. If conventional take-off methods are employed, the distance to 50 ft. under I.C.A.N. conditions at maximum A.U.W. is not to exceed 1,500 yards.

National Archives of Australia

NAA: A1196, 1/501/667

SECRET

The aim is to have the shortest take-off run compatible with the other characteristics required.

Landing

20. It must be possible to use normal powered approach and landing techniques under auxiliary power. Under I.C.A.N. conditions, and with all rocket fuel consumed, but with full weapon load, the landing distance over 50 ft. is not to exceed 1,500 yards. The aim is to have the shortest landing run compatible with the other characteristics required.

Air Brakes

21. Air brakes are required. As they will be used as an aid to combat, it must be possible to use them throughout the entire speed range of the aircraft without affecting stability or otherwise impairing its aiming and weapon firing qualities.

PARTICULAR DESIGN FEATURES

Accommodation

22. A pressure cabin is required. The pressure differential should not be more than 4 lb. per square inch and not less than $3\frac{1}{2}$ lb. per square inch. This will provide adequate cockpit pressure whilst avoiding the dangers of explosive decompression.

Emergency Escape

23. Because there may be many new operating hazards to be faced for the first time in this aircraft, particular attention must be given to ensure the best possible emergency escape facilities for the pilot. A dinghy and personal survival pack are required.

View

24. The best possible view is required particularly in the forward hemisphere. Special attention is to be paid to de-icing and de-misting the windscreen and canopy, using a method which imposes no restriction on the pilot's view through the transparency.

Hood and Windscreen Strength

25. Particular attention is to be paid to the strength of the hood and windscreen in order to reduce the risk of failure under the extreme operating conditions of temperature and pressure.

ARMAMENT

Guided Weapons

26. The armament is to consist of at least two Blue Jay air-to-air missiles.

Radar Ranging

27. Although adequate range information is necessary for the efficient use of Blue Jay, the present radar ranging equipment is likely to impose an intolerable weight and performance penalty on the aircraft. Radar ranging is not therefore to be fitted. The possibilities of obtaining the necessary range information by other lighter and less complicated means are to be examined.

Sighting

28. The normal reflector gunsight is required when Blue Jay weapons are carried.

National Archives of Australia

NAA: A1196, 1/501/667

Camera

29. A G.45 camera installation is required.

AIRCRAFT EQUIPMENT

General

30. Because of the limited range and endurance, and also to preserve the essential requirement for ease and speed of production, there is no intention of providing an elaborate standard of equipment for this aircraft or of regarding it as in any way capable of all-weather operation. The standard to be aimed at is that in the hands of a pilot of average wartime skill and experience the aircraft should be capable of taking off, climbing, and of delivering its attack, and returning safely to base by day in weather conditions down to 8/8th cloud, with base about 2,000 ft., and visibility about 3 miles. Operation in conditions somewhat worse than this is expected to be practicable but it is accepted that it may involve an appreciable problem due to numbers of aircraft landing away from their own bases.

Guidance to Target

31. It was originally intended to develop concurrently with the aircraft, some special system of radio or radar guidance. However, after closer examination of the guidance problem, it has now been decided to operate the aircraft under normal close control.

Flight Instruments

32. Flight instruments are required to supply all the information at present provided by the standard panel, in all conditions of flight of which the aircraft is capable. In particular, a means is required of presenting the pilot with information on pitch attitude and heading during near-vertical climb.

Radio and Communications

33. The following equipment is required:-

(a) V.H.F. providing 10 channels.

(b) Single channel standby V.H.F.

(c) Telescramble.

(d) I.F.F. Mark 10.

Personal Equipment

34. Connections are required for a pressure suit, an anti-g suit, and an air ventilated suit. If available, the Universal coupling now being developed will be required. It should be possible to operate the aircraft whilst wearing an inflated pressure suit.

35. Oxygen is required for a climb to 60,000 ft., 15 minutes at this altitude, including 5 minutes after a cabin pressure failure and with the pressure suit inflated and a descent to below 10,000 ft. in these conditions.

Electrical Power

36. A source of electrical power is required which will provide electricity for the operation of essential equipment during the descent with the rocket motor off.

/SERVICING

National Archives of Australia NAA: A1196, 1/501/667

SECRET

SERVICING

General

37. It is essential that every effort is made to design this aircraft to facilitate servicing. Accessibility of components is to be adequate to allow servicing by change of major components in the field by squadron personnel. The aircraft is to have a reliable performance with a minimum requirement for servicing or inspection, other than the need to replenish consumable stores, over any period of 100 hours flying or four months elapsed time, whichever is the less. Provision is to be made for simple and rapid refuelling, re-arming and replenishment servicing to facilitate turn-round of the aircraft within the shortest possible time.

Transportation

38. It will be necessary for adequate lifting or supporting points to be provided to facilitate transportation of aircraft if necessary, such as after a forced landing.

Target Date

39. The Air Staff require this aircraft in Service by 1957.

Air Ministry, D.O.R.(A)
18th August, 1953.

SECRET

National Archives of Australia

NAA: A1196, 1/501/667

6A

16 40

THE FIGHTER AIRCRAFT REQUIRED BY THE R.A.A.F. AS A REPLACEMENT FOR THE RA7 SABRE

APPENDICES

A - Summary of a paper on the Role and Employment of the R.A.A.F. in war.

B - Air Staff Requirement for the Air Superiority or Offensive Fighter to replace the Sabre in 1958.

22, 23, 38

INTRODUCTION

See paras 1 + 41

Strategical Appreciation

1. A paper on the Role and Employment of the R.A.A.F. in War has been prepared by D.A.S.P. and approved by C.A.S. for planning purposes. A summary of the relevant parts of this paper are attached as Appendix A.

Re-Arming Cycle

2. To comply with the current strategical appreciation, it is essential that task force units should be armed with the latest type of aircraft. Home defence squadrons and the operational training units, on the other hand, could be armed with the types which tend towards obsolescence and are thrown up as the result of re-arming the task force units. For the purpose of this paper, it is assumed that the re-arming cycle will be 4 years for M.T.F. fighter squadrons.

3. Currently estimated peace-time wastage rates indicate that, by approximately December 1957 reserves of Vampires for the Home Defence Force and Fighter Operational Training Units, and Sabres for the M.T.F. may be expended. By December 1957, moreover, the Vampire and Sabre may be obsolescent for the Home Defence Force and the Mobile Task Force respectively.

4. It is apparent, therefore, that if the R.A.A.F. is to be capable of undertaking its assigned role and to maintain its present planned peace-time order of battle -

(a) a new type of fighter aircraft must be introduced into the service for the M.T.F. in replacement of the Sabre progressively from December 1957; and

(b) the Sabres will be required to re-arm the Home Defence Force and the Fighter O.T.U. as they are thrown up by the re-arming of the M.T.F.

Purpose

5. The purpose of this paper, therefore is to determine the type of fighter aircraft which the R.A.A.F. will require in the period 1958 to 1961 as a replacement for the RA7 Avon Sabre.

National Archives of Australia NAA: A1196, 1/501/667

ROLE

6. To implement the policy set out in the paper on the Role and Employment of the R.A.A.F. in War, R.A.A.F. Fighter Units may be called upon to perform any or all of the following tasks of which the first mentioned is vital:-

(a) Assist in obtaining and maintaining air superiority by a campaign directed at the enemy's sources of air power in the field.

(b) Assist in operations against enemy lines of communications.

(c) Assist in the tactical support of land forces.

(d) Provide the air defence of base areas.

Air Superiority

7. To obtain and maintain air superiority, a fighter aircraft may be required to :-

(a) Attack and destroy all types of enemy aircraft likely to be encountered in the theatre of operations, both over the battle field and over enemy bases. The ability to undertake the latter task will largely determine the effectiveness of the aircraft to maintain air superiority.

(b) Escort bombers in attacks against enemy sources of air power on the ground.

(c) Deliver direct bombing, rocket or straffing attacks against enemy air bases and other sources of air power on the ground.

Ground Attack (See also sub-para.7(c) above)

8. If air superiority is obtained or as fighter aircraft become outclassed in the air to air battle they are usually employed in the ground attack role. For maximum effectiveness therefore, fighters should be capable of bombing, rocket and straffing attacks both in the tactical support of land forces and in interdiction attacks against enemy lines of communication.

Air Defence

9. In the air defence of base areas fighter aircraft should be capable of finding and destroying enemy attacking aircraft or guided missiles before they reach the target area. While the fundamental requirement is to destroy enemy bombers or guided missiles they must also be capable of combatting escorting fighters.

Priority of Tasks

10. It is difficult to define the priority of tasks as they will vary with time and by theatres. The air to air role, however, must predominate and the aircraft must be suitable for both fighter v's fighter and fighter v's bomber combat.

PEACE-TIME BUDGET LIMITATIONS

11. The proposed estimate for fighter aircraft to replace the RA7 Avon Sabre is for £23M to be spread over a 4 year period from January 1958. Unless the probability of a global war increases it is certain that this figure will not be increased.

12. To re-arm the M.T.F. for another 4 year cycle would require at least the same number of aircraft as are required for the present re-arming cycle, viz. 75-100.

National Archives of Australia NAA: A1196, 1/501/667

13. The indications are, therefore, that unless the balance of the force is re-cast or the number of fighter squadrons is reduced, the replacement fighter aircraft must not cost more than approximately £250,000 each and preferably should be much less. Further, it is obvious that the R.A.A.F. will only be able to afford one type of fighter at any one time unless the threat to Australia increases considerably.

TYPES OF FIGHTERS AND THEIR ABILITY TO SATISFY THESE REQUIREMENTS

All-Weather Fighter

14. For some time it has been hoped that the all weather fighter would become the ultimate type of fighter for all fighter operations. This hope has not yet been realised, however, as all-weather fighters have not been evaluated against day interceptors. Until they have successfully proved their capabilities in this regard they will only be suitable for night and bad weather operations and therefore tend to be specialist aircraft. On the other hand, in future air combat at super-sonic speeds and great altitudes, it may be necessary for fighter aircraft to be controlled from the ground or to carry their own search radar in order to find the enemy aircraft. It may well be, therefore, that the all-weather fighter will be the only type suitable for offensive operations against enemy fighters outside friendly radar cover. The R.A.F. and U.S.A.F. are investigating these problems but it will probably be several years before definite answers are obtained. Until these answers are forthcoming the feasibility of using all-weather fighters in all roles must remain a matter for conjecture. It would therefore be unwise to assume that the all-weather fighter could fulfil all the roles which the future R.A.A.F. fighter would be called upon to perform.

15. The all-weather fighter, as at present envisaged, is a large and complicated aircraft. It is conceivable that in the future, and even within the period of time under consideration, sub-miniaturisation of avionics may make it possible to fit suitable A.I. or search radar into smaller types of aircraft but the size of current all-weather aircraft does not suggest that this reduction is yet feasible. The cost of the all-weather fighter, therefore, will be greatly in excess of a day fighter of equivalent performance and would be beyond the resources of the R.A.A.F. to purchase on a peace-time budget except at the expense of the present Order of Battle.

16. The all-weather fighter is also a complex aircraft and due to extra manpower and equipment which would be required to service its electronics would be difficult to maintain in mobile operations.

17. While it may be desirable for the R.A.A.F. to provide an all-weather fighter for use in overseas theatres, it is considered that the provision of such a specialist aircraft is more properly the responsibility of the larger powers in theatres where joint forces will be operating.

18. The R.A.A.F. does have a requirement for all weather defence in the Australian theatre. Unless the threat increases, however, this requirement is very limited and the production or purchase of a small number of special aircraft for this task would be most uneconomical. When and if the threat to Australia is sufficient to warrant facing up to the cost of these aircraft it would probably be more economical to purchase them from overseas. While the latest types may not be readily available when they are

National Archives of Australia NAA: A1196, 1/501/667

required, types which are obsolete for the main overseas theatres would still be suitable for the defence of our main industrial areas for they would only have to cope with long range unescorted bombers as long as the present strategic situation remains unchanged.

19. While sufficient information is not yet available on ground to air missiles it may well be that they will prove to be the solution to the all weather defence of our highly centralised industrial areas.

Day Interceptor Fighter

20. The primary role of the interceptor fighter is to find and destroy enemy attacking aircraft or guided missiles before they reach the target area. The primary requirement for these aircraft is a very fast rate of climb and in order to achieve this requirement other aspects may be sacrificed. As a result the range of some day interceptor fighters is very restricted. The present trend in day interceptor design is tending towards the light weight fighter and the rocket interceptor. The ultimate weapon for interception is of course the ground to air missile.

21. While day interceptors may be eminently suitable for the daylight defence of bases in the Middle East, South East Asia or Australia their ability to carry the war to the enemy and to penetrate sufficiently far into enemy territory may be restricted by range and depends largely on the availability of suitable airfields. This range factor is critical in the Middle East, South East Asia and Australia. A force equipped with fighters of inadequate range may well be relegated to the purely defensive role in these theatres.

Rocket Interceptor

22. Very little is known of the rocket interceptor except that it is only capable of fulfilling a very specialised role. In its present conception it is purely a defensive aircraft. Before its capabilities can be fully assessed, a considerable amount of research and development into instruments, control methods and tactics will be required.

23. As both the R.A.F. and U.S.A.F. are investigating the rocket interceptor to meet their more urgent defence requirement and as our research and production capacity is severely limited, it is considered that the R.A.A.F. should merely keep a watching brief and should not embark on a project which is so restricted in its application.

Simplified Day Fighter

24. It has been said that -

> "In the intractable problem of air defence it seems that a new approach to fighter design might pay valuable dividends. Due to their very size, weight and ever increasing elaboration of equipment the current day interceptors as well as the night and all weather fighters have become alarmingly expensive both in money and man-hours."

25. The light fighter concept is by no means new. For 38 years at least designers of several countries have sought for one reason or another, to save size, weight and complication, and consequently cost and man-hours. None of the types which achieved any real degree of simplicity, however, saw service with the exception of the M.E.163 which was designed for a highly specialised role.

National Archives of Australia NAA: A1196, 1/501/667

26. It is pertinent to note the reasons given by the R.A.F. for an aircraft of this type :-

"Assuming that massed daylight attacks will be the first serious menace to our security, it will clearly be necessary to deploy large numbers of day fighters against them. It is very doubtful whether the economic resources of this country will be capable of providing sufficient day fighters of the Meteor, Vampire, Venom, F.3 and Swift classes to match the numerical weight of enemy medium bomber attacks, especially as a very high proportion of attacking formations will have to be destroyed if the atom bomb attacks are to be prevented.

Current development work on small, simple and cheap turbo-jets having a life of about 50 hours, creates the opportunity to design a light fighter carrying a minimum effective armament and equipment which can be produced quickly in large numbers. The Air Staff wish to exploit this possibility."

27. An examination of the brochure on the Folland "Gnat" reveals that in order to achieve simplification the basic armament has had to be reduced to 2 Aden guns with only 105 rounds each and the internal fuel has been limited to 100 gals. which is only sufficient for a 40 min. sortie. Although the R.A.F. have a real requirement for this type of aircraft to meet the specialised threat to the U.K. they have not yet seen fit to order production but are concentrating on the more costly and complicated day interceptors and all weather fighters.

28. It is apparent therefore that in order to achieve simplicity it is necessary to accept a loss of flexibility and limit the role of the aircraft to highly specialised functions. This may be warranted in the U.K. and/or American theatres because of the peculiar threat. Unless the performance of this type of aircraft can be improved it is considered that the R.A.A.F. Mobile Task Force if armed with this type would be reduced to a defensive role in the Middle East and in South East Asia.

29. It is understood that the U.S. have abandoned the light weight fighter concept and the U.K., although encouraging the project as a private venture, will not give it official support. It is considered, therefore, that a project of this type is too much of a gamble for the R.A.A.F. to support to the exclusion of a more conventional approach at this stage.

Long Range Fighter

30. The role of the long range fighter is primarily to locate and destroy the enemy in the air or on the ground outside our own defence areas and/or in his own territory. It may also be necessary when the situation demands, to use long range fighters to escort or support bomber aircraft. In addition to the primary role, long range fighters have a secondary role of ground attack, as after the required degree of air superiority has been achieved, they may be used on day intruder operations against targets of opportunity or in direct and indirect support tasks.

31. The present thinking is that the long range fighter requirement will be met by variants of the all-weather fighter types. The final decision rests largely on the outcome of the investigations mentioned in para.14 above. In any case it is apparent that in order to obtain the range required while still retaining sufficient performance to cope with the day interceptor, the aircraft may be of a size comparable with the Javelin, C.A. 23 etc. or even larger. Increased efficiency in jet engines during the period under review however, may tend to reduce the size of these aircraft.

National Archives of Australia NAA: A1196, 1/501/667

32. This type of aircraft would be eminently suitable for the offensive roles in the Middle East and especially so in the South East Asian and Australian theatres. There is no reason why it should not also be suitable in the defensive role particularly in the Australian theatre as its fuel load can be restricted to increase its rate of climb.

Air Superiority or Offensive Fighter

33. The air superiority or offensive fighter has a similar role to that of the long range fighter. It is required to obtain and maintain air superiority over the land battle and to assist in the direct and indirect support of that battle. It should also be capable of escorting tactical bomber aircraft.

34. It is a compromise between the long range fighter and the pure short range day interceptor. It does not have the same range requirement as the long range fighter and therefore will be smaller in size. Because it is not required to defend such concentrated and vital targets it need not have the same rate of climb as the day interceptor. On the other hand it has more ability to penetrate enemy territory than the day interceptor and hence to force the enemy into a contest for air superiority or to grant air superiority by default. Further, as it will frequently be operating within friendly radar cover it may not be necessary for it to carry its own search radar.

35. This type of aircraft would be suitable to fulfil R.A.A.F. requirements in the Middle East or South East Asia, both in a global or a limited war. Further, although it would not be as suitable as the day interceptor for the defence of the main air defence areas in Australia it would be adequate to meet the limited threat.

36. It is considered that an aircraft of this type should be within the capacity of Australia to produce or purchase on a peacetime budget.

SELECTION OF THE MOST SUITABLE TYPE

37. The all-weather fighter while it might ultimately meet all our requirements and may even become essential for offensive fighter operations beyond friendly radar coverage is considered to be unsuitable as a replacement for the Sabre as it is -

(a) Not yet proved as suitable for other than night and bad weather operations,

(b) handicapped for mobile operations,

(c) more costly than a day fighter of equivalent performance and would be beyond the capacity of the R.A.A.F. to purchase on a peace-time budget.

Further, the provision of such costly specialist aircraft is more properly the responsibility of the larger powers in theatres where joint forces will be operating and is not warranted for the defence of Australia under the current threat.

38. The rocket interceptor and the light weight fighter, although they might be required for the defence of Australia if the threat increases, would restrict the fighter element of the R.A.A.F. to a purely defensive role. If a need for these types does arise therefore, they would be required in addition to the basic fighter type and not as a replacement for that type. The rocket interceptor and the light weight fighter are therefore unsuitable as replacements.

National Archives of Australia NAA: A1196, 1/501/667

39. The range factor is critical in the Middle East, South East Asia and Australia. A force equipped with fighters of inadequate range may well be relegated to the purely defensive role in these theatres. The short range day interceptor, therefore, would not meet R.A.A.F. requirements as a replacement for the Sabre.

40. The long range fighter would successfully fulfil all our requirements with the exception of the limited all-weather requirement for the defence of Australia. In its present conception however, this aircraft would probably be beyond the capacity of Australia to produce or purchase on a peace-time budget.

41. The air superiority or offensive fighter would be suitable to fulfil our requirements in the Middle East and South East Asia both in a Global or a limited war. Further, although it would not be as suitable as the day interceptor for the defence of our main air defence areas in Australia it would be adequate to meet the limited threat. It should also be possible to re-arm our force with this type on a peace-time budget.

STATEMENT OF REQUIREMENTS FOR THE AIR SUPERIORITY OR OFFENSIVE FIGHTER

General

42. As far as possible the requirements have been substantiated by known or estimated research and development data on overseas types. Without constant and detailed discussions with aircraft designers, however, it is dangerous to lay down hard and fast requirements. It is considered, therefore that the broad requirements stated below should be used as a starting point for discussion and that detailed requirements be laid down only after an accurate study is undertaken with aircraft designers.

43. An assessment of the main requirements which are summarised below is at Appendix B.

Performance

44. Speed. The fighter should be capable of a speed of not less than M = 1.5 and preferably M = 2.0.

45. Height. The fighter should be capable of operating at 60,000 feet.

46. Rate of Climb. The time to climb to 40,000 feet at normal A.U.W. should not be more than 4 minutes.

47. Landing and Take Off. The aircraft should be capable of operating from a 6000 feet strip at sea level corrected to I.C.A.N. conditions. Wheel loading and tyre pressures should be kept as low as possible so that the aircraft can operate from hastily prepared or repaired airstrips.

48. Manoeuvreability. Good manoeuvreability is required.

49. Radius of Action. The radius of action when carrying basic armament and overload tanks should not be less than 500 n.m. and preferably should be 750 n.m.

50. A.U.W. Because of the limitations of the R.A.A.F. peacetime budget the overall size and complexity of the aircraft should be kept to a minimum.

National Archives of Australia NAA: A1196, 1/501/667

Armament

51. The following armament is required (guided missiles will not be carried with bombs or rockets):-

(a) Four Aden type guns, preferably 30MM calibre with a muzzle velocity of at least 3000 f.p.s.

(b) Four Blue Jay, but consideration to be given to the alternative carriage of Red Dean during the design study.

(c) A Gyro type gunsight, with radar ranging facilities. (The gunsight to operate efficiently without radar ranging installed and be suitable for rocketry and dive bombing.) A close study will be made of British and American development and an Operational Requirement stated.

(d) 2 x 1000 lb. MC or geletrol bombs of the types specified in OR/ARM.24 and OR/ARM.33 respectively.

(e) Maximum number of rockets of the type specified by OR/ARM.17 (Issue No. 2). The aircraft installation must not impair performance in the air combat role.

52. When the aircraft is used in an air to air role, the turn-around time including a complete re-arm should be under 10 minutes.

Navigation

53. The following navigational aids are required :-

(a) An en route navigational aid, incorporating the doppler principle, weighing not more than 200 lbs.

(b) AN/ARN.21 for homing.

(c) Zero Reader.

CONCLUSIONS

54. The R.A.A.F. require an air superiority or offensive day fighter to replace the Sabre in 1958.

55. The aircraft should not cost more than approximately £250,000 each and preferably should be much less.

56. The broad specifications for this aircraft are summarised in paras. 42 to 53 above.

RECOMMENDATION

57. That an Air Staff Requirement be raised for an air superiority or offensive day fighter based on the broad statement at Appendix B.

17 Jul. 53

Wg.Cdr.
D.Ops.

National Archives of Australia

NAA: A1196, 1/501/667

SECRET

APPENDIX A TO
9/84/51 Pt.II(10A)
dated 2 JUL. 53

SUMMARY OF A PAPER ON THE ROLE AND EMPLOYMENT OF THE R.A.A.F. IN WAR.

(File No.60/501/286 refers)

1. In Global War

(a) Home Defence. "A period of time should be available after mobilisation for expansion and development of home defence forces.

Attacks will probably be confined to sporadic attacks by long-range bomber aircraft."

The type of aircraft required, however, must be "suitable for the air defence of this country, consistent with the fact that the weight of attack which can be mounted from bases in Indonesia is not likely to be as severe as that to be expected in the major theatres."

(b) Mobile Task Force. The Mobile Task Force "will be deployed in either the Middle East or South East Asia, depending upon the threat at the time." While "Australia's contribution in global war might be made in the phase following the first onslaught "....." we cannot ignore the fact that R.A.A.F. units deployed overseas may feel the impact of the first onslaught and must be equipped, trained and supported accordingly,"....." Its role will be mainly tactical, ".....and in this role it may be called upon to perform any or all of the following tasks, of which the first mentioned is vital:-

(i) Assist in obtaining and maintaining Air superiority by a campaign directed at the enemy's sources of air power in the field.

(ii) Operations against enemy lines of communication.

(iii) The tactical support of land forces.

(iv) The Air Defence of base areas."

2. In Cold War

(a) Home Defence. "There is at present no requirement for Home Defence "....." however, elements capable of rapid expansion for home defence should be in existence at the outbreak of war, as a nucleus for rapid development."

(b) Mobile Task Force. "The Mobile Task Force will be employed in a tactical role, in support of land forces, and in interdiction, or the defence of bases, and assistance in winning the air battle and maintaining air superiority."

National Archives of Australia NAA: A1196, 1/501/667

AIR STAFF REQUIREMENTS FOR THE AIR SUPERIORITY OR OFFENSIVE FIGHTER TO REPLACE THE SABRE IN 1958.

ANNEXURES:-

1. Performance Data of British Fighters.
2. Performance Data of American Fighters.
3. Performance Data of Russian Fighters.
4. Performance Data of Russian Bombers.
5. Map of the Australian and South East Asian Theatres showing radii of action from various bases.
6. Map of the Middle East showing radii of action from various bases.

PERFORMANCE

General

1. At Annexures 1 and 2 are some performance figures of British and American fighters currently under development and listed for production during the 1954/58 period. Little accurate data on some of these aircraft is available and some of the performance figures shown are based on estimates only. The figures given, however, do indicate the possible performance of aircraft at present under development.

2. At Annexures 3 and 4 are some estimated performance capabilities of Soviet Fighter and Bomber aircraft for the period 1954 to 1960. These estimates have been extracted from the U.S.A.F. Air Technical Intelligence Digest dated 1st July, 1952. While these figures may not prove to be accurate they are the only estimates available to indicate the types and approximate performance of enemy aircraft which may be encountered in a global war, both in overseas theatres and in the defence of Australia, or in a limited cold war overseas.

Speed

3. Speed is one of the cardinal requirements for an air superiority offensive fighter: in offensive warfare an aircraft with superior speed can largely dictate the tactics as it can take the offensive at will. A study of the expected performances of allied and Russian fighters indicates that the speed of the air superiority or offensive fighter should not be less than Mach. 1.5 and preferably should be as high as Mach. 2.0.

Height Capability

4. Air combat in KOREA, at present is taking place between 40,000 - 47,000, and the MIG15 has been reported operating at heights in excess of 50,000 feet. From available data on current Russian fighters under development, (Annexure 3) it may be assumed that combat altitudes by 1958, will be as high as 60,000 ft., and thus to be on an equal operational combat footing, the offensive fighter will be required to operate at that altitude.

National Archives of Australia NAA: A1196, 1/501/667

Rate of Climb

5. The rate of climb of the air superiority/offensive fighter is not of major importance provided it has superiority in speed. On the other hand an aircraft which can operate at 60,000 feet, or reach a level speed of better than Mach. 1.5 will have a sufficient power to weight ratio to ensure a rapid rate of climb. From an examination of expected Soviet aircraft capabilities it is considered that the time to climb to 40,000 feet at normal A.U.W. should not be more than 4 minutes. When used in the defensive role the A.U.W. can be decreased by reducing the fuel and/or weapons load which will materially increase its rate of climb.

Landing and Take Off

6. The air superiority/offensive fighter will normally be required to operate over the land battles in the tactical roles and should therefore be capable of operating from hastily prepared or repaired airstrips. The landing and take off distances of the aircraft should therefore be kept as low as possible and in any case should be such that the aircraft can operate from a 6,000 ft. strip at sea level corrected to I.C.A.N. conditions. For the same reasons the wheel loadings and tyre pressures should be kept as low as possible.

Manoeuvreability

7. Good manoeuvreability is required in all fighters but it is not as important as speed in the offensive role. An aircraft which will meet the height and rate of climb requirements given above should have sufficient manoeuvreability. It is understood that the Convair XF102 which is expected to have a maximum speed of Mach. 1.9 has turned inside an F.86 in comparative trials and is considered to be superior in its handling qualities.

Radius of Action

8. The offensive fighter is a compromise between the long-range fighter and the day interceptor. In the air-to-air role it must have sufficient range to be capable of penetrating enemy territory to carry the war to the enemy and to escort tactical bombers. In the air to ground role its range should be sufficient to allow attacks on tactical targets in direct or indirect support of the ground forces.

9. At Annexure 5 is a map of the Australian and South East Asian theatres showing radii of action 500 n.m. to 750 n.m. from various bases from which the offensive fighter might operate. While there are many factors to be considered the map does indicate that a radius of action, carrying basic armament and overload tanks, of not less than 500 n.m., and preferably 750 n.m., is an essential requirement. The carriage of bombs and/or rockets would of course reduce this radius of action.

10. At Annexure 6 is a map of the Middle East showing radii of action of 500 n.m. and 750 n.m. from various bases from which the offensive fighter might operate. In this theatre also the indications are that a radius of action of 500 n.m. would be acceptable but 750 n.m. would be desirable.

National Archives of Australia NAA: A1196, 1/501/667

11. It is considered, therefore, that the aircraft when carrying basic armament and overload tanks should have a radius of action of not less than 500 n.m. and preferably 750 n.m.

All Up Weight

12. Because of the limited peace-time budget the overall size and complexity of the aircraft should be kept to a minimum. On the other hand the aircraft must be capable of meeting R.A.A.F. requirements. In this connection it is pertinent to note that invariably the demand is to develop and modify aircraft from the moment of their conception and it is also far more difficult to add additional equipment to an aircraft than to remove it. It is considered, therefore, that the requirements for this aircraft should not be relaxed unless it is proved impossible to meet them.

ARMAMENT REQUIREMENTS

General

13. It is axiomatic that the armament of an aircraft must be related to its role. For each type of operation that an aircraft may be called upon to perform there is a best weapon. Where an aircraft is required to undertake more than one type of operation it may not be practicable to carry the various "best" weapons and then a compromise must be reached.

14. The aircraft under review will be required to :-

(a) Engage the enemy's fighters in air combat; often at maximum range and for extended periods.

(b) Destroy bomber aircraft attacking our own base areas.

(c) Attack and inflict maximum damage on a variety of tactical targets, either in direct support of the land battle or as a contribution towards obtaining and maintaining air superiority.

15. The broad functions of the aircraft outlined above are not intended to indicate any order of priority. It is assumed, however, that the air to air roles are the more important and where the armament requirements for these clash with the ground attack role, they should be given precedence.

16. It is not envisaged that this aircraft should be "all weather" in any sense. For this reason it is not proposed to consider a collision course sighting system.

Air Combat - Fighter versus Fighter

17. For fighter versus fighter work the essential requirements of an offensive weapon are :-

(a) The ability to build up lethal density in the minimum time, i.e. a high rate of fire.

(b) A short time of flight of the projectile, coupled with the ability to open fire at long range i.e. a high muzzle velocity.

(c) A good chance of obtaining a kill from each round striking the target; each projectile should be as destructive

National Archives of Australia NAA: A1196, 1/501/667

as possible, compatible with (a) and (b) above, i.e. a large calibre weapon.

18. It can be shown that a battery of high performance machine guns is the best compromise to meet all these requirements. Ultimately the gun may be superseded by the guided missile but during the period under review such weapons will be expensive as well as in short supply and are not likely to be readily available for fighter versus fifhter air combat. Furthermore, they will provide for only one or two attacks on any sortie and because of external carriage will reduce aircraft performance very considerably. There is also a possibility that the manoeuvreability of the enemy's fighter could lessen their effectiveness in this type of combat, although this is by no means proven.

19. The rocket battery has a big disadvantage which is not likely to be overcome before it is permanently outmoded by the guided missile. The velocity of the projectiles is so low that an attacking aircraft has to close to approximately 300 yds. on a target flying at 600 knots before it can open fire with any hope of success.

20. For the Sabre replacement it is therefore recommended that the primary armament for fighter versus fighter work should be the machine gun and that provision be made for suitable guided missiles should they eventuate in quantity during the period under review.

21. The guns should be Aden type, preferably 30 MM calibre, with a muzzle velocity in excess of 3000 f.p.s. and a rate of fire of at least 1500 r.p.m. A minimum requirement is four guns each with an individual firing time in excess of 10 seconds. More guns and/or firing time would be desirable.

Air Combat - Attacks on Bombers

22. Enemy bombers may well be carrying weapons of mass destruction and it is therefore of paramount importance that they are intercepted and destroyed before they can accurately release their load. It is with the destruction of the bomber that this part of the paper is concerned. Interception is assumed.

23. Attack on High Speed Unarmed Bombers. The bomber now has such a performence that it is becoming increasingly difficult for the fighter to achieve an advantage in height, speed or acceleration which is required when using conventional gun armament. Guided weapons can overcome these problems.

24. Attack against Slower Heavily Armed Bombers. In general a fighter, conventionally armed, will be forced to fly a curve of pursuit and close to at least 400 yds. range if its fire is to become effective. Despite the speed of modern fighters they are still vulnerable to concentrated return fire from the bomber formations and their casualty rate would be high. The use of guided weapons would overcome this disadvantage by enabling the fighter to stand-off at 1000-2000 yds. and still retain accuracy of fire.

25. It is obvious, therefore, that the guided missile is the best weapon for air to air attack on bomber or multi-engined reconnaissance aircraft. Present indications are that the air to air missiles of the "near miss" variety now being developed will have a lethality of 50%. Two such weapons is the minimum acceptable loading per aircraft to ensure the destruction of a single bomber on each attack.

26. It is recommended, therefore, that this aircraft should be equipped to carry a minimum of two and preferably four air to air

National Archives of Australia NAA: A1196, 1/501/667

homing weapons. A requirement, OR/ARM.36, has already been stated for Blue Jay as the most promising weapon for this purpose. Consideration should also be given to the carriage of Red Dean, although the size of this weapon may make it unsuitable for the projected size of the aeroplane.

27. Technical opinion indicates that these weapons will have to be carried externally and this gives rise to performance penalties. Wind tunnel tests have shown that the positions which give least drag are under the wings or at the wing tips but nevertheless the drag rise in these positions is in the order of 30% to 40%. If, however, it is possible to bury half the missile in the body of the aircraft and maintain a smooth shape the drag rise is only about 2%. This important aspect should not be overlooked during design studies.

Ground Attack

28. Ground attack targets are vulnerable to machine gun fire, rockets and bombs. Bombs may be launched either in a dive or in level flight at very low altitudes. This latter method of attack is particularly effective when napalm bombs are being dropped.

29. For ground attack it is recommended that provision be made for the following weapons :-

(a) Machine Guns. For ground attack a high muzzle velocity is imperative to give impact penetration at the target and short time of projectile flight. In this respect the gun called up for fighter versus fighter work should prove adequate.

(b) Bombs. Two types of bombs are generally needed for ground attack work, M.C. and Celetrol. In order to retain maximum performance whilst carrying these stores they should be aerodynamically the best weapons available. The weapons called up to meet OR/ARM. 24 and 33 should meet these requirements. Provision should be made for the carriage of at least two bombs per aircraft.

(c) Rockets. Provision should be made for the carriage of as many rockets as possible. Tier stowage is acceptable. The rocket should be of the high performance variety i.e. OR/ARM.17 (Issue No.2)

Sighting System

30. Until recently a radar ranging gunsight was thought to be an essential requirement for air to air combat. American experience in Korea has now shown, however, that the serviceability of radar ranging is not entirely satisfactory and that the weight penalty involved is not offset by the value gained from the device in air to air combat, fighter versus fighter. Consequently, many pilots favour its deletion and a return to the G.G.S. type of sight with manual ranging. In face of the evidence this viewpoint is worthy of further examination. Nevertheless, rader ranging is highly desirable, if not essential for the launching of guided missiles.

31. It is, therefore, recommended that the gunsight for this aircraft should have provision for radar ranging, but that it should be possible to operate the equipment efficiently in air to air combat manually if so desired. There is reason to suppose that the U.S.A.F. is now designing a gunsight of this nature and it may well satisfy our requirement providing that it is also suitable for dive bombing and rocketry. Efforts are being made to obtain further information on this matter and ultimately it is proposed to raise a specific Operational Requirement for a suitable sight.

National Archives of Australia NAA: A1196, 1/501/667

Summary

32. It is fortuitous that there is no major clash in space requirements for any of the armament suggested above; guided missiles will not be carried with bombs or rockets.

33. The recommended armament for the Sabre replacement is summarised as follows :-

(a) Four Aden type guns, preferably 30 MM calibre with a muzzle velocity of at least 3000 f.p.s.

(b) Four Blue Jay, but consideration to be given to the alternative carriage of Red Dean during the design study.

(c) A gyro type gunsight, with radar ranging facilities. The gunsight to operate efficiently without radar ranging installed and be suitable for recketry and dive bombing. A close study will be made of British and American development and an Operational Requirement stated.

(d) 2 x 1000 lb. MC or geletrol bombs of the types specified in OR/ARM.24 and OR/ARM.33 respectively.

(e) Maximum number of rockets of the type specified by OR/ARM.17 (Issue No. 2). The aircraft installation must not impair aircraft performance in the air combat role.

34. Finally it is desired to emphasise that when this aircraft is used in an air to air role the turn-around time including a complete re-arm should be under 10 minutes.

THE NAVIGATION REQUIREMENT

General

35. The factors which influence the navigation requirement for the offensive fighter are as follow:-

(a) Role.
(b) Range.
(c) Endurance.
(d) Meteorological considerations.
(e) Terrain of operations.

36. In turn, the navigation requirement for the fighter may be sub-divided as follows :-

(a) En route navigation aids.
(b) Attack navigation aids.
(c) Homing navigation aids.
(d) Approach and landing aids.

37. Each sub-division of the requirement will be assessed in the ensuing consideration in the light of the several factors affecting the navigation requirement.

En Route Navigation Aids

38. The air superiority fighter will be required to operate over long distances of sea in South East Asia and of sea and featureless terrain in the Middle East (see Maps and Annexures 5 and 6). In many instances, no doubt, it will be required to operate at extreme range. Navigational inaccuracies en route between base and target and return will reduce the safe range of the aircraft and thus its operational efficiency.

National Archives of Australia NAA: A1196, 1/501/667

39. Cumulative navigation errors after a 750 mile sea crossing are likely (50% error) to cause an error in landfall of 35 nautical miles. At approximately 1 nautical mile per gallon, such an error involves a weight penalty of about 300 lbs. Similar errors would occur during the return to base but would be smaller because a homing aid will be provided. It thus appears that a weight allotment of 200 lbs. for an en route navigation aid would not be a penalty but would achieve in practice an increase in radius of action. In this respect the doppler technique offers promise for an aid giving track to 1° and distance run to about one half per cent. This navigation aid is at present being studied and an Air Staff Target Requirement will be raised in the near future.

40. The endurance of the aircraft is unlikely to be more than two (2) or three (3) hours, therefore provision of an auto-pilot for en route flight cannot be justified at this stage. The Zero Reader, however, at a small weight penalty, will minimise the difficulties of accurate flight.

Attack Navigation Aids

41. The role of the aircraft, as stated, does not appear to justify the weight penalty of an attack navigation aid of the H2S or A.I. type.

Homing Navigation Aids

42. Although an en route navigation aid of the accuracy suggested in para. 39 above would normally enable the aircraft to return safely to base, provision of an independent homing aid is essential. Failure in the offensive section of an operation due to unserviceability of the en route navigation aid will be acceptable on a small percentage of occasions. Inability to locate base, however, is completely unacceptable and must be insured against by provision of an independent homing aid.

43. Such an aid should have a dependable range of 200 n.m. and it is unlikely that conventional U.H.F./D.F. systems would satisfy that requirement. A.N/A.R.N.21 is the standard U.K./U.S. and Australian radio homing aid and is expected to have a range of 200 nautical miles. This equipment should be installed in the air superiority fighter.

Approach and Landing Aids

44. Meteorological considerations in the likely theatres of operations do not indicate any requirement for special approach and landing aids. U.H.F./D.F. controlled descents, together with G.C.A. at major bases are adequate for approach and landing.

Summary

45. The recommended navigational aids for the air superiority fighter are summarised as follows :-

(a) En route navigational aid not weighing more than 200 lbs.
(b) AN/ARN.21 for homing.
(c) Zero reader.

National Archives of Australia NAA: A1196, 1/501/667

SECRET

ANNEXURE 1 TO APPENDIX B
TO 9/48/51 PT.II (10A)
DATED 2 JUL. 1953

PERFORMANCE DATA
BRITISH FIGHTERS

Type	A.U.W.	Speed	Rate of Climb	Range	Armament	Ceiling	Engine Thrust	Time to Height	Endurance
Hunter Mk.II D.F.	N.15840	SL.608 Kts 540/40000 530/45000	10300	Rnge.580 Comb.Rad.130 300 imp.galls to be increased to Swift range.	4 Adens in fuselage Rounds 150	Op.48800 Cruise 49200	1 Sapphire 8300	6.1/40000 8.1/45000	1.25 Comb. endur..45
Swift Mk.II D.F.	M.19480 M.17460	SL.610 Kts 540/40000 525/45000	14300	730 imp.galls range 1220 Rad.405	4 Adens in fuselage Rounds 150 Rocket Bat. Bomb.Inst.	Op.48700 Cruise 40500	1 Avon RA7 Reheat 9100 W/O R.H. 7150	5/40000 6.9/45000	2.6 absol.
Javelin Delta Wing	M.36100 N.31600	SL.604 Kts. 540/40000 520/50000 M .95	10000	10000 imp.galls 2x250 belly Range 1510 n.m. Rad.580,	Blue Jay, Red Dean 4x30 m.m in wings rounds 160	Op.50800 Cruise 52000	2 Sapphires ea. 8330	6.1/40000 10.9/50000	2.95 absol. 2.15 combat.
DH.110 F4/48 Vixen N.F.	M.33850 N.31250	SL.610 Kts. 540/40000 520/50000 M .95	11000 15750	1320 imp.galls. 1280 n.m.absol. Comb.Rad.330 2x150 drop tanks	4x20 2x30 200 rds.	Cruise 45600 Op52500	2x7500	4.2x40000 7.9/50000	3.15/40000
F23 English Electric	25700 N.	540 Kts with reheat 775/36000 710/45000 W/o reheat 580/45000	11500/ 36000 with R.H. 2700/ 45000 W/O R.H.	800 gals.	2x30 mm. 160 rds.	Op.54500 with reheat Op.49000 W/O reheat	2 Sapphires + reheat 9375	1.7/36000 2.7/45000 with reheat 5.3/45000 W/O reheat	2
Folland Gnat Light Gen. Purpose Day Fight	5350 lbs. overload 6000	SL.630 Kts. 550/36000' max level sp. M.96 with R/H speed at 40000' is M1.2	15200'/ min at SL W/O R.H. 44000'/ min at SL. with R.H. 10000/min at 20000' without R.H. 24700'/min. at 20000' with R.H.	Endurance 40 min.	2x30 mm Aden105 rds/gun 5 secs cont. firing. Rocket Bat. or "Blue Jay"	48000' W/O heat 56000' with reheat	1 Bristol "saturn" 3750 at SL. W/O R.H. 5625 at SL with R.H.	5.76/40000' without R.H. 2.81 mins/ 40000' with reheat	with max. internal fuel 81 mins W/O reheat at 4000 40 mins with reheat at 4000

National Archives of Australia NAA: A1196, 1/501/667

SECRET

ANNEXURE 2 TO APPENDIX B
TO 9/84/51 PT.II (10A) dated
2 JUL. 53

PERFORMANCE DATA
AMERICAN FIGHTERS

Type	A.U.W.	Speed	Rate of Climb	Range	Armament	Ceiling	Engine Thrust	Time to Height	Endurance	
F86H	19012	Combat Speed 539 Kts. M.SL.609	SL 12500 with drop tanks 7600	1356 n.m. Com.rad. with 2x200 tanks 600n.m.	A4 Sight R/P & R/P battery 2x1000 bomb 6x.5 cal. 4x20 mm.	50000	GE J73 9200	To 30000' 5.6 mins.	750 galls. internal 2x200 2x120 external	Production will commence Sept.53
F100 Sabre 45 D.F.	28000	M 1.2 but cap. of reaching 1.3-1.4 at 30000'			4x20 mm A4 Sight		1xJ57 9500/ 10000 + after burner additional 5000 2x10000		750 internal 2x275 external	Expected to fly June 53. No auto pilot. Can operate from F86 field.
F101										Long range penetration fighter.
F102 Convair Delta	23000	Top 1150 Kts. M. 1.9 can turn ins.F.86	Init. R.O.C. 48000 /min.		6 missiles Falcon air to air 24x2.75" rockets	Op. 59000	1xJ40 13000 Event. 1xJ67 21000			In full production in 1957. Full electronic control. Automatic pilot.
F103 Republ. Delta Wing	31000	Design is for top speed of M.3				60000	1xJ67 21000			NOTE. Work suspended lack of funds.
Lock-heed Min. Wt. Fter.	15000 Light Wt. Fighter	Max. M 1.4								Believed work suspended.

National Archives of Australia NAA: A1196, 1/501/667

SECRET

ANNEXURE 3 TO APPENDIX B
TO 9/84/51 PT.II (10A) DATED
2 JUL. 1957

PERFORMANCE DATA
RUSSIAN FIGHTERS

Type	Speed	Rate of Climb	Ceiling	A.U.W.	Range	Time to Height	
MIG.17 All weather Day Int.	SL.635 MPH. 650 mph/ 10000	6000	50000	15000	700 range Rad.250	2-3 mins. to 40000	
Probably not in production MIG.19 High per. inter.							
Twin Jet Dalta - Chenanovsky	Top speed SL. over 650 mph. 800/30000		60000		600 n.m. Rad.200	3 mins/ 40000	
Tupolev T.U. All weather fighter. Primary role light bomb. 1957-60	Latest swept wing top speed over 600 mph. SL.650/750 800/1000 at 30000		60000	27000	Rng.600- 700 Rad.200/ 250	3 mins to 40000 2 mins to 40000	
Penetration Fighters 1960	SL.625 575 Kts. at 30000		52000		Rng.1.800 Rad.720		

National Archives of Australia NAA: A1196, 1/501/667

SECRET

ANNEXURE 4 TO APPENDIX B
TO 9/84/51 PT. II (IOA) dated
2 JUL. 53

PERFORMANCE DATA
RUSSIAN BOMBERS

Type	Speed	Range	Ceiling	Bomb Load	
IL.26 Light Bomber 1957-60	SL. 550 Kts. 525/20000	1900-2000 Rad. 950/1000	50000	6600	
IL.27 Light Bomber	535 SL 500/20000	1800 n.m. Rad. 900	48000	6600	
IL.28 Light Bomber					
Model 150 Med. Bomb in full prod. 1957/60	SL. 535 Kts. 550 480/30000 500/	4000 4500 Rad. 2100/ 2400	48000 50000	10000	
Model 31 6 eng. turbo prop Inter continental bomber 1957-60	SL. 450/465 425/465 at 30000	Over 6500 1957-7000 Prop 10000 1960 jet 9000 Rad. 1957- 3500 1960 prop 5000 1960 jet 4500	 45000 47000 48000	10000	
Ground Attack 1960	SL. 550	1000 Rad. 430	40000	4400	

National Archives of Australia NAA: A1196, 1/501/667

ANNEXURE 6 TO
APPENDIX "B" TO
9/104/51 PT. II (10A)
DATED 2 JUL. 63

19

MALTA
NICOSIA
HABBANIYAH
IDRISS
BENINA
EL ADEM

R.A.F.A 500 N.M
" " 750 "
BASE A/D

National Archives of Australia
NAA: A1196, 1/501/667

ANNEXURE 5 TO
APPENDIX 'B' TO
9/84/51 Pt II (10A)
DATED 2 JUL 53

CAR NICOBAR
BUTTERWORTH
LABUAN
SINGAPORE
BIAK
MOMOTE
HOLLANDIA
NADZAB
COCOS IS
BATHURST IS
HIGGINS
DARWIN
TRUSCOTT

R of A 500 N.M.
- - - 750 "
BASE A/D

National Archives of Australia
NAA: A1196, 1/501/667

O'B.

3A

5A

18

DRAFT

AN APPRECIATION

OF

THE CONTROL ASPECTS
OF THE C.A.C. ROCKET INTERCEPTOR

Information

1. The problem of interception at high altitudes and at high speeds can be expressed in terms of time and distance. As the aim of all interceptions must be that of destroying the enemy far away from his target, this aim must then involve radar range, the positions of the target relative to the airfield from which the interceptor will take off, and the radar ~~screen~~ station.

2. In order to avoid as many parameters as possible, that case in which the radar and the airfield are coincident but remote from the target, is considered. The aim will be to destroy the target over the airfield.

Introduction.

3. An interception can be split into well defined phases. These phases are as follows:-

(a) Reporting and Initial Control. This phase ~~starts at the moment of target detection and finishes at the moment when the interceptor's wheels leave the ground~~ in that affected by the type of interception facilities used, and may be ~~neglected~~ disregarded. ~~on the orders of the Vector Controller. The time involved may be of the order of 5 - 7 minutes. In Australia it is hoped that this phase may be completed in 5 minutes as the air situation and control system are likely to be less complex than those prevailing in other theatres.~~

(b) Climb and Height. This phase to date had been dependent upon the performance of the interceptor. The intention of this paper will be to show that psychological factors are involved when rocket propulsion is involved.

..../2

National Archives of Australia NAA: A1196, 1/501/667

17

(c) Acceleration. The phase where the interceptor accelerates to maximum cruising speed.

(d) The Interception. This phase appears to be a constant period which is independent of speed. It is of the order of 3 to 6 minutes and is a function of controller ability allied to aircrew ability.

(e) Final Turn and Overtake. This is a phase when aircraft performance is again paramount.

(f) Lights on and Shoot. The final phase being a function of aircraft performance as a gun platform, armament and aircrew ability.

4. The Performance of the C.A.C. Rocket Interceptor will be examined only in so far as the interception may be affected. A performance of this order holds many attractions for the Controller in his quest for time, and would seem to point the way to the future.

5. In order to appreciate the Rocket Interceptor a case of the single Fighter Versus the single Bomber will be examined in the phases mentioned in paragraph 3. The further complication introduced by many versus many ~~can be discussed later~~ is not considered.

Conditions for Consideration

6. The following conditions will be considered:-

(a) Bomber speed M .9 at 55,000 ft. (T.A.S. 600 m.p.h.)

(b) Fighter Climb vertical and accelerating to M 1.6 at 55,000 ft

Speed Level Flight M .91 at 55,000 ft.

Turn 3G radius 1.75 miles.

The Interception Problem

7. (a) ~~Reporting and Initial Control~~ Sector Control Consideration

(i) ~~In~~ The consideration of the type of fighter to be used in air defence is a matter of ~~policy, with the decision resting in the Chiefs of Staff Committee.~~

..../3

National Archives of Australia NAA: A1196, 1/501/667

Economy of force must always be a prime consideration, but should a Rocket Interceptor be decided necessary in air defence then the small radius of action, the necessity for suitable bases, and the geographical position of these bases must be weighed against the high speed and high rate of climb of this type of fighter. In addition, some difficulties may arise in operating the Rocket Interceptor in Squadron or Wing formations, as formation flying can not be conducive to fuel economy.

(ii) The Sector Controller must use his discretion as to the type of fighter he will use when he is provided with more than one type. ~~The mechanics of this phase are independent of fighter type.~~ This decision may not be easy if the direction of the raid is in doubt.

(b) Climb to Height

(i) At the present time a large percentage of the total interception time is occupied by this phase. At 40,000 feet using the Avon Sabre type of fighter 31% of the time is taken by the climb. A high rate of climb is very attractive.

(ii) Factors involved in the vertical climb - Special instruments will be necessary to enable the pilot to climb vertically.

(iii) Levelling off must be effected by rolling over and then rolling level as negative "G" of a high order will be involved if the normal levelling off procedure were followed.

(iv) ~~Rate~~ Degree of roll indicators will be necessary to make it possible for the pilot to manoeuvre his aircraft into the correct attitude so that he will be able to roll onto his back on the required heading.

..../4

National Archives of Australia NAA: A1196, 1/501/667

14

(v) The Rocket Interceptor makes no provision for such instruments and indeed their weight may well preclude their use.

15

(vi) It would seem that a climb at an angle less than vertical would solve all these problems. The effect of this reduction in terms of time to height and endurance is shown at appendix "A". It appears that considerable work may be necessary to find a nice balance between Angle of Climb and endurance.

and make controller judgement somewhat more difficult. ~~but do not affect the time involved~~.

(e) Final Turn and Overtake

(i) The high rate of turn and small radius involved is most attractive and is conducive to a high order of control accuracy. A high overtaking speed ~~will~~ would go some way towards offsetting the dangers involved in a stern chase provided dive brakes for rapid deceleration are available.

(ii) As dive brakes are not available the controller must continue to aim for the normal "in behind" position of 1 - 1½ miles.

(f) Sights on and Shoot. This is an armament problem but is so far as it takes time it is also a control problem. The Controller may be called upon to re-position if ~~their~~ his time is excessive under difficult weather conditions.

8. Radar. Owing to the visual sighting problem at high altitudes the radar must be capable of 16 to 20 miles range. In addition a wide angle of search will be necessary to compensate for inaccuracies in control ~~or~~ and to angles of approach which ~~are~~ may be forced

National Archives of Australia NAA: A1196, 1/501/667

14

(v) The Rocket Interceptor makes no provision for such instruments and indeed their weight may well preclude their use.

(vi) →

(c) Acceleration. The Rocket Interceptor accelerates throughout its whole climb phases and reaches 1.69 M at 55,000 feet. If the interception is to be carried out at M .91 as stated in paragraph 6 a deceleration must be effected. As no dive brakes are incorporated, deceleration may occupy an unduly large portion of the remaining interception time, ~~with a resultant~~ in addition to effect on manoeuvrability ~~.~~ may be considerable.

(d) The Interception. High speeds mean high closing speeds and make controller judgement somewhat more difficult, ~~but do not affect the time involved~~.

(e) Final Turn and Overtake

(i) The high rate of turn and small radius involved is most attractive and is conducive to a high order of control accuracy. A high overtaking speed ~~will~~ would go some way towards offsetting the dangers involved in a stern chase provided dive brakes for rapid deceleration are available.

(ii) As dive brakes are not available the controller must continue to aim for the normal "in behind" position of 1 - 1½ miles.

(f) Sights on and Shoot. This is an armament problem but is so far as it takes time it is also a control problem. The Controller may be called upon to re-position if ~~their~~ his time is excessive under difficult weather conditions.

8. Radar. Owing to the visual sighting problem at high altitudes the radar must be capable of 16 to 20 miles range. In addition a wide angle of search will be necessary to compensate for inaccuracies in control ~~or~~ and for angles of approach which ~~are~~ may be forced

National Archives of Australia NAA: A1196, 1/501/667

13

upon the Controller by necessity. As weight is of prime importance the G.L. radar envisaged will be totally unsuitable to fulfil this commitment in addition to that of gun laying.

9. Conclusions

(a) Advantage. The advantages given by rocket propulsion are high rate of climb, high speed, and quick "Take-off".

(b) Disadvantage. The disadvantages are the various instruments required to make the interception possible, small radius of action; special refuelling installations necessitating special airfields suitably spaced, high fuel consumption and low endurance.

(c) Special limitations. The difficulty of vertical climb and the necessity for deceleration suggest a compromise is necessary to overcome these special limitations.

Recommendation

10. The C.A.C. Rocket Interceptor in its present form is unsuitable for employment in air defence. Its particular advantages would point to the necessity for further investigation into its usefulness. As the role of interceptor involves the Controller as well as the pilot, the interception problem as it affects both users should be given an equal place with aeronautical design.

National Archives of Australia NAA: A1196, 1/501/667

Appendix A.

SECRET.

12

AIRCRAFT RESEARCH & DEVELOPMENT UNIT

R.A.A.F. LAVERTON

ROCKET INTERCEPTOR.

by

J.J.Thompson Ph.D.

1. The following relates to the endurance of this aircraft at altitude, when techniques other than the vertical climb (C.A.C. Report A - 132) are employed.

2. It was intended to calculate the performance, notably fuel consumption, when climbing at constant angles but closer investigation showed this to be extremely laborious and require information not available at present. Accordingly an attempt was made to employ the analysis used for the vertical climb and this led to the result

$$h_\theta = h_{90} \sin\theta + (V_\theta - V_{90})t \sin\theta + \frac{gt^2}{2}(\sin\theta - \sin^2\theta)$$

h_θ = height reached in time t at a climb angle θ

h_{90} = " " " " " in a vertical climb

V_θ = speed at ground level at the angle θ

V_{90} = initial vertical rate of climb

3. Values of V_θ were estimated, using the fact that V_0 = 500 m.p.h. (=44,000 ft/min) and V_{90} = 35,000 ft/min.

4. This simple analysis gave increases in times to height of the order of 2 seconds (up to 60,000 ft) as the climb angle decreases from 90° to 50°. As the effect of the increase in drag with Mach No has been ignored this estimate is likely to be optimistic.

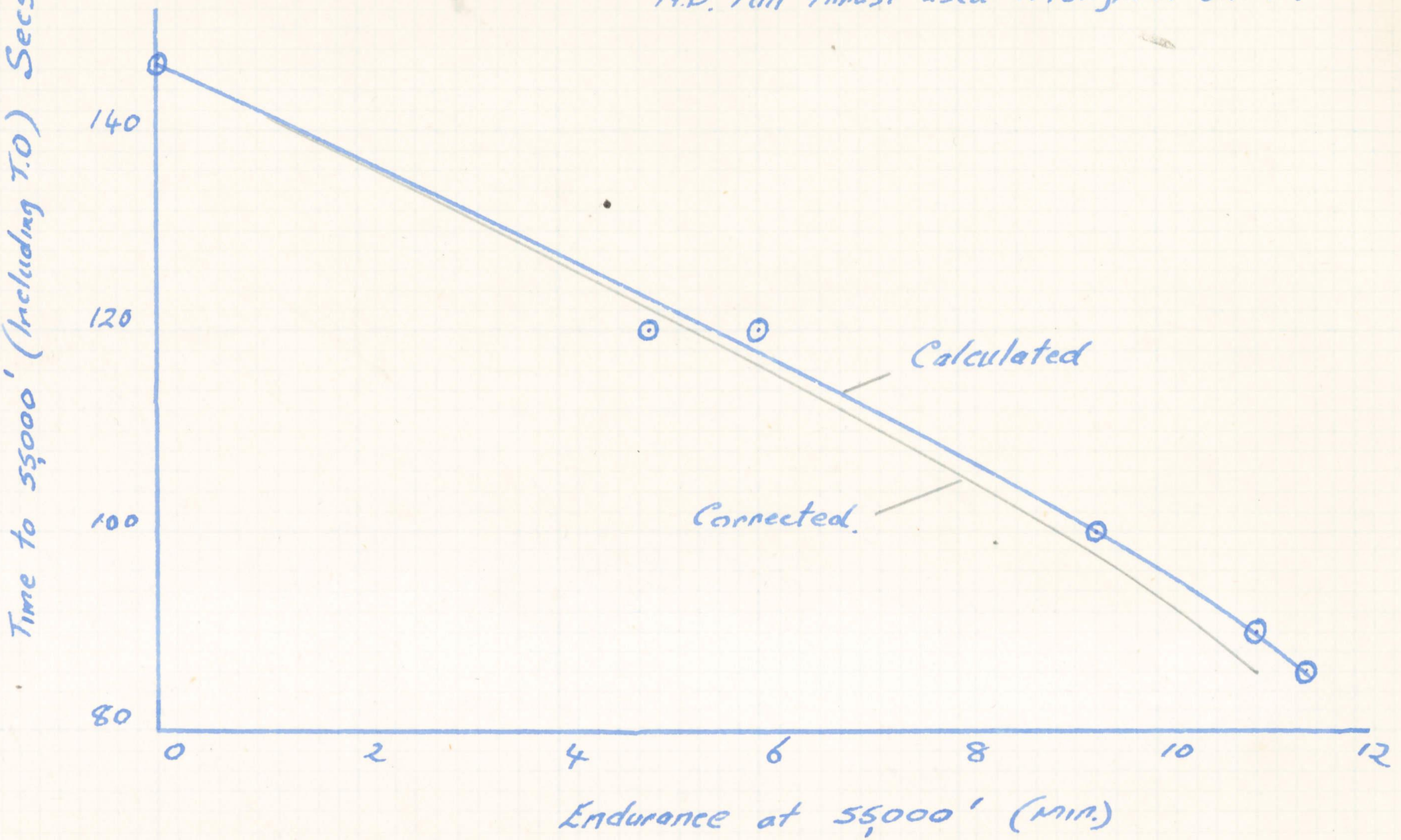
5. It was thought advisable therefore to obtain some idea of the increase in time to height acceptable, by estimating the effect of time to height on endurance at 55,000 ft. The calculation involved is similar to that already reported, and the results are shown on the attached graph. The calculated curve was corrected to pass through the known endurance of 11 mins after an 86 second vertical climb.

6. It will be noted that an increase in time to 55,000 ft of 10 seconds, say, due to climbing other than vertically, reduces the endurance from 11 to about 9½ minutes. On the basis of these results it could be said that climbs at angles less than 90° - say down to 50° - would be possible without seriously impairing the endurance at this height.

7. Because of the assumptions involved, no great confidence is felt in these results and more accurate calculations would be necessary if the matter assumes greater importance.

National Archives of Australia NAA: A1196, 1/501/667

N.B. Full thrust used throughout Climb.



=

National Archives of Australia
NAA: A1196, 1/501/667

AIR MAIL(DIP BAG)

COMMONWEALTH OF AUSTRALIA

SECRET
Central Registry

1.501.632 44

WHITEHALL 2101.

ROYAL AUSTRALIAN AIR FORCE,
OVERSEAS HEADQUARTERS,
CANBERRA HOUSE,
85-87, JERMYN STREET,
LONDON, S.W.1.

REFERENCE 312/3/Air(65A) 4332

30th September 1952

RECD.
14 OCT 1952
C.A.S.
107

The Secretary,
Air Board,
Victoria Barracks,
St. Kilda Road,
Melbourne,
Victoria,
Australia.

AIR STAFF REQUIREMENTS - R.A.F.

Air Ministry has advised the following Amendment (No.2) to O.R.301 for a Rocket Propelled Interceptor, forwarded under cover of this Headquarters letter 312/3/Air 3675 dated 4th September 1951 :-

Paragraphs 7 and 34	Delete in toto. Renumber subsequent paragraphs accordingly.

(W.N. GIBSON)
Group Captain,
Officer T/Commanding.

SECRET

Ops 1d. 10/52

OR 301 Amended 23/2.

National Archives of Australia NAA: A1196, 1/501/667

1/501/667

3A

SECRET

9

ROCKET PROPELLED INTERCEPTOR

D.A.F.I.

1. An air staff appreciation is in the process of being written as to whether the R.A.A.F. needs a high altitude interceptor to destroy very high flying enemy bomber aircraft. At present it is thought that only rocket propulsion can enable an interceptor to operate successfully above heights of 50,000 feet.

2. It is required to know -

"The threat and possible scale of attack to Australia from 1956 - 1962 using bombers flying at altitudes in excess of 50,000 feet."

3. It would be appreciated if an early reply could be given to this query.

17 Jun 52.

Wing Commander, D.Ops.

Reply D.A.F.I. loose minute TIC BE1/20 dated 18 Jun. 52 + returned to D.A.F.I.

17 Sep. 53.

D/D.OPS

National Archives of Australia NAA: A1196, 1/501/667

DEPARTMENT OF AIR

SECRET 2A

8

MINUTE PAPER

(This side only to be written on)

SUBJECT: ROCKET PROPELLED INTERCEPTOR

OPS.1

1. At Encl.1A you will see a loose minute in which D.C.A.S. directs that an air staff appreciation on the value of an aircraft such as the Rocket Interceptor proposed by C.A.C. (Encls.1B and 1C) with a view to deciding whether there is an operational requirement for same in the R.A.A.F.

2. R.A.F. Air Staff requirement No.OR/301 - Rocket Propelled Interceptor - is temporarily attached to this minute as Encl.2B. From this operational requirement (see paragraph 1) it will be seen that the rocket propelled interceptor is designed for the specific task of combatting the very high flying enemy aircraft. For the purpose of this appreciation it should be assumed that these aircraft will be flying above 50,000 feet. In this connection it should be noted that aircraft with conventional jet engines will have a very limited rate of climb above 50,000 feet. A bomber aircraft will be able to reach heights above 50,000 feet en route to its target at a slow rate of climb but a conventional fighter might not be able to intercept within the time available with present or predicted warning systems because of its limited rate of climb above 50,000 feet.

3. For the purpose of this appreciation it can be assumed that while a prototype could be produced in Australia by the end of 1954, it would be at least 1956 before production models were in service (see paragraph 7 Encl.2B).

4. You are, therefore, to prepare a draft paper as soon as possible.

5. You should consult D.A.F.I. and D.A.S.P. in order to establish:-

Probable

"the threat and possible scale of attack to Australia from 1956 - 1962."

6. Other specialist officers in this directorate such as Ops.7, Ops.8 and Wing Commander Elderton, should be co-opted to write the respective sections of the paper as required.

7. I have had some discussion with D.G.M.S. (M.A.4) with regard to visability above 50,000 feet and you should consult him to obtain the latest information on the requirement to supplement visual sight with A.I. at and above those altitudes.

8. I will be available to discuss any aspects with you.

11/6/1952.

Wing Commander, D/D.Ops.

National Archives of Australia NAA: A1196, 1/501/667

1/501/633 (22A)
SECRET

~~22A~~ 2B

SECRET

C.43840/51/O.R.1

7

AIR STAFF REQUIREMENT NO. O.R./301 - ROCKET PROPELLED INTERCEPTOR

INTRODUCTION

1. The current day interceptor projects are expected to be adequate in performance to match the enemy threat in normal circumstances but may be unable to destroy very high flying enemy aircraft.

2. An aircraft to fulfil this requirement must have an outstanding rate of climb and altitude performance. So far as is known at present these characteristics can only be provided by rocket propulsion and although aware of the probable operating limitations that obtain with this method, the Air Staff consider that the promise of tactical advantage more than outweighs other considerations.

REQUIREMENT

3. The Air Staff require a single seater rocket propelled interceptor class of aircraft built to the broad specification that follows.

GENERAL DESIGN CONSIDERATIONS

4. Unconventional take-off methods are acceptable but any specialised equipment involved, such as catapults or launching ramps, must be designed concurrently and must feature ease of transport and assembly so that bases can be set up at short notice.

5. In order to assist turn-round time and avoid a major ground handling problem, it is desirable that the aircraft should be fitted with a light-weight chassis for landing. Conventional chassis may on the other hand be dispensed with if the required performance cannot otherwise be obtained, but in this case the aircraft design must cater for ease of recovery after landing either at, or away from its base. Any M.T. requirement in this respect should, if at all possible, be combined with that arising out of paragraph 4.

6. The aircraft or its rocket motor is in no way to be regarded as expendable.

~~7. It is intended to place a small pre-production order of the selected design for Service trials. Any further production order will be based on the results of these trials.~~ deleted A.L. No 21. See Encl

PERFORMANCE

Rate of Climb

~~8.~~ 7. Justification of this project depends mainly on the ability to reach an exceptionally high altitude quickly and a figure considerably better than that expected in contemporary interceptor projects is essential. The aircraft is therefore required to climb from sea level to 60,000 feet in $2\frac{1}{2}$ minutes.

Maximum Operational Speed

~~9.~~ 8. The aim is that aircraft of this type should ultimately be capable of supersonic speeds at all heights above 30,000 feet. In the first instance, however, maximum operational speeds of the order of .95 Mach are acceptable if this permits substantial saving of time in design work and development or if this approach is deemed technically advisable. The greatest practicable degree of thrust control by throttling is to be provided.

/Endurance

SECRET

National Archives of Australia NAA: A1196, 1/501/667

SECRET

Endurance

9. Should provide climb to 60,000 feet plus at least 10 minutes cruising at M = ·8 and 2 minutes combat at M = ·95 at that height. No allowance need be made for the descent.

Manoeuvrability and Strength

10. A high degree of manoeuvrability is required at all heights. Normal fighter flight factors are required.

Landing

11. To facilitate landing at, or away from base, without power, the landing condition must be such that slow approach and landing speeds are possible. This requirement over-rides that for supersonic speeds outlined in paragraph 9 above, should it be found that the two are conflicting.

Air Brakes

12. Air brakes are required. As they will be used as an aid to combat it must be possible to use them throughout the entire speed range of the aircraft without affecting stability or otherwise impairing its aiming and rocket firing qualities.

PARTICULAR DESIGN FEATURES

Accommodation

13. A pressure cabin is required which will maintain a pressure equivalent to not higher than 25,000 feet when the aircraft is at 60,000 feet.

14. For pre-production aircraft, heating and ventilation are required in accordance with A.P.970 requirements for U.K. and Europe only.

15. Adequate means are to be provided for ensuring the pilot's escape from the aircraft in emergency. Dinghy and personal survival pack is required.

View

16. The best possible all-round view is required and special attention is to be paid to de-icing and demisting the windscreen and canopy, using a method which imposes no restriction on the pilot's view through the transparency.

Protection

17. Provision is to be made for the fitting of the following armour protection if required:-

(a) Pilot. Protection from a direct hit by ·5 ammunition fired from within a 20° cone dead ahead.

(b) Fuel and Oxident Installation. Protection from a direct hit by ·5 ammunition fired from within a 20° cone dead ahead if this protection can so largely be combined with (a) above as to involve no substantial extra weight penalty.

18. The armour protection should as far as possible be made easily detachable.

G.302522/8/51/120

SECRET

National Archives of Australia NAA: A1196, 1/501/667

5

Hood and Windscreen Strength

19
20. Particular attention is to be paid to the strength of the hood and windscreen in order to reduce the risk of failure under the extreme operating conditions of temperature and pressure.

ARMAMENT

Rockets

20
21. Initially, the armament is to consist of a battery of 2 in. air to air rockets which must be capable of firing a salvo calculated to ensure a high probability of destruction of the medium and high altitude bomber. It is acceptable for the rockets to be externally carried in containers provided that the required performance is not prejudiced thereby. It must be possible to fire half the rocket load at any one time.

Rocket Sight

21
22. The normal reflector gun sight is acceptable but space provision is to be made for fitting the gyro gun sight if required. Radar ranging is not required.

Guided Weapons

22
23. Provision is to be made for the fitting when available of the small direct hitting air to air guided weapon, as an alternative to the rocket battery.

Camera

23
24. A G.45 camera installation is required.

AIRCRAFT EQUIPMENT

General

24
25. Because of the limited range and endurance, and also to preserve the essential requirements for ease and speed of production and low landing speed, there is no intention of providing an elaborate standard of equipment for this aircraft or of regarding it as in any way capable of all-weather operation. The standard to be aimed at is that in the hands of a pilot of average war-time skill and experience the aircraft should be capable of taking off, climbing and delivering its attack, and returning safely to base by day in weather conditions down to 8/8th cloud, 10,000 feet thick with base about 2,000 feet, and visibility about 3 miles. Operation in conditions somewhat worse than this is expected to be practicable but is likely to involve an appreciable recovery problem due to numbers of aircraft landing away from their own base.

Guidance to Target

"26. 25 It was originally intended to develop concurrently with the aircraft, some special system of radio or radar guidance. After closer examination of the guidance problem to determine a specific and practical system, it has, however, been decided to operate the aircraft under normal close control".

guidance to the target on
s. There is however some doubt
with this aircraft, both for
ort endurance.

system of radio or radar guidance
raft to enable the pilot to home
requirement is being examined
separately.

Flight Instruments

26
27 28. Flight instruments are required to provide safe attitude information on flight conditions at all times.

/29.

National Archives of Australia

NAA: A1196, 1/501/667

5

Hood and Windscreen Strength

19
20. Particular attention is to be paid to the strength of the hood and windscreen in order to reduce the risk of failure under the extreme operating conditions of temperature and pressure.

ARMAMENT

Rockets

20
21. Initially, the armament is to consist of a battery of 2 in. air to air rockets which must be capable of firing a salvo calculated to ensure a high probability of destruction of the medium and high altitude bomber. It is acceptable for the rockets to be externally carried in containers provided that the required performance is not prejudiced thereby. It must be possible to fire half the rocket load at any one time.

Rocket Sight

21
22. The normal reflector gun sight is acceptable but space provision is to be made for fitting the gyro gun sight if required. Radar ranging is not required.

Guided Weapons

22
23. Provision is to be made for the fitting when available of the small direct hitting air to air guided weapon, as an alternative to the rocket battery.

Camera

23
24. A G.45 camera installation is required.

AIRCRAFT EQUIPMENT

General

24
25. Because of the limited range and endurance, and also to preserve the essential requirements for ease and speed of production and low landing speed, there is no intention of providing an elaborate standard of equipment for this aircraft or of regarding it as in any way capable of all-weather operation. The standard to be aimed at is that in the hands of a pilot of average war-time skill and experience the aircraft should be capable of taking off, climbing and delivering its attack, and returning safely to base by day in weather conditions down to 8/8th cloud, 10,000 feet thick with base about 2,000 feet, and visibility about 3 miles. Operation in conditions somewhat worse than this is expected to be practicable but is likely to involve an appreciable recovery problem due to numbers of aircraft landing away from their own base.

Guidance to Target

26. Early models may if necessary rely for guidance to the target on conventional G.C.I. fighter control methods. There is however some doubt whether these methods will be satisfactory with this aircraft, both for technical reasons and also owing to its short endurance.

27. There is therefore a requirement for a system of radio or radar guidance to be developed concurrently with the aircraft to enable the pilot to home within visual range of his target. This requirement is being examined separately.

Flight Instruments

26
27 28. Flight instruments are required to provide safe attitude information on flight conditions at all times.

/29.

National Archives of Australia NAA: A1196, 1/501/667

Radio and Communications

"28 27 The following equipment is required :-

(a) V.H.F. providing 10 channels.

(b) Telescramble.

(c) IFF Mark 10."

equipment can only be determined ara. 27 above. Meanwhile the

g of a centimetric responder beacon or I.F.F.

Survival

28 29 30. Pressure suit connections are required. The aircraft should be capable of being flown by a pilot wearing an inflated pressure suit.

29 30 31. Oxygen stowage sufficient for maximum demand rate for 15 minutes is required.

Electrical Power

30 31 32. A source of electrical power for the operation of essential equipment during a power-off descent is required.

SERVICING

General

31 32 33. It is essential that every effort is made in the design of this aircraft to facilitate servicing. Accessibility of components is to be adequate to allow servicing by change of major components in the field by squadrons. The aircraft shall have a reliable performance with a minimum requirement for servicing or inspection, other than the need to replenish consumable stores, over any period of 100 flying hours or four months elapsed time, whichever is the less. Provision is to be made for simple and rapid refuelling, rearming and replenishment servicing to facilitate turn-round of the aircraft within the shortest possible time.

Transportation

32 33 34. It will be necessary for adequate lifting or supporting points to be provided to facilitate transportation of aircraft if necessary, after a forced landing.

Production Date

33 34 35. ~~The target date for first production of aircraft to the initial pre-production order is 1954.~~ -deleted A.L.2 See Encl 5A.

Air Ministry, D.O.R.(A).

22nd August, 1951.

G.302522/8/51/120

National Archives of Australia NAA: A1196, 1/501/667

4

Radio and Communications

The ultimate requirement for radio and equipment can only be determined as a result of the examination outlined in para. 27 above. Meanwhile the following equipment is required:-

(a) V.H.F. providing 10 channels.

(b) Telescramble.

(c) Space provision for the fitting of a centimetric responder beacon or I.F.F.

Survival

28/29 ~~30~~. Pressure suit connections are required. The aircraft should be capable of being flown by a pilot wearing an inflated pressure suit.

29/30 ~~31~~. Oxygen stowage sufficient for maximum demand rate for 15 minutes is required.

Electrical Power

30/31 ~~32~~. A source of electrical power for the operation of essential equipment during a power-off descent is required.

SERVICING

General

31/32 ~~33~~. It is essential that every effort is made in the design of this aircraft to facilitate servicing. Accessibility of components is to be adequate to allow servicing by change of major components in the field by squadrons. The aircraft shall have a reliable performance with a minimum requirement for servicing or inspection, other than the need to replenish consumable stores, over any period of 100 flying hours or four months elapsed time, whichever is the less. Provision is to be made for simple and rapid refuelling, rearming and replenishment servicing to facilitate turn-round of the aircraft within the shortest possible time.

Transportation

32/33 ~~34~~. It will be necessary for adequate lifting or supporting points to be provided to facilitate transportation of aircraft if necessary, after a forced landing.

Production Date

33/34 ~~35~~. ~~The target date for first production of aircraft to the initial pre-production order is 1954.~~ -deleted AB 2 See Encl 5A.

Air Ministry, D.O.R.(A).

22nd August, 1951.

G.302522/8/51/120

National Archives of Australia

NAA: A1196, 1/501/667

DEPARTMENT OF AIR

MINUTE PAPER

(This side only to be written on)

SECRET

1A

b.a.s. file 7326.

SUBJECT: MANNED ROCKET INTERCEPTOR

DEPT. OF AIR
1 | 501 | 667

3

Air Cdre. Ops.

1. Attached is a brochure which I have received from Commonwealth Aircraft Corporation, with the suggestion that the Air Staff might like to sponsor a design study along the lines indicated.

2. Before we are justified in proposing a project which will involve considerable expenditure of money, we should clear our minds as to the necessity for such an aircraft.

3. The role of the aircraft answering to the outlined specification would be that of close defence of a base area, such as that now discharged by the C.A.F. squadrons.

4. Under the present international line-up, our air defence areas are liable to attack by hostile aircraft on a light scale only, but they would undoubtedly make use of weather and night factors to deliver their attack. It would only require one or two successful raids to tie up an unduly high proportion of our air resources in local defence. If we can produce locally an aircraft at low cost, and capable of operation by day or night and under all weather conditions other than those which require an instrument landing system for successful flight, I am sure that we would have far more effective air defence capacity than we have at present, using any of the aircraft available or on order. In this particular case of home defence, I do not regard range as the overriding factor that it is for aircraft in the Mobile Task Force.

5. The Manned Rocket Interceptor to be successful must carry gun laying radar, and be capable of being vectored on to the target with great precision, i.e., within a radius of the target not greater than the limits of the G.L. radar.

6. I would like the Operations staff to prepare an appreciation on the value of an aircraft such as that under discussion, with a view to deciding whether there is an operational requirement for same.

V.E. Hancock

Air Vice Marshal,
DEPUTY CHIEF OF THE AIR STAFF.

1 May 52.

Att.

National Archives of Australia
NAA: A1196, 1/501/667

1B.

2

COLUMBIAN NATURAL CLASP NO. 97N
®
THE UNITED STATES ENVELOPE CO. SPRINGFIELD, MASS.
10 x 13

National Archives of Australia NAA: A1196, 1/501/667

69-132

REPORT No. A-132
ISSUE. 2.

SECRET.

COPY No. 2

ROCKET INTERCEPTOR.

COMMONWEALTH AIRCRAFT CORPORATION
PROPRIETARY LIMITED

M 442

National Archives of Australia NAA: A1196, 1/501/667

SECRET.

ROCKET INTERCEPTOR.

PREPARED BY

ENGINEERING DEPARTMENT.

COMMONWEALTH AIRCRAFT CORPORATION.

PROPRIETARY LIMITED.

APRIL 1952

A-132
ISSUE.2.

National Archives of Australia

NAA: A1196, 1/501/667

ROCKET INTERCEPTOR.

The first issue of this report, in November 1951, covered a preliminary investigation of the performance and size of a manned rocket interceptor.

Since that time, it has been found possible to reduce the dimensions to an even more favourable size, at the same time maintaining the requisite performance for an interceptor fighter.

With this reduction, a single Reaction Motor of a tested type is used.

At the lower thrust to weight ratio a reduction in the time to height has taken place but with some addition to the duration of the cruise.

Interception may now be made at all stages from the climb to the maximum operational range of 90 miles. These missions are illustrated on figures 3, 4 and 5.

The high performance has not, in any way, compromised the low speed characteristics. With a glide and landing wing loading of 13.0 lb/ft.^{2}, a touchdown speed not exceeding 75 knots is achieved.

National Archives of Australia NAA: A1196, 1/501/667

A large amount of American wind-tunnel data is available and from these, with the appropriate corrections, the curves of figures 6 to 16 have been obtained. In addition, small scale flying models have been made and these have shown agreement with certain particulars in the curves, as well as indicating the stability of the aircraft.

Oxygen and alcohol-water have been used as fuels since they appear to be the best combination from the handling and availability point of view. The combined tankage is 375 gallons.

Six 3 inch Oerlikon type, air to air, rockets, with proximity fuses, will give a high intensity of firepower.

A simply constructed mock up of the cockpit area has shown that ample clearance is available for the fitting of a North American type ejection seat.

The small size of the various component parts combined with the use of constant chord lifting surfaces should make the aircraft particularly attractive from the constructional point of view.

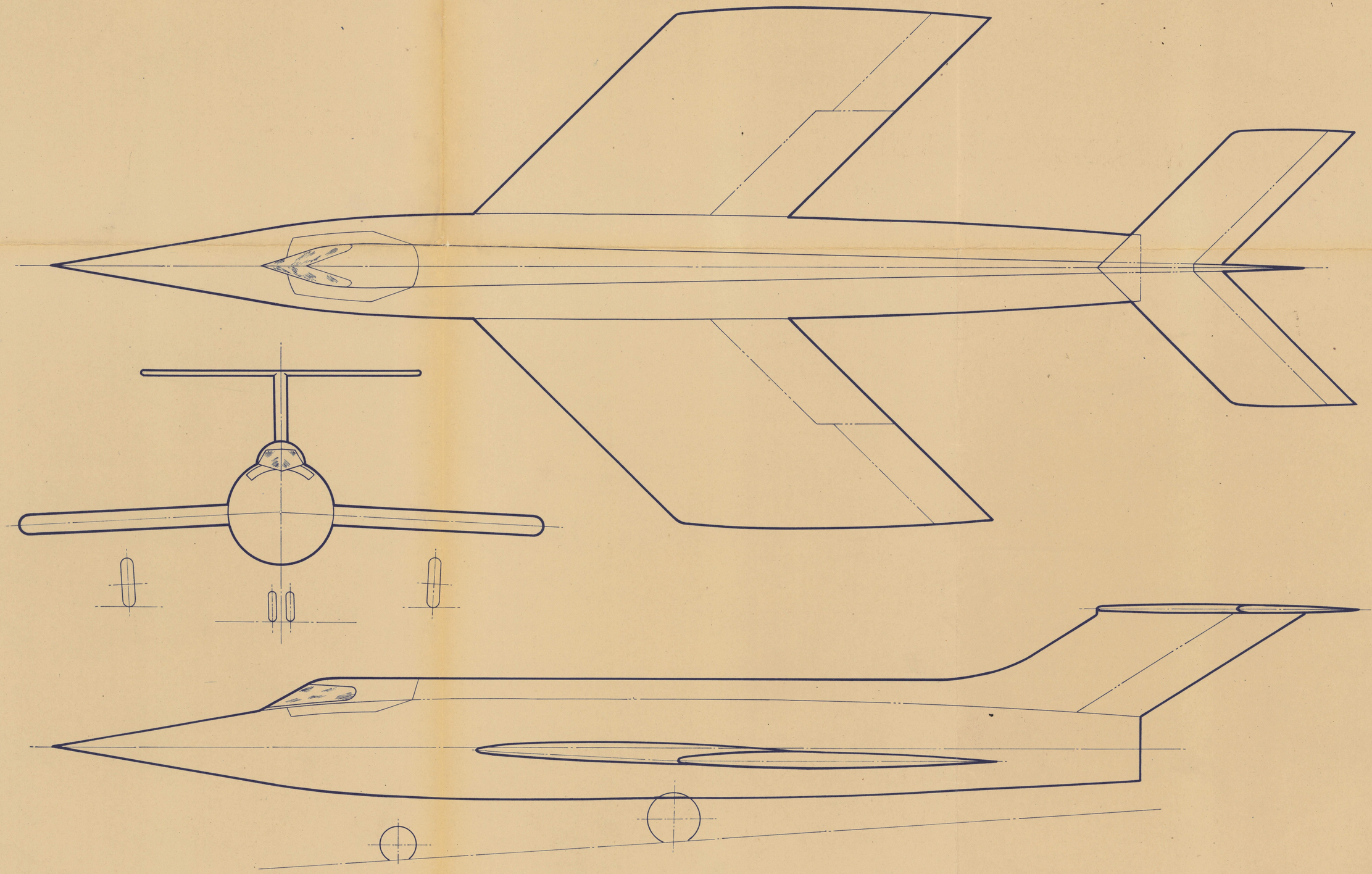
Sufficient overseas data is available to assess the aerodynamic characteristics with reliability.

It is felt that sufficient work has been done to indicate the feasibility of such a project.

National Archives of Australia

NAA: A1196, 1/501/667

FIG. I.



FEET.

0 1 2 3 4 5 6 7 8 9 10

ROCKET INTERCEPTOR.

COMMONWEALTH AIRCRAFT CORPORATION.

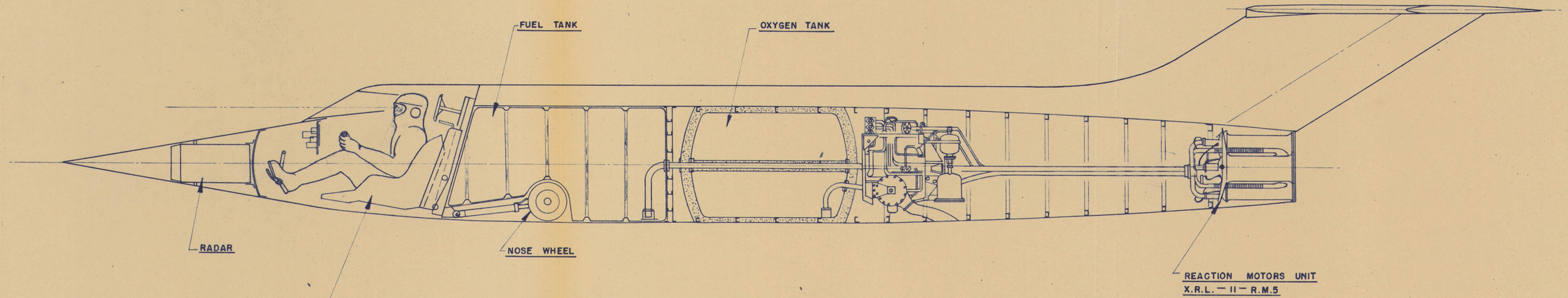
PROPRIETARY LIMITED.

FIG. I.

National Archives of Australia

NAA: A1196, 1/501/667

FIG. 2.



0 1 2 3 4 5 6 7 8 9 10

SCALE :— $\frac{1}{2}$" = 1 FT.

FUSELAGE LAYOUT.

National Archives of Australia NAA: A1196, 1/501/667

GENERAL DATA

WING DATA

Area - Gross	135.0	ft.^{2}
Nett	108.0	ft.^{2}
Span	15.0	ft.
Chord	9.0	ft.
Aspect Ratio	1.67	
Airfoil Section	N.A.C.A. 64A006	
Taper Ratio	1.0	
Sweepback	45.0°	

FLAP DATA

Type	Plain	
Area (Total	13.5	ft.
Span (Per Flap)	3.0	ft.
Chord (normal to hinge)	1.59	ft.
Angular Movement	0° Up 40° Down	

National Archives of Australia NAA: A1196, 1/501/667

AILERON DATA

Type	Plain	
Area (Aft Hinge - Total)	10.5	ft.^{2}
Span (Per Ail.)	3.0	ft.
Chord (normal to hinge)	1.24	ft.
Angular Movement	20° Up	20° Down
Differential	0°	

FUSELAGE DATA

Length	31.0	ft.
Max. Dia.	3.0	ft.
Max. Frontal Area	7.70	ft.^{2}

National Archives of Australia

NAA: A1196, 1/501/667

HORIZONTAL TAILPLANE DATA

Area	28.0	ft.^{2}
Span	8.0	ft.
Chord	3.5	ft.
Aspect Ratio	2.28	
Air Foil Section	N.A.C.A. 64A007	
Taper Ratio	1.0	
Sweepback	45.0°	
Angular Movement	0° Up 10° Down	

ELEVATOR DATA

Area (Aft Hinge)	7.0	ft.^{2}
Span	8.0	ft.
Chord (normal to hinge)	0.62	ft.
Angular Movement	30° Up 20° Down	

National Archives of Australia NAA: A1196, 1/501/667

VERTICAL TAILPLANE DATA

Area (Nett)	18.0	ft.^{2}
Height from F.R.L.	4.0	ft.
Chord	6.0	ft.
Taper Ratio	1.0	
Airfoil Section	N.A.C.A. 64A008	

RUDDER DATA

Area	6.0	ft.^{2}
Span	3.0	ft.
Chord (normal to hinge)	1.42	ft.
Angular Movement	30° Left 30° Right	

National Archives of Australia NAA: A1196, 1/501/667

WEIGHT SUMMARY

1. STRUCTURE		
1. Wing		270
a) Skin (0.036")	105	
b) Ribs	38	
c) Webs, doors	18	
d) Spars	29	
e) Stringers	22	
f) Fittings	22	
g) Ailerons & Balance	16	
h) Flaps	20	
2. Tailplane		60
a) Skin (0.036")	28	
b) Ribs	4	
c) Stringers	5	
d) Root Spar	3	
e) Fittings	8	
f) Elevators	12	
3. Fin		50
a) Skin	14	
b) Ribs	4	
c) Stringers, Spars	9	
d) Fittings	7	
e) Rudder	16	
4. Fuselage		226
a) Canopy	27	
b) Dorsal	14	
c) Skin, Stiffeners	116	
d) Formers	49	
e) Fittings	10	
f) Insulation	10	

National Archives of Australia NAA: A1196, 1/501/667

5. Undercarriage		150
(i) Main		
a) Tyres, Tubes	16	
b) Wheels, Brakes	26	
c) Legs, Axles	47	
d) Jacks	4	
e) Brakes	8	
f) Up, Down Locks	4	
(ii) Nose		
a) Tyres, Tubes Wheels (2)	14	
b) Leg Axle	25	
c) Jacks	3	
d) Up, Down Locks	3	
6. Controls		64
a) Stick	5	
b) Pedals	7	
c) Aileron System	7	
d) Elevator System	8	
e) Rudder System	8	
f) Tailplane Screwjack	20	
g) Flaps		
i. Jacks (2)	5	
ii. Control	1	
h) Engine	3	
Total Structure		820

II. POWER

1. Liquid Oxygen - Alcohol Unit RM1 XLR-11-RM-5.		344
a) Combustion Units and Valves	210	
* b) Turbo pump	90	
* c) Steam generator and Starting Tank	38	
d) Turbine Speed Control Valve	6	

National Archives of Australia NAA: A1196, 1/501/667

2. Oxygen System		69.0
a) Oxygen Tank 0.036" Gauge	28.0	
b) Insulation Fibre-glass @ 0.63 lb/ft.^{2}	28.0	
c) Pressure Refuelling Connection and Dump Valve	8.0	
d) Pressure Relief Valve	3.0	
e) Vent Line 1" O.D. and Couplings	0.8	
f) Transfer Pipe 2" O.D. and Couplings	1.2	
3. Alcohol Water System		22.4
a) Bag Tank @ 0.16 lb/ft.^{2}	12.0	
b) Pressure Refuelling Connection and Pump Valve	5.0	
c) Pressure Relief Valve	2.1	
d) Vent Line 1" O.D. and Couplings	0.8	
e) Transfer Pipe 2" O.D. and Couplings	2.1	
f) Filter	0.4	
4. Nitrogen System		30.1
a) Bottles	20.0	
b) Charging Connection	0.2	
c) Reducing Valves (2)	5.2	
d) Non Return Valves (2)	1.0	
e) Tank Connections (3)	0.6	
f) Piping		
4 feet 1" O.D.	0.6	
3 feet $\frac{3}{8}$" O.D.	0.4	
g) Couplings	2.1	

National Archives of Australia NAA: A1196, 1/501/667

5. Hydrogen Peroxide System 3.5

a) Tank 0.036	2.0
b) Filler	0.4
c) Drain	0.3
d) Piping 1" O.D. and Couplings	0.8

Total Power 469

III. SERVICES

1. Electrical 36

a) Batteries	14
b) Battery Supports	0.5
c) Wiring	7.5
d) Plugs	3
e) Switches	3
f) Circuit Breakers	8

2. Air System 12

a) Bottles 2 @ 60 cu. ins.	3.4
b) Piping	2.4
c) Valves	2.5
d) Air Filter	0.7
e) Pressure Reducing	1.3
f) Relief Valve	0.5
g) Charging Connection	0.2
h) Non Return Valves	1.0

3. Oxygen System 14

a) Bottles	12
b) Regulator, Piping	2

National Archives of Australia NAA: A1196, 1/501/667

4. Instruments 16

a)	A.S.I.	0.7
b)	Altimeter	1.3
c)	T. & B.	2.0
d)	Clock	0.3
e)	E2A Compass	0.3
f)	Fuel Contents	
	Indicator	0.7
	Transmitter	1.4
g)	Rocket Temp.	
	Indicator	0.8
h)	Cabin Pressure	0.5
i)	Fuel Pressure	0.6
j)	U/C, Flap Indic.	0.4
k)	P8 Compass	2.6
l)	Lines, Fittings	4.4

Total Services 78

IV. FIXED EQUIPMENT

1. Armament 11

a)	2 Racks for 3 Rockets each	8
b)	Firing, Fusing, etc.	3

2. Radio 10

a)	V.H.F. Microphone	2.0
	Wiring	0.5
	Aerial	1.0
b)	Radar	6.5

Total Fixed Equipment 21

National Archives of Australia NAA: A1196, 1/501/667

V. FURNISHINGS		80
a) Ejection Seat	70	
b) Rear Vision	0.3	
c) Safety Belt	3.9	
d) Instrument Board	2.5	
e) Miscellaneous	3.3	
Total Furnishings		80
TARE WEIGHT		1468
VI. SERVICE LOAD		
a) Communications Set	8	
b) Radar & Sight	80	
c) Crew & Pressure Suit	200	
d) Armament 6 off 3 in. Oerlikon type rockets	132	
e) Oxygen	1560	
f) Water-alcohol	2040	
g) Hydrogen Peroxide	70	
h) Potassium Permanganate	6	
		4096
ALL UP WEIGHT		5564
LANDING WEIGHT		1756

No fuel No ammunition.

Wing loading 13.0 lb/ft.^{2}

These weights have been proportioned on those achieved in the Walter H.W.K. 109-509C. Unit.

National Archives of Australia NAA: A1196, 1/501/667

PERFORMANCE

(I.C.A.N. CONDITIONS)

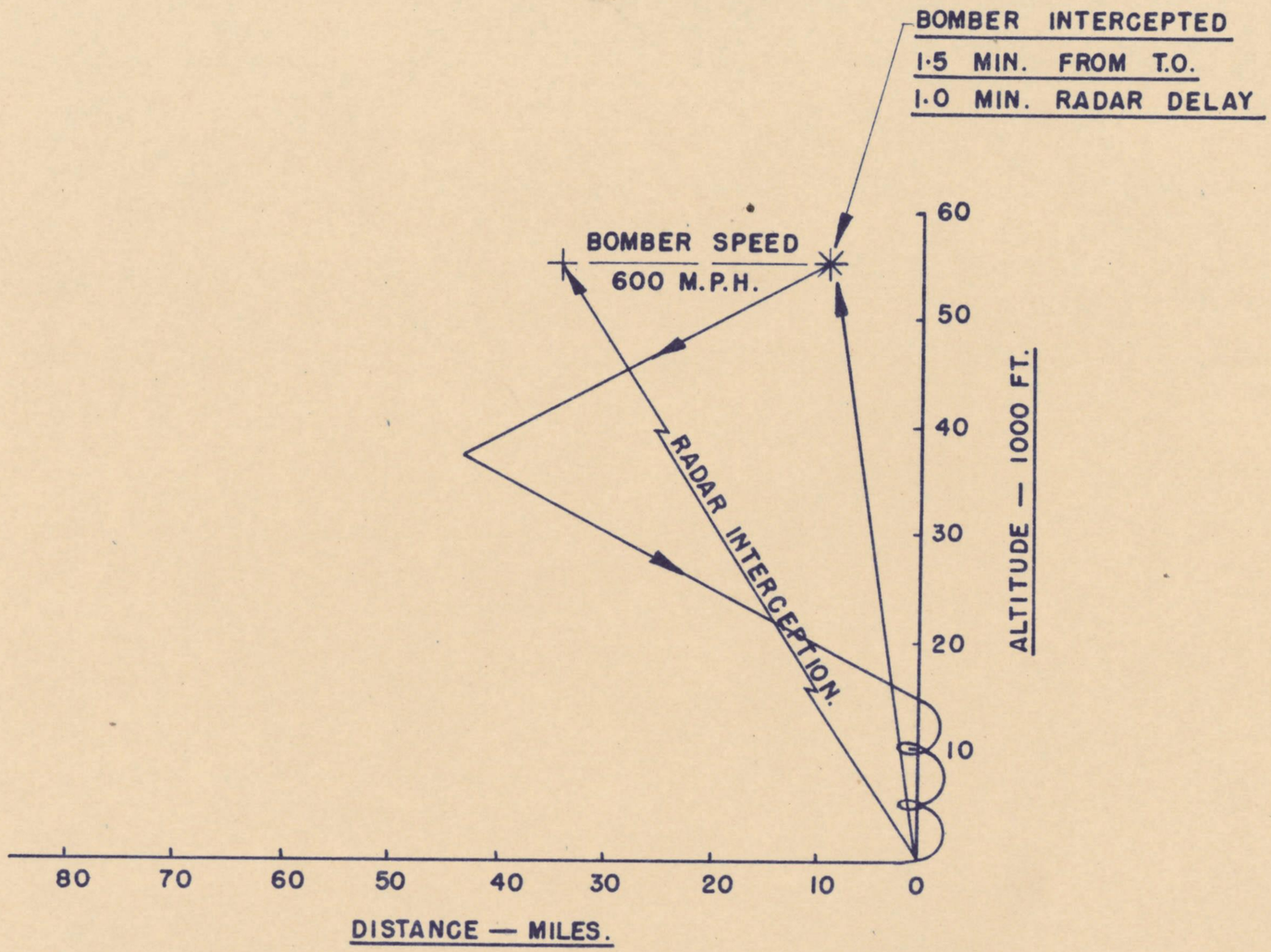
Take-Off Speed		110 Knots
Ground Run		200 Yards
Climb (Incl. T.O.)	10,000 ft.	35 sec.
	20,000 ft.	50 sec.
	30,000 ft.	62 sec.
	40,000 ft.	73 sec.
	50,000 ft.	82 sec.
	60,000 ft.	90 sec.
Max. Speed in Vertical Climb at 60,000 ft.		730 Knots
Landing Speed		75 Knots
Ground Run		250 Yards

National Archives of Australia

NAA: A1196, 1/501/667

M 304

FIG. 3.



INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION.....

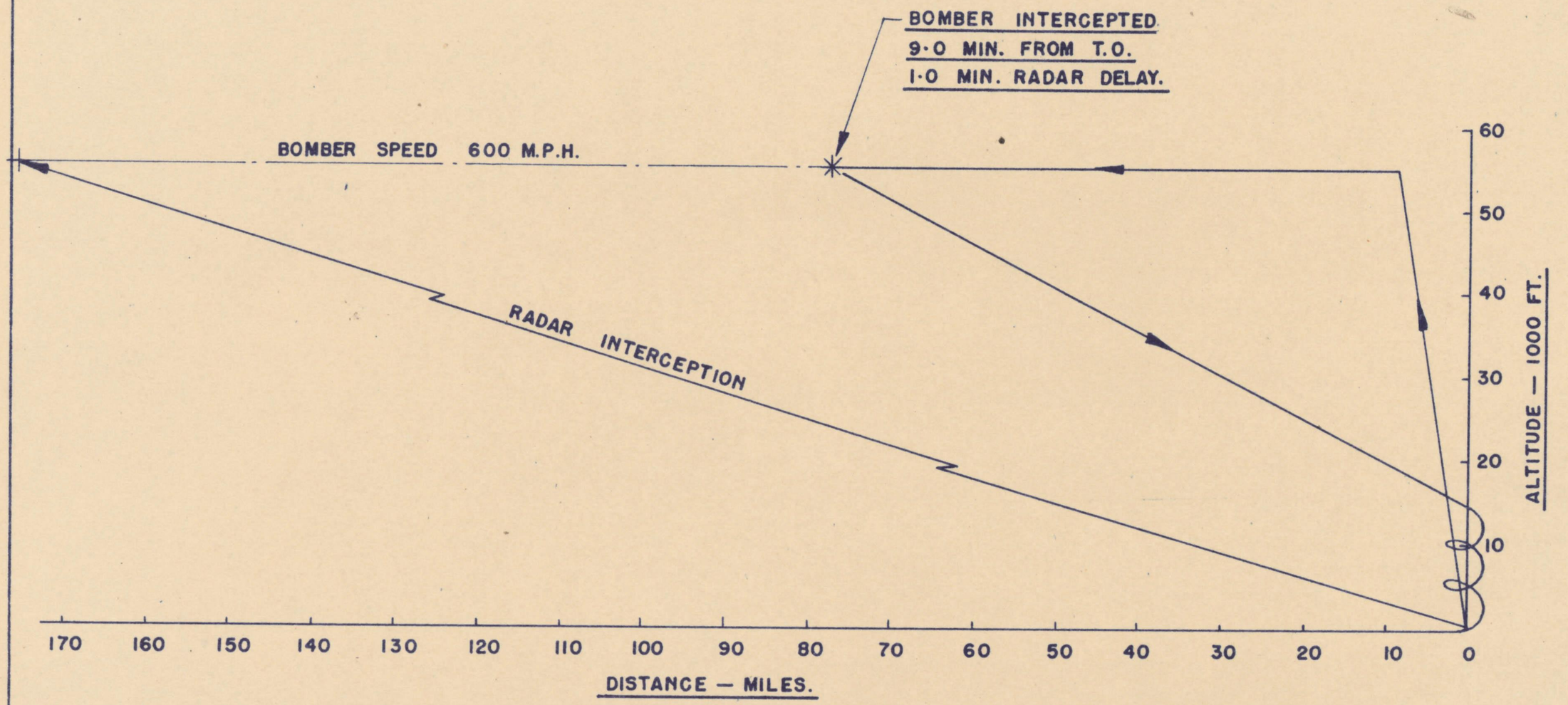
SHEET No.....

National Archives of Australia

NAA: A1196, 1/501/667

M 304.

FIG. 4.



INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

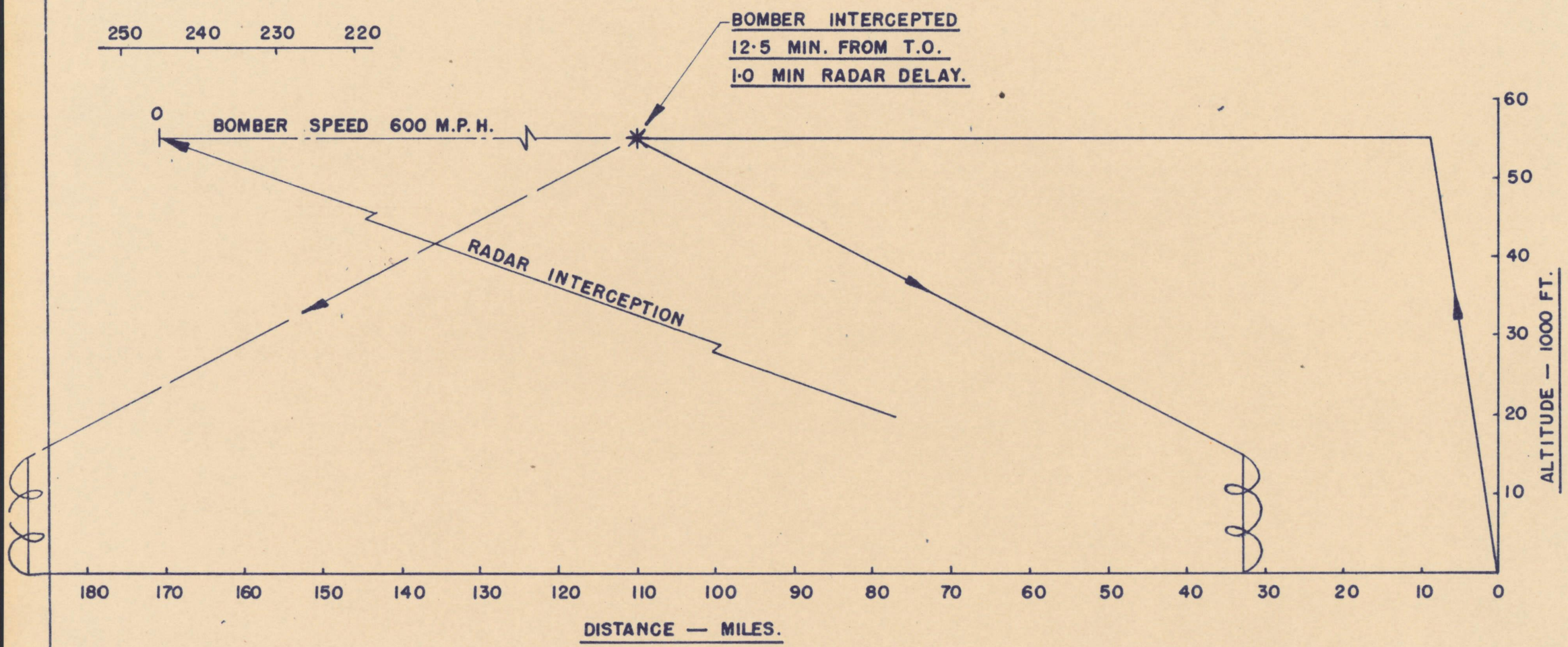
SECTION.....

SHEET No.....

National Archives of Australia NAA: A1196, 1/501/667

M 304

FIG. 5.



INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

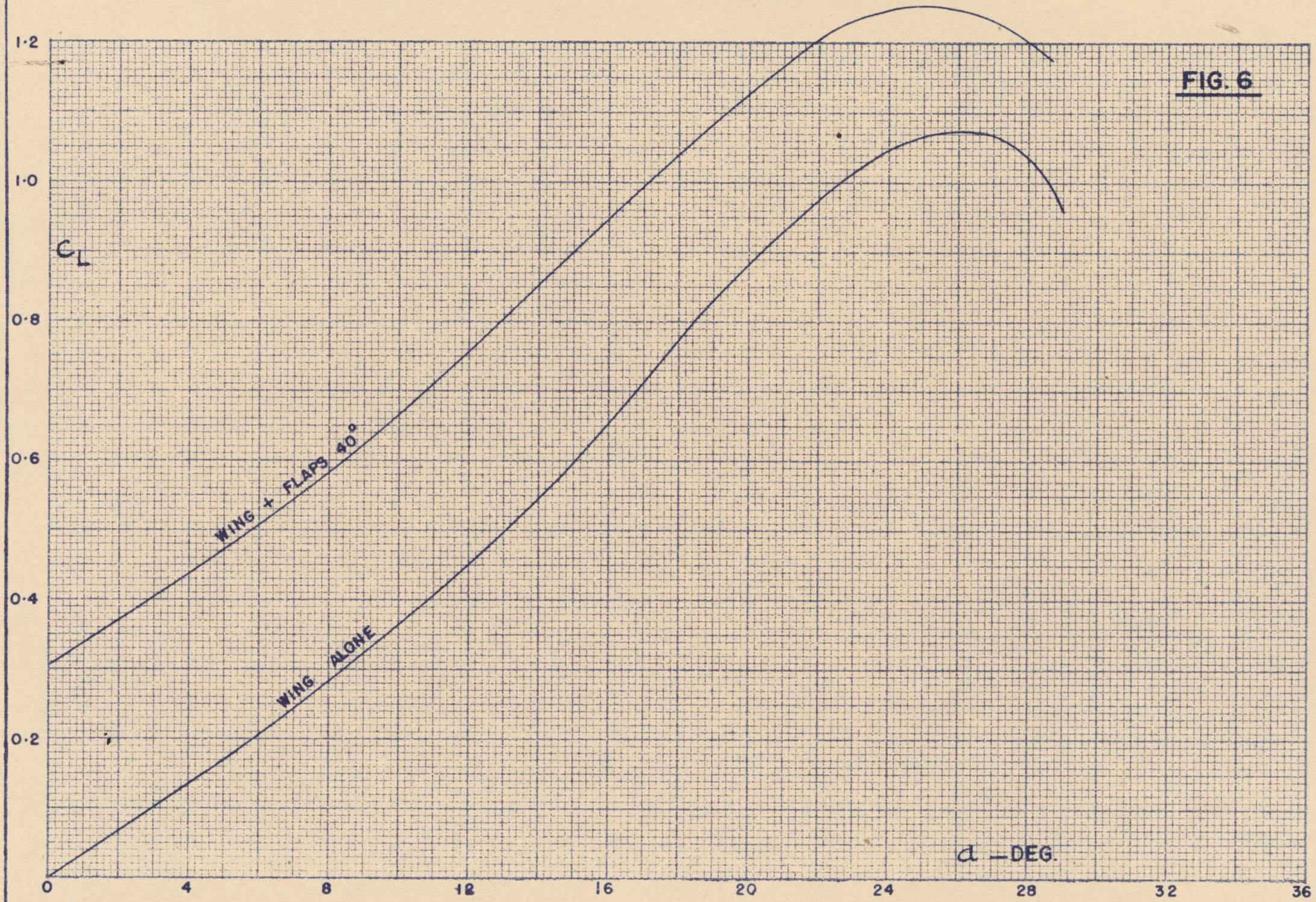
SECTION.....

SHEET No.....

National Archives of Australia NAA: A1196, 1/501/667

M 325

FIG. 6



PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

DATE:

A-132-2

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

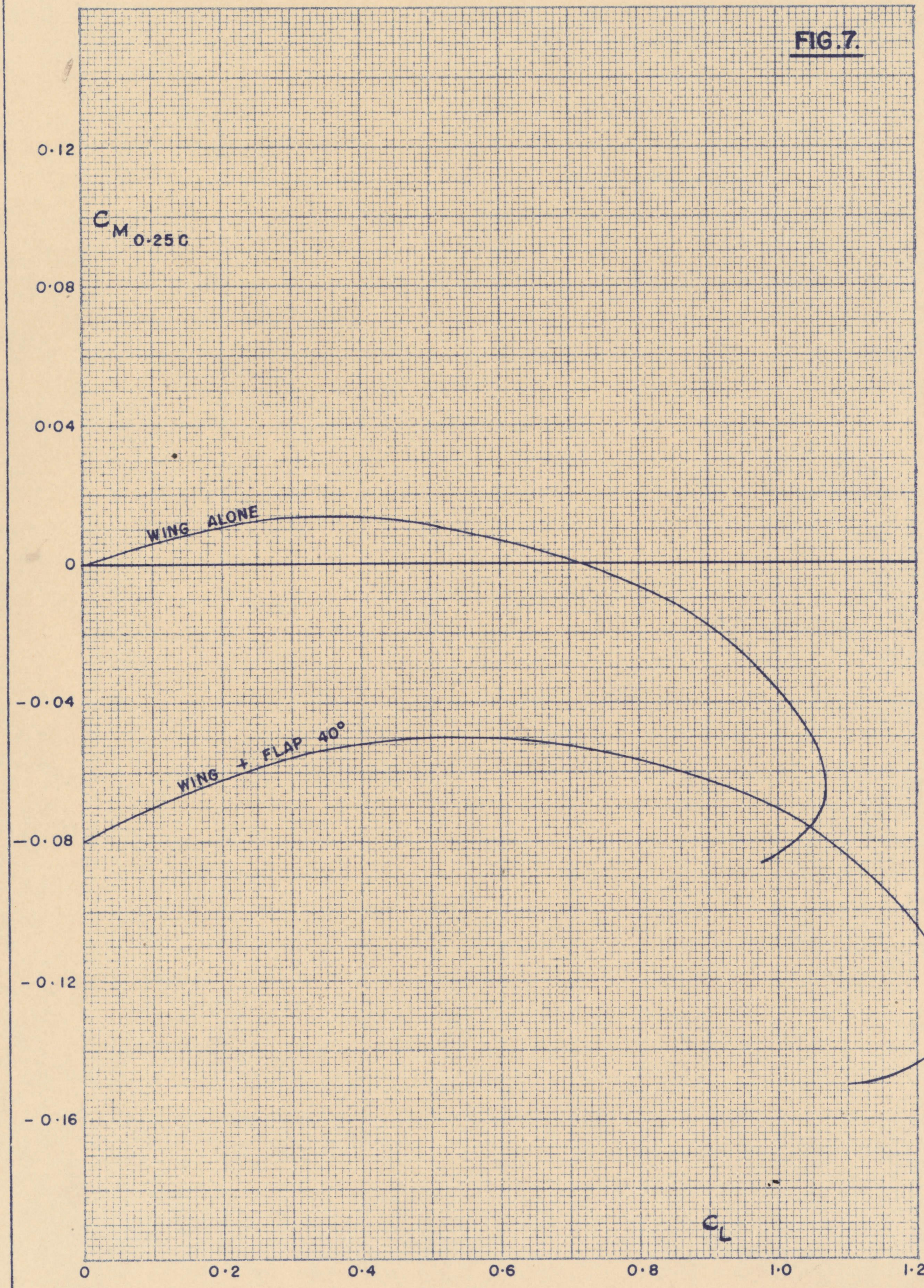
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG.7.



National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

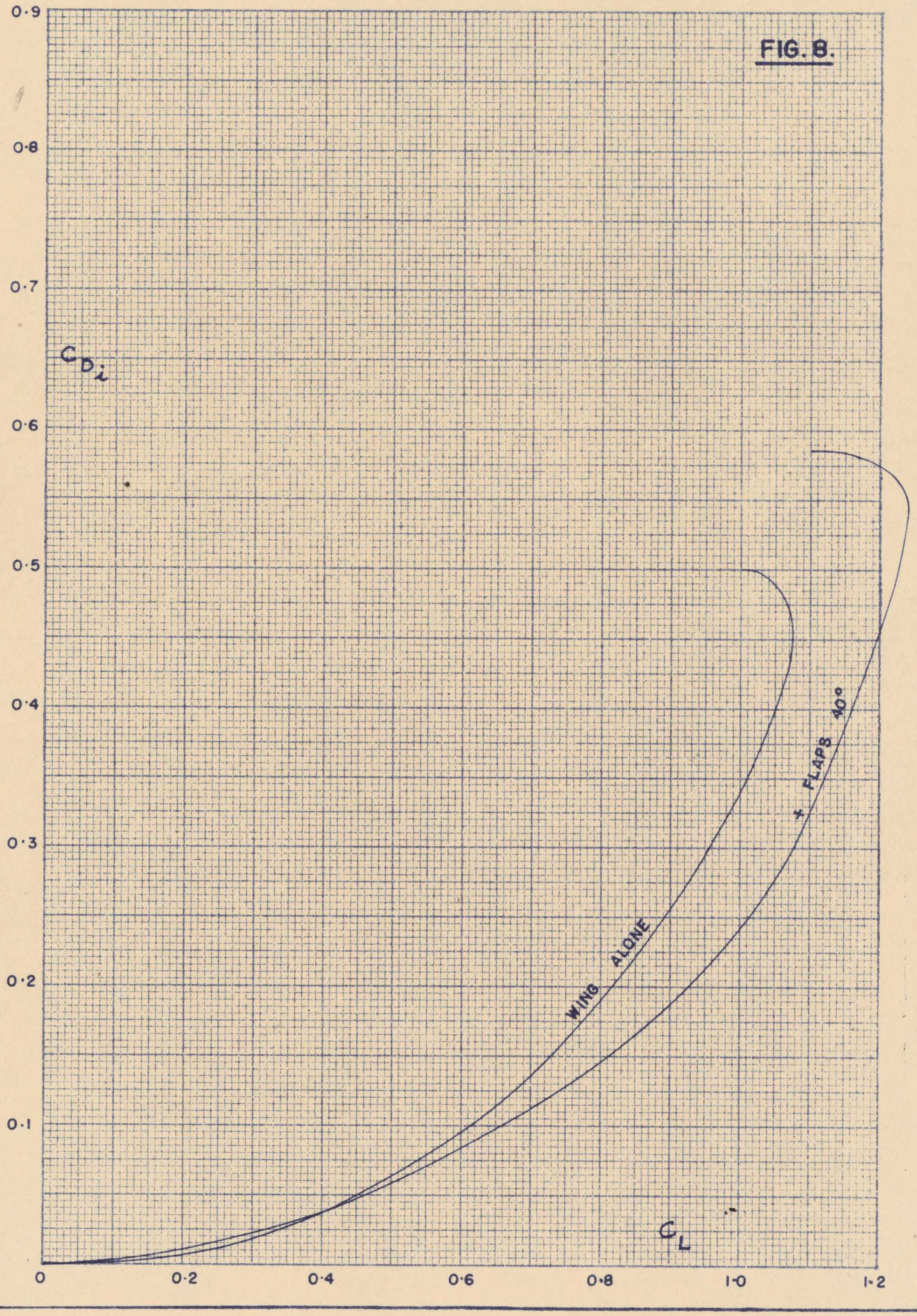
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG. 8.



M 325

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

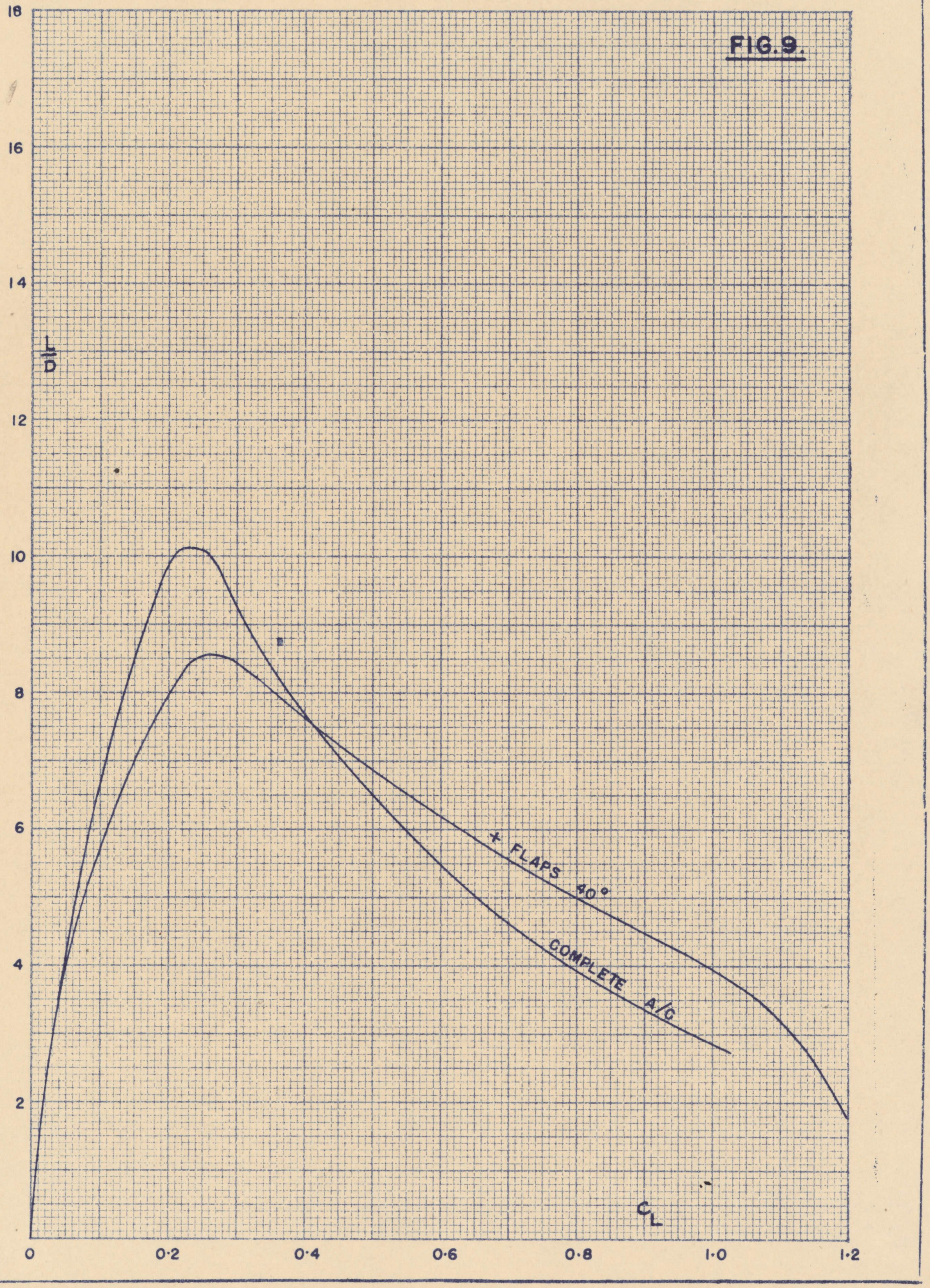
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG.9.



M 325

National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

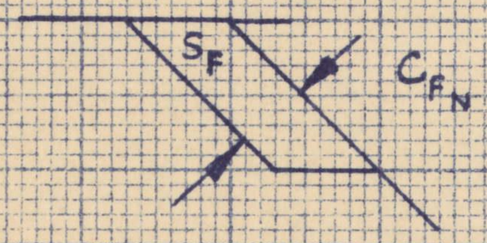
A-132-2

DATE:

FIG. 10.

FLAP HINGE MT.

$$C_H = \frac{H}{q S_F C_{F_N}}$$



FLAP ANGLE 40°

C_H

0·4
0·2
0
−0·2
−0·4
−0·6
−0·8
−1·0

0
0·2
0·4
0·6
0·8
1·0
1·2

C_L

M 325

National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

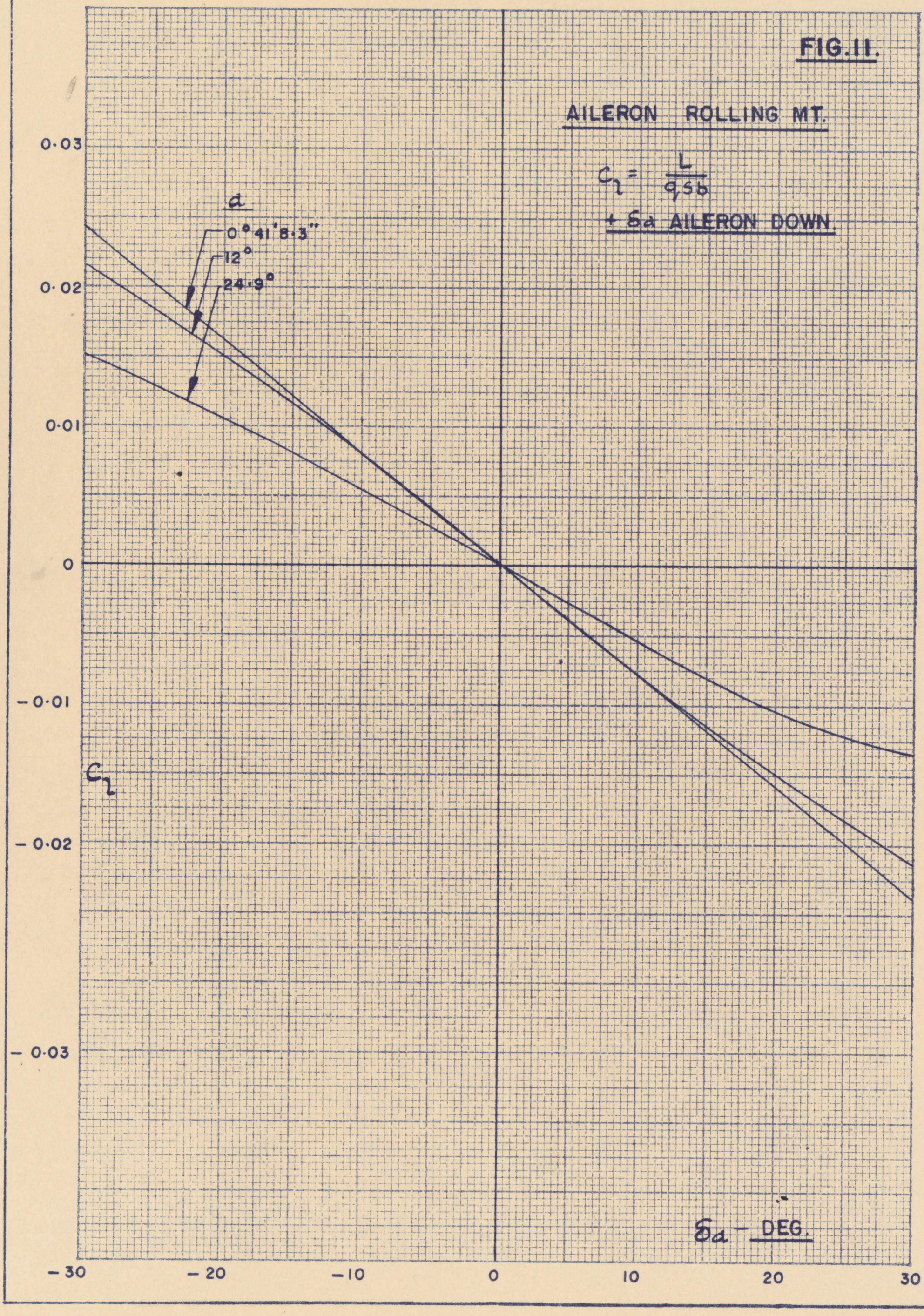
DATE:

FIG.11.

AILERON ROLLING MT.

$C_l = \frac{L}{qSb}$

+ δa AILERON DOWN.



M 329

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

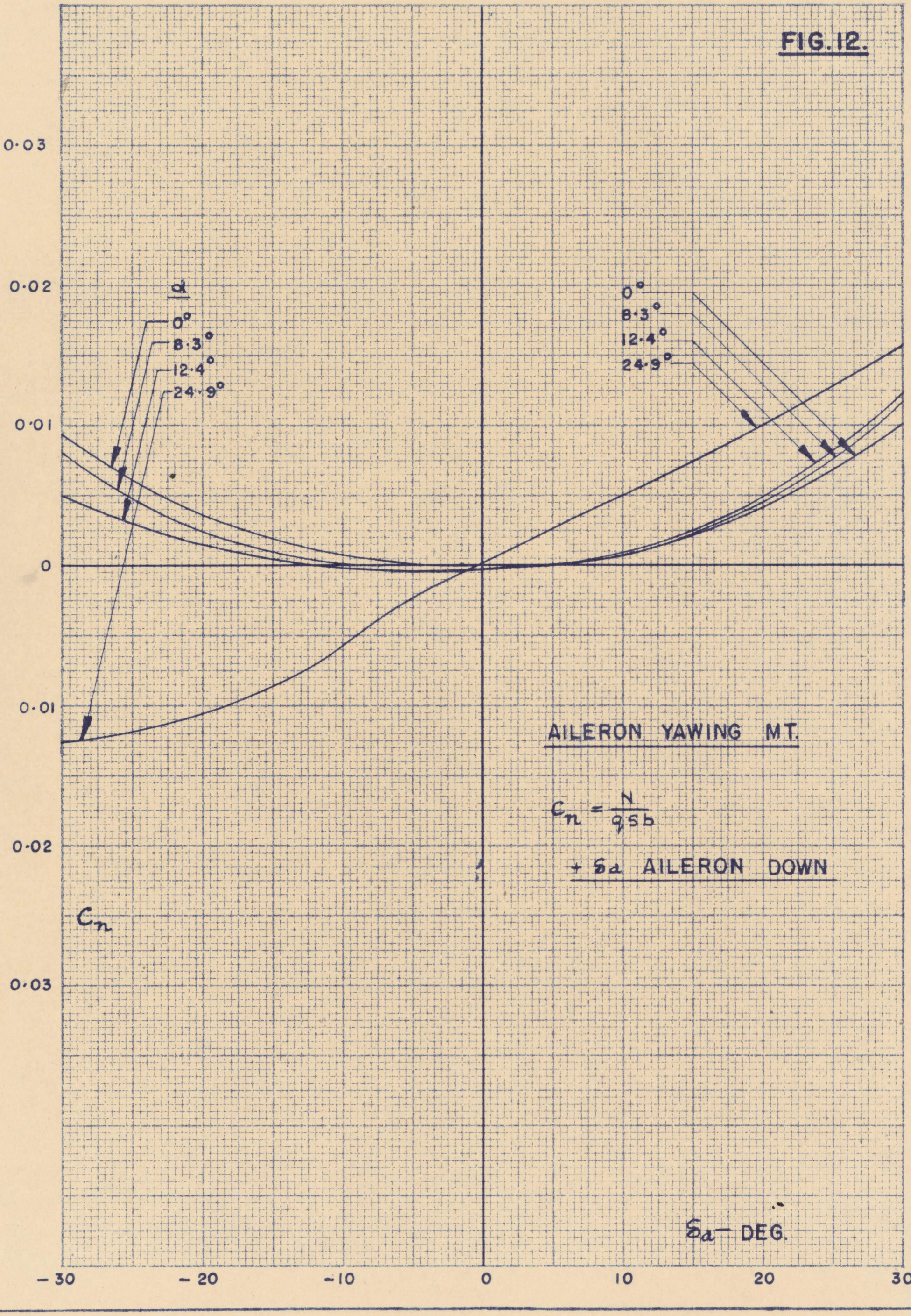
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG. 12.



M 325
National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

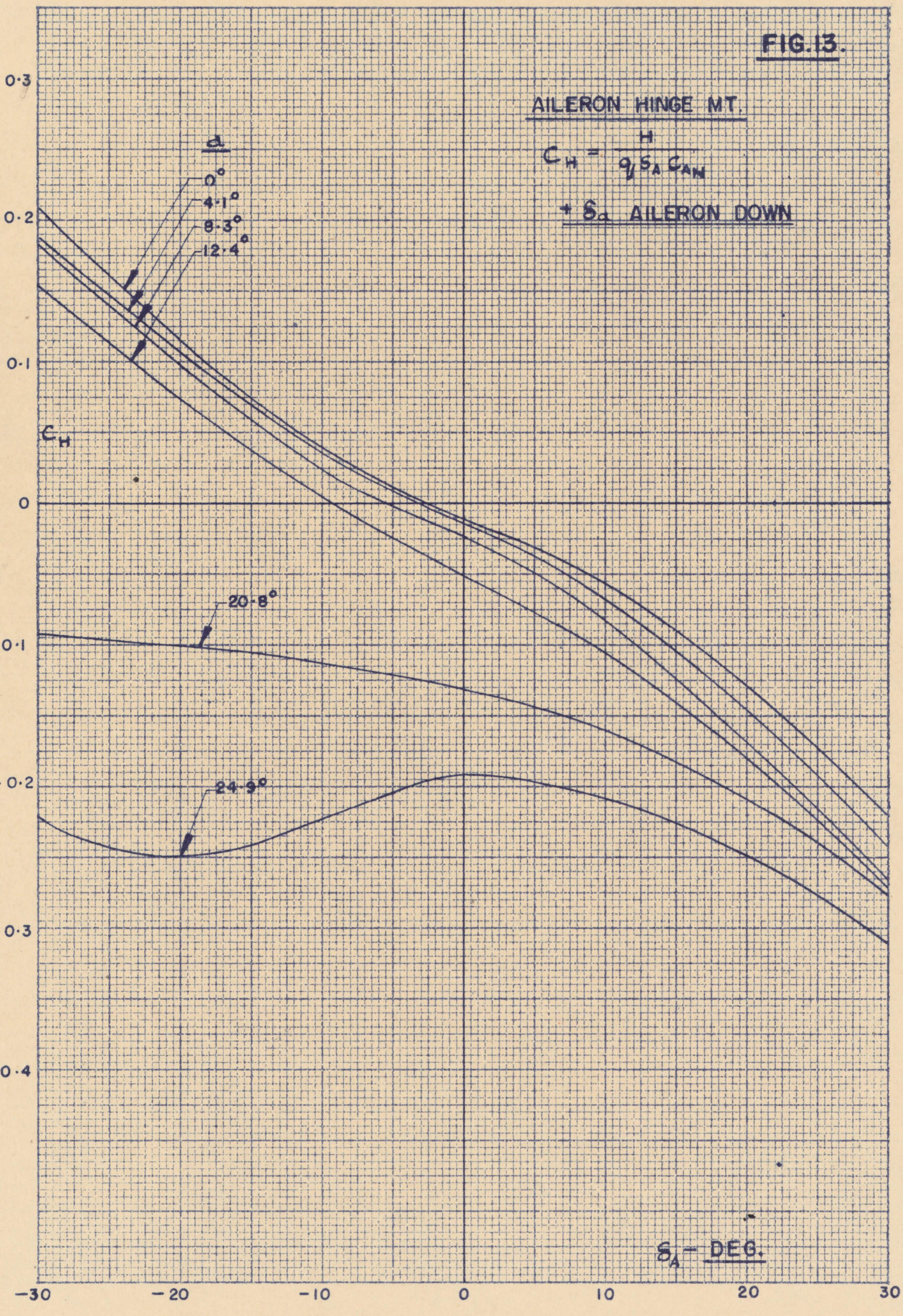
DATE:

FIG.13.

AILERON HINGE MT.

$$C_H = \frac{H}{q S_A C_{AH}}$$

+ δ_a AILERON DOWN



National Archives of Australia M 323 NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

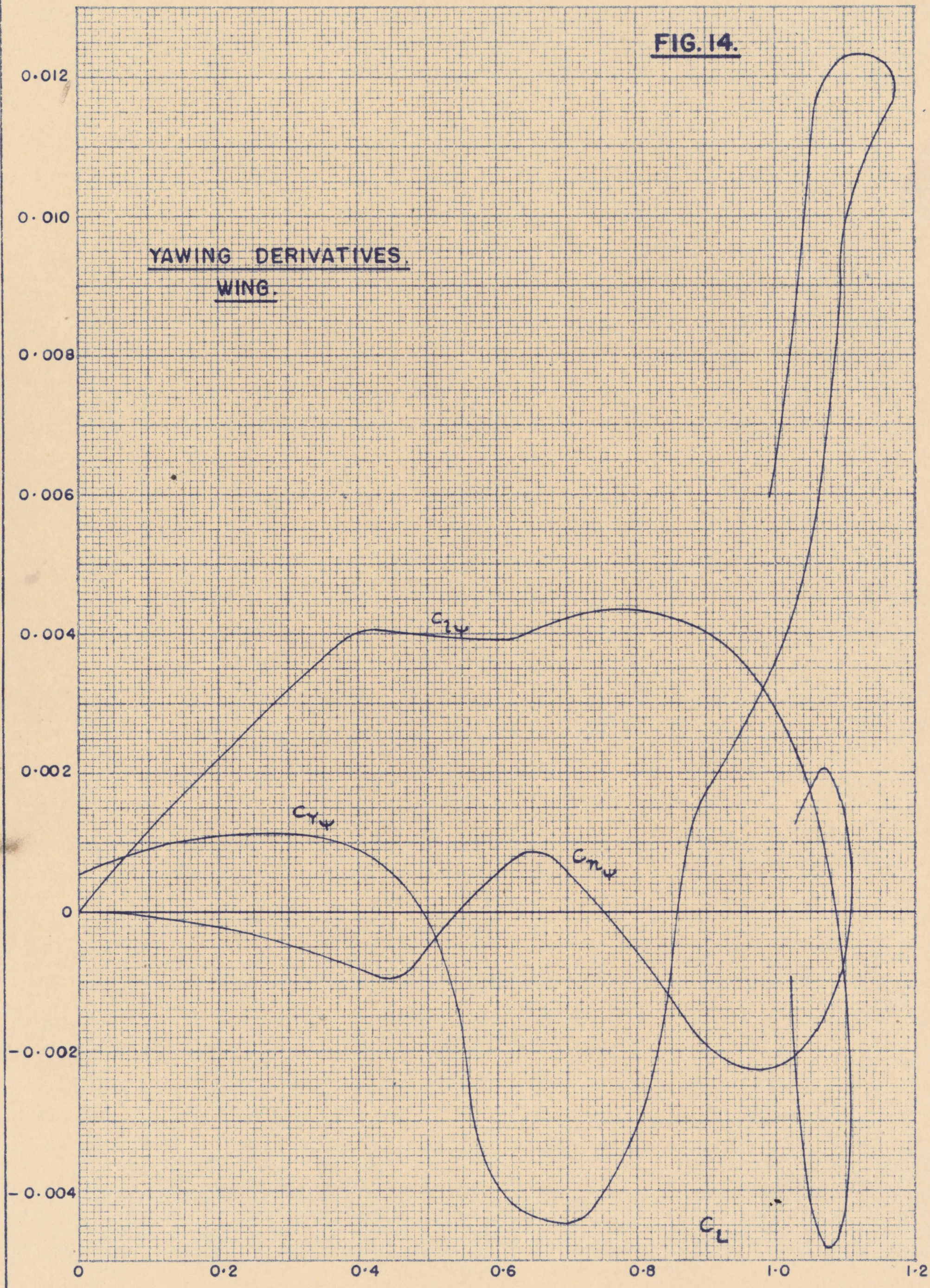
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG. 14.

YAWING DERIVATIVES.
WING.



M 325
National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

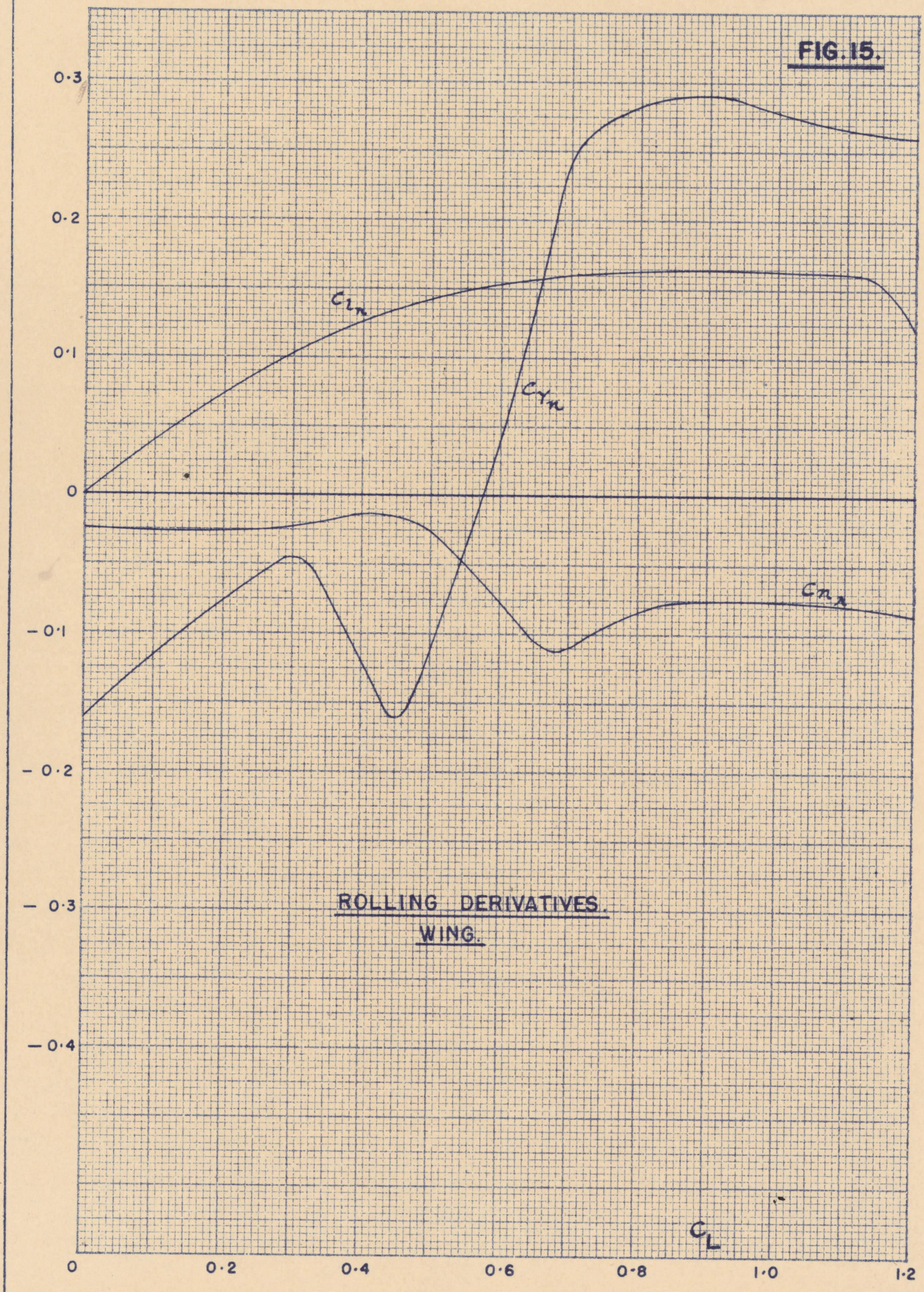
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG. 15.



M 325

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

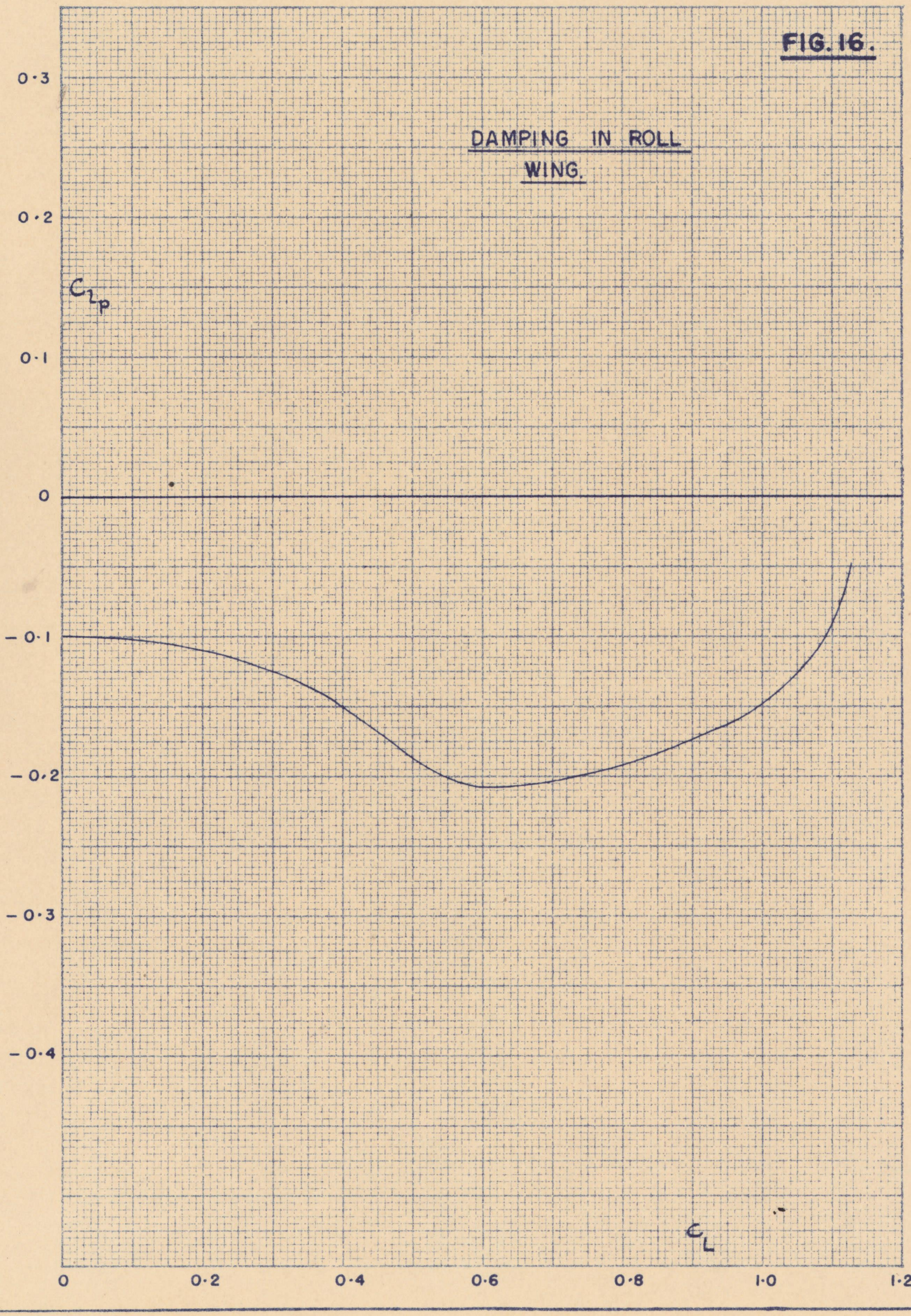
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

FIG. 16.



M 325

National Archives of Australia
NAA: A1196, 1/501/667

BY SAFE HAND

R.D. Austin Wg Cdr

2464.

SECRETARY DEPARTMENT OF AIR
VICTORIA BARRACKS
ST. KILDA ROAD
MELBOURNE
AUSTRALIA

DOSD

FROM:
OFFICE OF THE AIR ATTACHE
AUSTRALIAN EMBASSY
WASHINGTON, D. C.
U. S. A.

National Archives of Australia NAA: A1196, 1/501/667

ON HIS MAJESTY'S SERVICE

COMMONWEALTH OF AUSTRALIA

If not delivered within 7 days, return to
DEPARTMENT OF AIR,

.....

.....

National Archives of Australia

NAA: A1196, 1/501/667

REPORT No. A-132
ISSUE. 2.

SECRET.

1-66

COPY No. 2

ROCKET INTERCEPTOR.

COMMONWEALTH AIRCRAFT CORPORATION
PROPRIETARY LIMITED

M 442

National Archives of Australia NAA: A1196, 1/501/667

SECRET.

ROCKET INTERCEPTOR.

PREPARED BY

ENGINEERING DEPARTMENT.

COMMONWEALTH AIRCRAFT CORPORATION.

PROPRIETARY LIMITED.

APRIL 1952

A-132
ISSUE.2.

National Archives of Australia NAA: A1196, 1/501/667

ROCKET INTERCEPTOR.

The first issue of this report, in November 1951, covered a preliminary investigation of the performance and size of a manned rocket interceptor.

Since that time, it has been found possible to reduce the dimensions to an even more favourable size, at the same time maintaining the requisite performance for an interceptor fighter.

With this reduction, a single Reaction Motors unit of a tested type is used.

This engine uses liquid oxygen and alcohol-water and a combined tankage of 375 gallons is provided.

At the lower thrust to weight ratio an increase in the time to height has taken place but with some addition to the duration of the cruise.

Interception may now be made at all stages from the climb to the maximum operational range of 90 miles. These missions are illustrated on figures 7 to 10.

The high performance has not, in any way, compromised the low speed characteristics. With a glide and landing wing loading of 13.5 lb/ft.^{2}, a touchdown speed not exceeding 75 knots is achieved.

National Archives of Australia NAA: A1196, 1/501/667

A large amount of American wind-tunnel data is available and from this, with the appropriate corrections, a number of the attached curves have been obtained. In addition, small scale flying models have been made and these have shown agreement with certain particulars in the curves, as well as indicating the stability of the aircraft.

Six 3 inch Oerlikon type, air to air, rockets, with proximity fuses, will give a high intensity of firepower.

A simply constructed mock up of the cockpit area has shown that ample clearance is available for the fitting of a North American type ejection seat.

The small size of the various component parts combined with the use of constant chord lifting surfaces should make the aircraft particularly attractive from the constructional point of view.

Sufficient overseas data is available to assess the aerodynamic characteristics with reliability.

It is felt that sufficient work has been done to indicate the feasibility of such a project.

National Archives of Australia

NAA: A1196, 1/501/667

CONTENTS.

		Page
Introduction		1
General description		
	Structure	9
	Power	11
	Services	13
	General data	20
	Weight summary	25
Performance		31
Interception		34
Summary		64

Plate 1.	Flying model	5
2.	do.	6
3.	Cockpit mockup	17
Figure 1.	Three view	7
2.	Comparison with CA-22	8
3.	Fuselage detail	16
4.	Undercarriage stowage	18
5.	Instrument panel	19
6.	Installation of rockets	37
7.	Interception diagram	38
8.	do.	39
9.	do.	40
10.	do.	41

National Archives of Australia NAA: A1196, 1/501/667

Page

Aerodynamic data

Figure	11.	True air speed	43
	12.	Rate and time of climb	44
	13.	Glide speed	45
	14.	Time of glide	46
	15.	Lift v. incidence	47
	16.	Pitching moment	48
	17.	Induced drag	49
	18.	Wave drag	50
	19.	Lift/drag ratio subsonic	51
	20.	Lift/drag ratio supersonic	52
	21.	Flap hinge moment	53
	22.	Elevator effectiveness	54
	23.	Aileron rolling moment	55
	24.	Aileron yawing moment	56
	25.	Aileron hinge moment	57
	26.	Yawing derivatives	58
	27.	Rolling derivatives	59
	28.	Damping in roll	60
	29.	Effect of Mach No. on roll	61
	30.	Wing load distribution subsonic	62
	31.	Wing load distribution supersonic	63

National Archives of Australia

M 304

NAA: A1196, 1/501/667

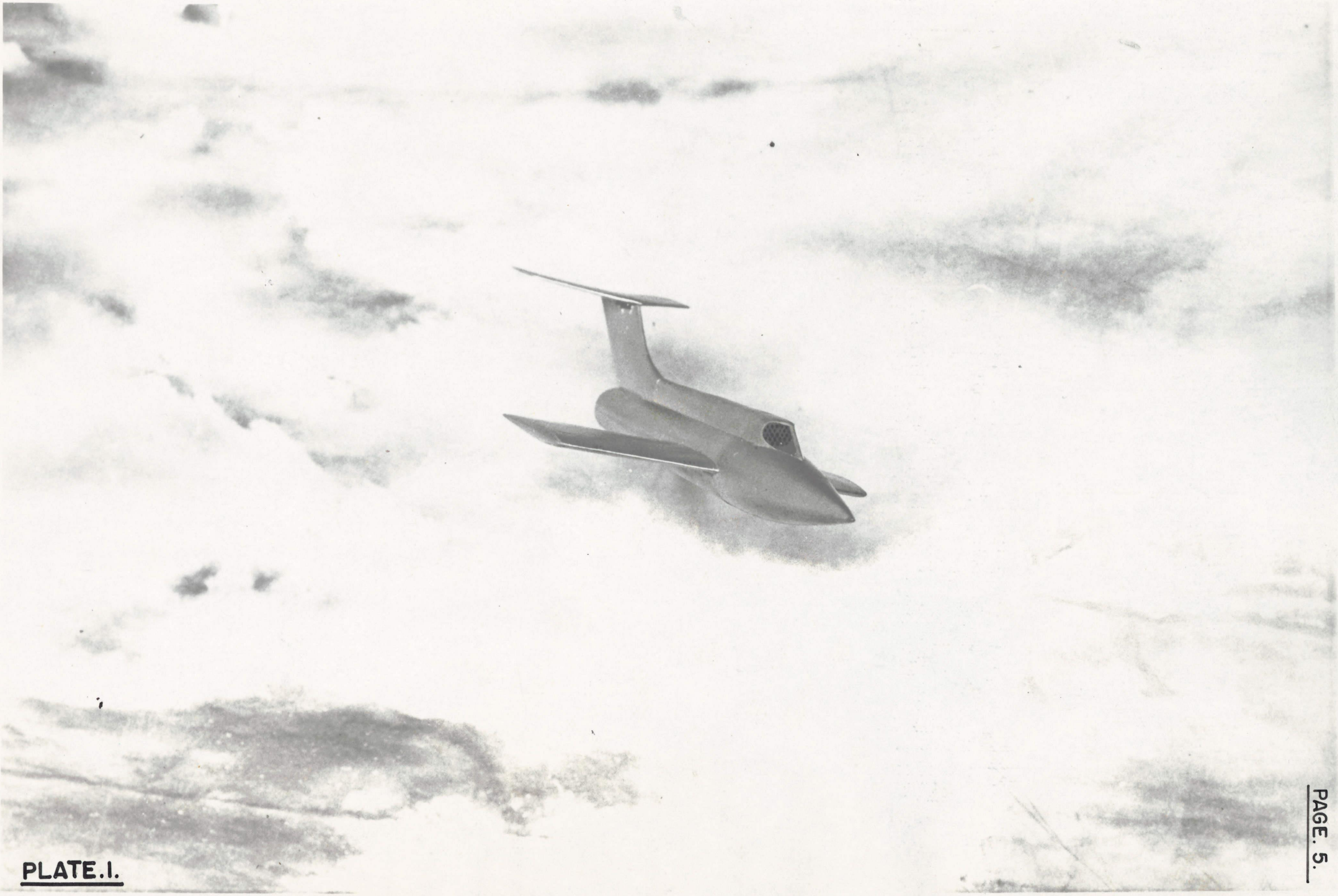


PLATE.I.

National Archives of Australia NAA: A1196, 1/501/667

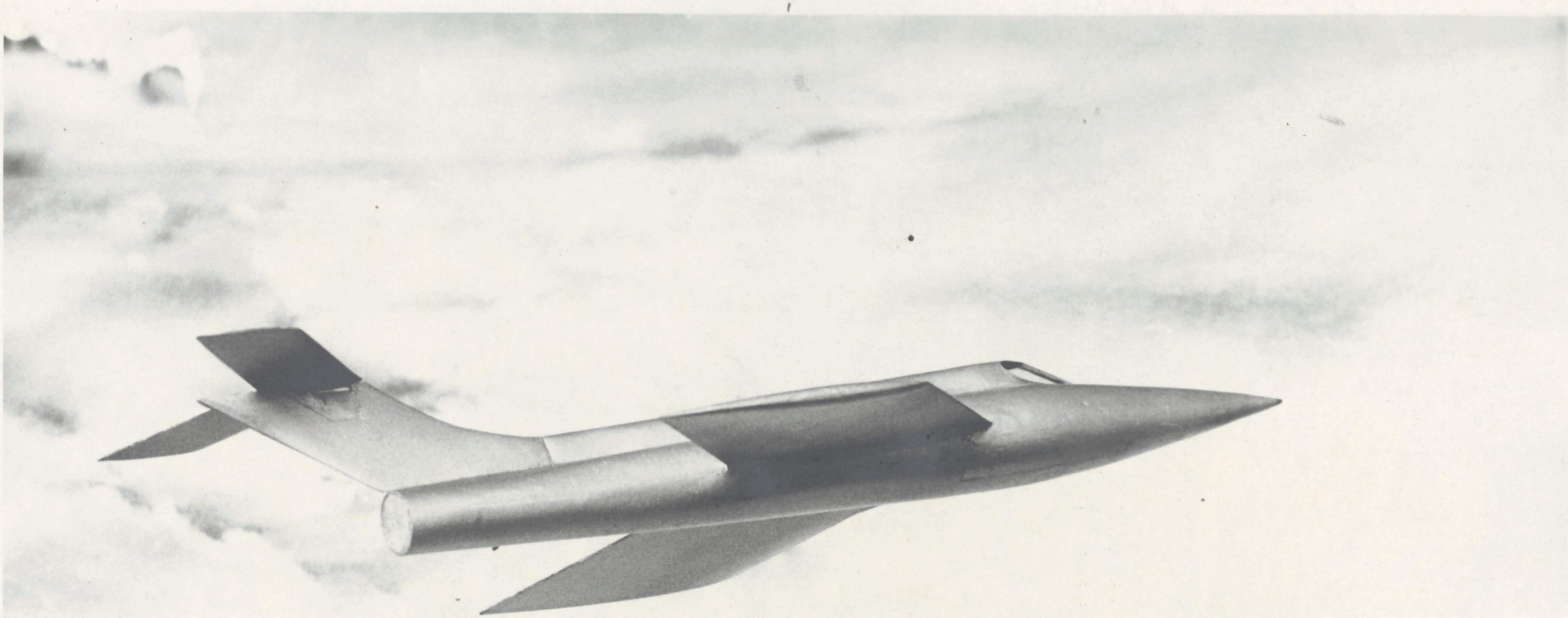
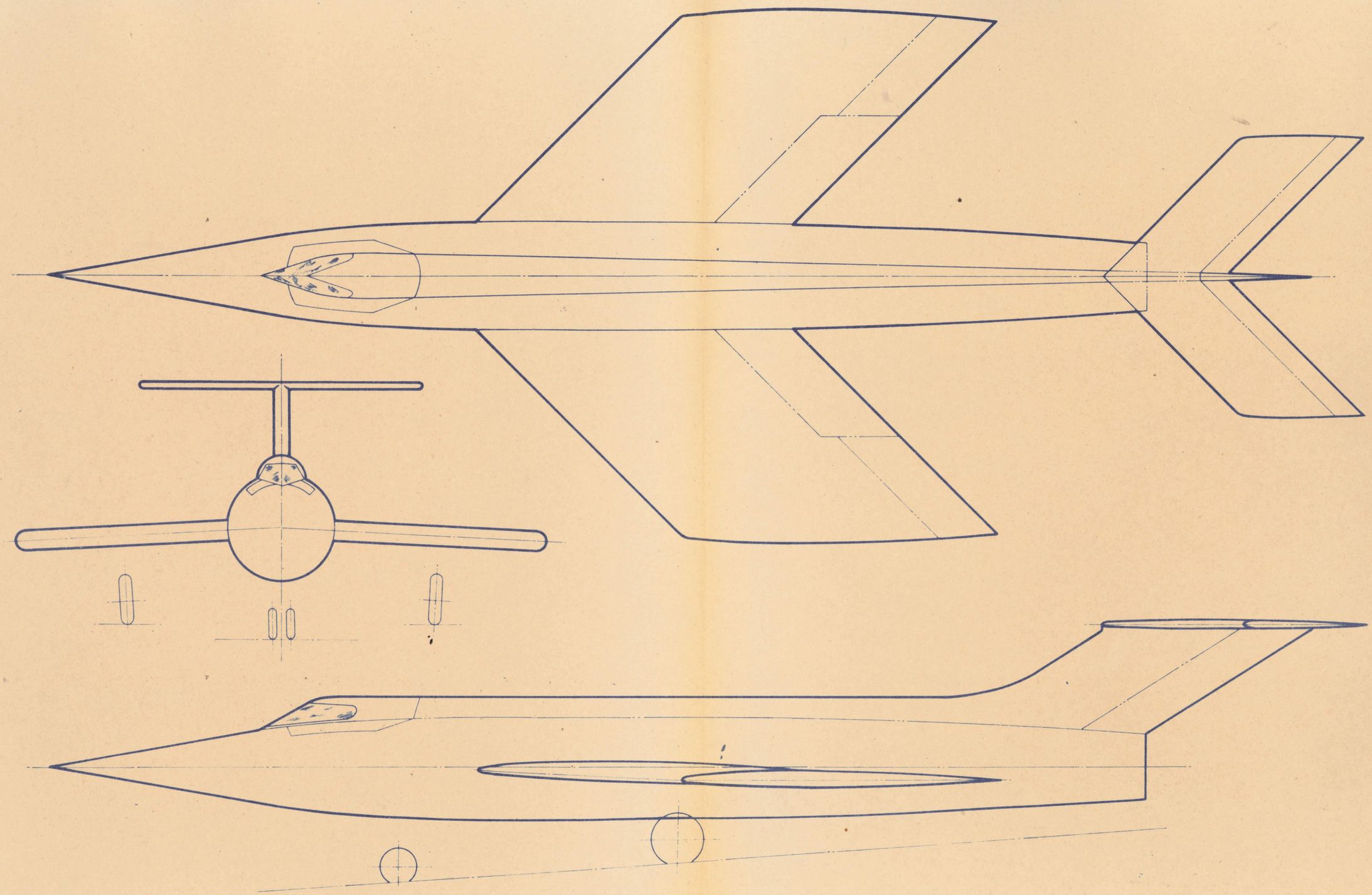


PLATE. 2.

National Archives of Australia NAA: A1196, 1/501/667

FIG. I.



FEET.

0 1 2 3 4 5 6 7 8 9 10

ROCKET INTERCEPTOR.

COMMONWEALTH AIRCRAFT CORPORATION.
PROPRIETARY LIMITED.

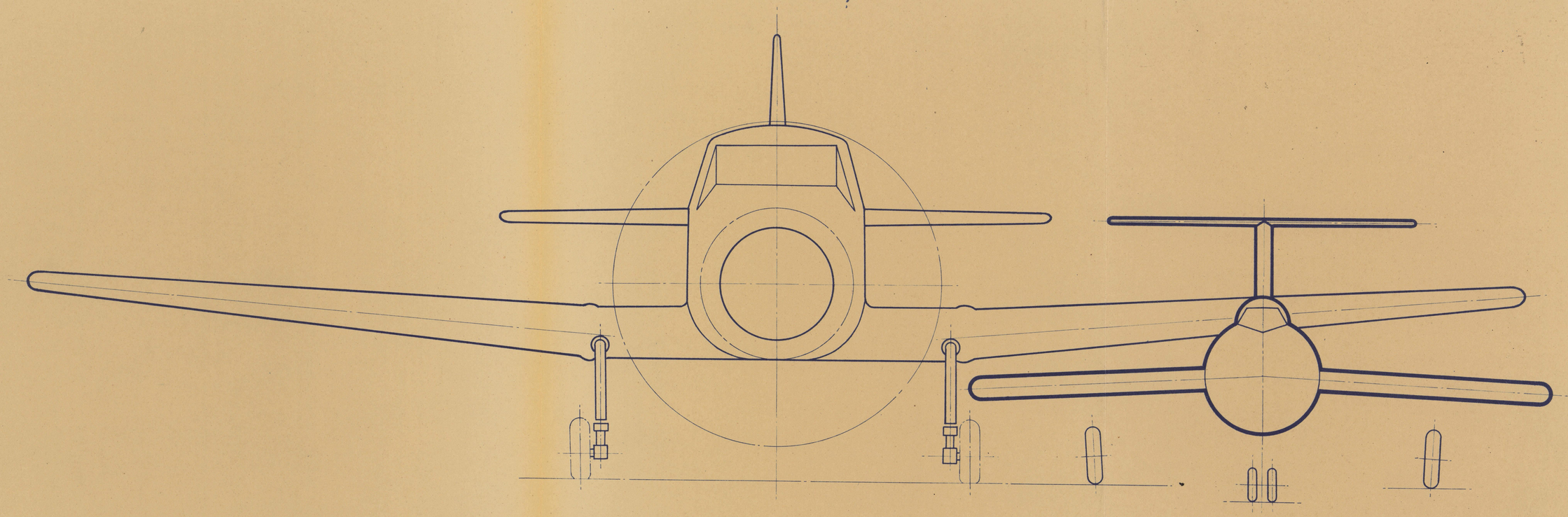
FIG. I.

National Archives of Australia NAA: A1196, 1/501/667

FIG. 1.

National Archives of Australia

NAA: A1196, 1/501/667



FRONT VIEW COMPARISON WITH CA22.

National Archives of Australia
NAA: A1196, 1/501/667

GENERAL DESCRIPTION.

(A) STRUCTURE

As may be seen from the illustrations, the main characteristics of the aircraft are the low aspect ratio swept mid-wing, the position of the tailplane at the extremity of the fin and the long well pointed nose.

Although the wing thickness is moderately low at 7%, the large chord permits complete stowage of the wheels in the wings, thereby leaving the mid fuselage almost uninterrupted for fuel stowage.

The radar and the cockpit at the front balances the engine, the pumping and the valves in the rear portion.

The form of structure will be conventional throughout, that is, monocoque and semi-monocoque.

Due to the small radius of curvature of the body, the maximum diameter being three feet, it has been found possible, with very little increase in weight, to use a pure monocoque form. This means that with the exception of certain local stiffening members, particularly around the cockpit area, no fore and aft stiffeners will be required. This will, of course, materially assist manufacture.

National Archives of Australia NAA: A1196, 1/501/667

The lifting surfaces will be of skin stringer spar type with the ribs, in general, normal to the leading edges. Small, closely spaced stringers provide the skin support necessary for a smooth exterior surface when under load.

Practically the whole structure will be made in light alloy to both 24 ST and 75 ST specification and with thicknesses ranging from 0.016 to 0.081 inch.

For the preliminary analysis, the stiffness criteria for swept surfaces issued by the R.A.E. have been followed. These have also been applied to the N.A.A. Sabre and found to give agreement so that it is felt that skin gauges of 0.032, 0.051 and 0.081 for the wing, tailplane and the fin will be satisfactory.

The maximum speed is limited by these stiffnesses to 600 m.p.h. E.A.S. and fig. 11 indicates the extent to which the corresponding true speed increases with altitude. It is seen that, for an aircraft designed specifically for operation at high levels, an ample margin is provided.

Since the duration above 30,000 ft. will not exceed 20 minutes, pressurisation will be maintained by the sealing of the cabin at take off. Pressure will be regulated in the normal way by an aneroid controlled valve associated with an emergency dump valve, maintaining 30,000 ft. conditions at all higher levels.

The permissible leakage rate will be not greater than 1 lb. per in.^{2} per hour at 3½ lb. per in.^{2} pressure differential.

The exhalation from the pilot's oxygen system will cover this loss under flight conditions.

A further margin of safety will be provided by the pressurised suit in which cabin pressure will be maintained by this oxygen supply.

Although the fuselage diameter at the cockpit is less than three feet, the mock up has shown that ample room is available. Leg clearance is facilitated by the small instrument panel.

An ejection seat of the type fitted to the N.A.A. Sabre is provided in which ejection will follow release of the canopy.

National Archives of Australia NAA: A1196, 1/501/667

This canopy, illustrated in both plate and fig. 3, will have two flat panels of $\frac{3}{8}$ inch toughened glass, intersecting in an invisible joint at the centreline.

There will, therefore, be no interference with the sighting.

The nosewheel type landing gear is fitted with either twin $3\frac{1}{2}$ - 4 wheels or a single $12\frac{1}{2}$, 4 - $5\frac{1}{2}$ wheel at the front and single 18, 4.25 - 10 wheels at the main points, the latter with single disc brakes, foot operated.

Tyre pressures will be 70 and 90 p.s.i. on the nose and main wheels respectively.

The fittings attaching the nose leg to the fuselage will be stiffened for both ground and air towing.

The position of the main undercarriage allows 10° of roll, tail and rear aileron down, with three inches of clearance.

All control surfaces will be manually operated through a combination of push rod and cable. The tailplane will, however, be actuated by a Rotax 4346 irreversible electric screwjack and will operate as an alternative to the elevators at high speed.

Plain flaps, electrically operated by two Miles EJ 275 actuators, will be used for both take off and landing.

As detailed in the weight summary, the structure weight is estimated at 820 lbs. This is based upon a load factor of 10 at a combat stressing weight of 2200 lbs. and represents 37% as a proportion of such.

B. POWER

To date, units have been placed in production utilising the following fuels,

a) Liquid oxygen - alcohol
b) Hydrogen peroxide - alcohol
c) Nitric acid - aniline

National Archives of Australia NAA: A1196, 1/501/667

Examples of all three are to be found in England and America today.

There are advantages and disadvantages in each, and the quest for new fuels is continuing. Those such as fluorine and hydrogen offer very considerable increases in specific thrust.

Both hydrogen peroxide and nitric acid are hazardous when not subject to close control. That this can be achieved, on the ground at any rate, has been demonstrated. Both have a degree of permanency which is lacking in liquid oxygen. Both have a higher specific gravity and when the insulation required for oxygen is also taken into account, offer a considerable saving in volume.

However, the high rate of evaporation of liquid oxygen renders it comparatively safe. It has the advantage that it can be easily made, on the spot, if required, and is, therefore, cheaper.

Storage in the aircraft, for any length of time, would be out of the question due both to loss through evaporation and to the reduction in temperature of the structure surrounding the tank.

This means that, for interception purposes, special provision for fuelling would need to be made. This may take the form of a mobile container, holding the amount of oxygen required and which would be itself heavily insulated. This container would, under pressure, transfer the 160 galls. into the aircraft upon the warning being received.

The decision to use a liquid oxygen-alcohol unit has been largely influenced by the existance of a well tried American unit in the right thrust category. This is the Reaction Motors XLR-11-RM-5 four combustion chamber engine as fitted to both the Skyrocket and the Bell XSI and which has seen service for a number of years. This unit also possesses the pumping gear which is essential for any extended range.

Whilst we have weights and dimensions of the combustion chambers and the valves, we have no information of this sort on the pumping gear. There is reason to suppose that it is operated on similar principles to that on both the V2 and the German Walter Unit, 109-509 K. For these we have complete weights and it is

National Archives of Australia NAA: A1196, 1/501/667

from these that we have deduced a weight for this gear on the Reaction Motors engine. The pumps are operated by the dissociation of hydrogen peroxide, in the presence of a catalyst, into steam.

The installation of the power unit in the fuselage can be observed in fig. 3.

A rubber bag tank holds the alcohol since there is no particular problem here.

The oxygen tank, of 0.036" thick aluminium is insulated by two layers of Refrasil type glass wool blanket of a total thickness of 2 inches around the circumference and 3 inches at each end. The loss from this insulation will be 1 lb. per minute when the outside temperature is 80°F. This loss figure is similar to that on the V-2.

Both tanks are forward of the pumps in order to assist the nitrogen gas in purging the tanks, since the greater part of the fuel will be used in the vertical climb.

The gas will be carried in 3000 lb/in.^{2} bottles and reduced in pressure through standard aneroid valves.

The four chambers of the combustion unit can be used separately or combined and in this way a substantial variation of thrust is available at the maximum efficiency.

C. SERVICES

Electrical storage in the form of three 24 V, 5 AH lightweight silver-zinc batteries is provided.

The duties and consumptions of the various items are listed as follows:-

National Archives of Australia NAA: A1196, 1/501/667

TABLE I

Battery	Item	Consumption amps.	Continuous Time minutes	No. of cycles
1.	Radar	65(est.)	2.2	
2.	Tailplane	20	7	
	Flap	3 av.	1.25	5
	Nav. lights	2.1	45	
3.	Pitot heat	4.2	)	
	Cockpit lights	0.85	)	
	Instruments	0.15	)45	
	Radio	1.2	)	

The extreme length of flight will be 40 minutes. There is, therefore, a five minute margin on those items which may be in continuous use.

The tailplane trim is actuated for the take off as well as during flight at speeds above M = 1.0. The time of 7 minutes quoted refers to absolutely continuous use. In practice, of course, this would not occur and the effective time would be more like 15 minutes. There will, therefore, be a considerable margin of safety.

The three batteries, weighing a total of 22 lbs, will be changed each flight.

By placing each battery close to its equipment it is hoped to save materially on the wiring weight.

An air system operating from 2,60 $in.^3$ 3000 p.s.i. storage bottles is required for the landing gear, giving three complete cycles of operation.

Sufficient oxygen is carried to provide 100% oxygen for the whole flight with a reserve of 40%.

So far as is known, the pressure suit has a face vizor and the oxygen is fed into this without the necessary of a contact mask.

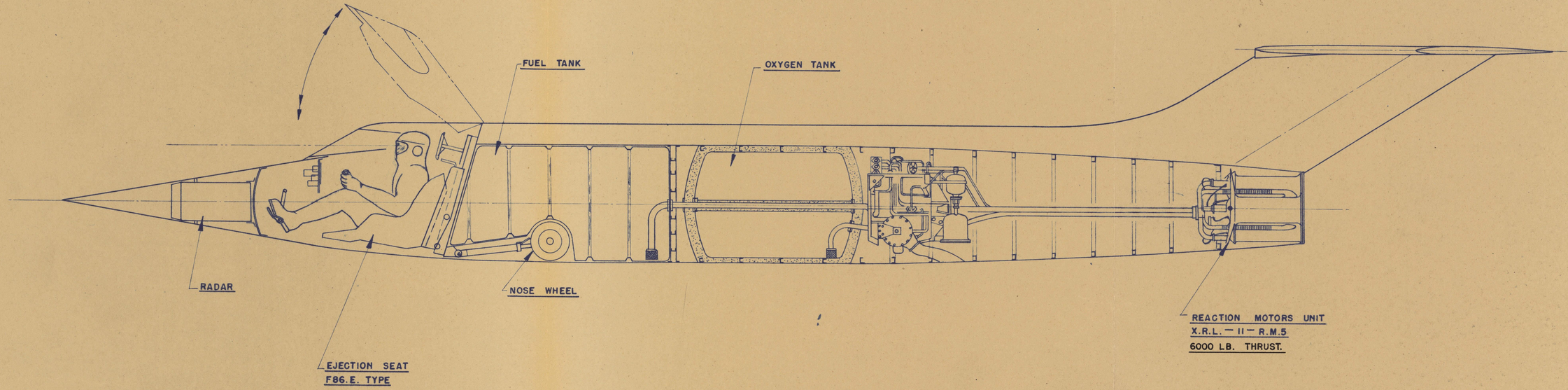
National Archives of Australia NAA: A1196, 1/501/667

The instrument grouping on the panel can be seen in fig. 5. In addition, an E2A and a P8 compass will be carried.

The turn and bank will be an electrically operated D.C. instrument, type C323.

National Archives of Australia

NAA: A1196, 1/501/667



0 1 2 3 4 5 6 7 8 9 10

SCALE :— $\frac{1}{2}$" = 1 FT.

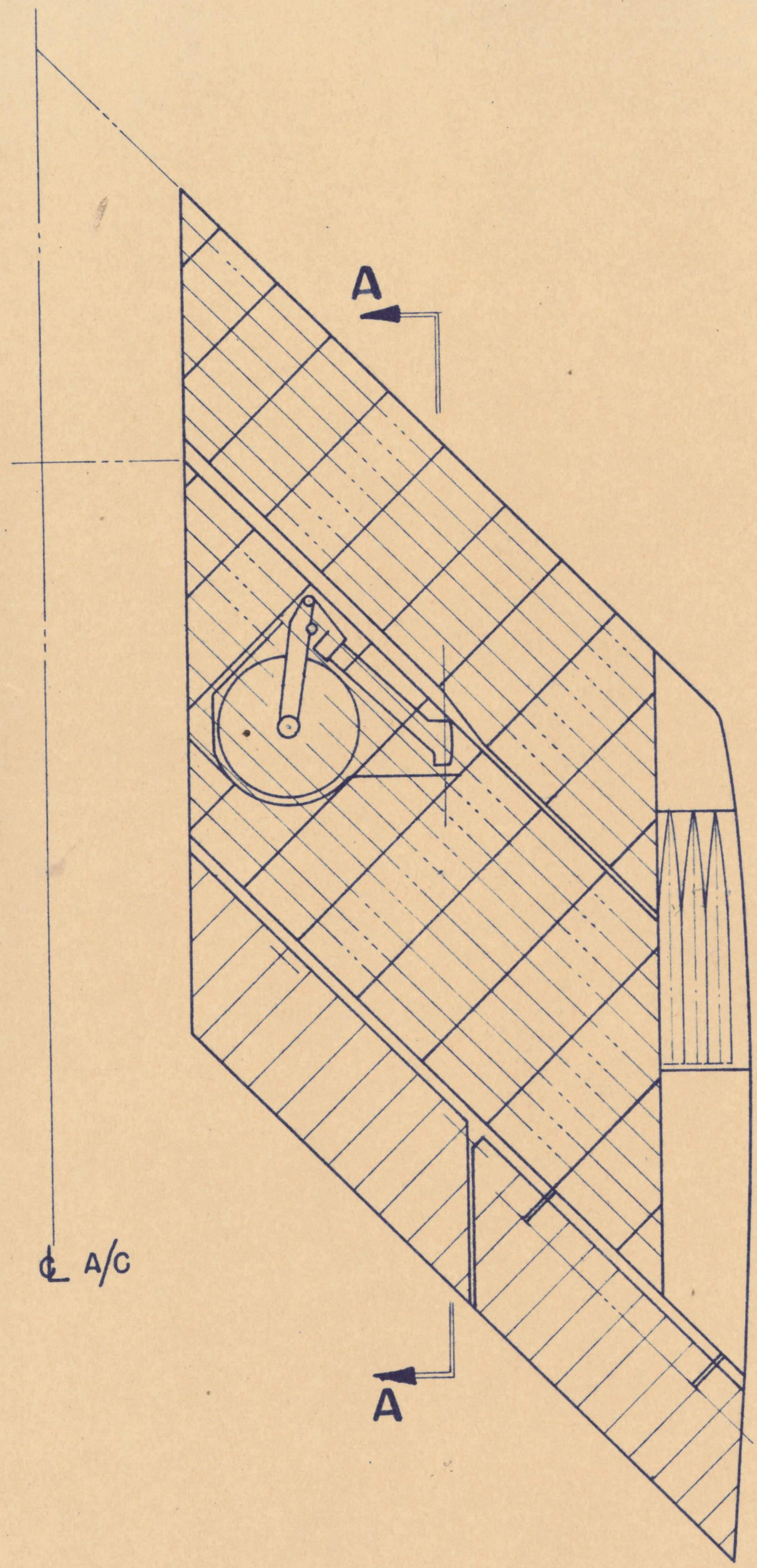
FUSELAGE LAYOUT.

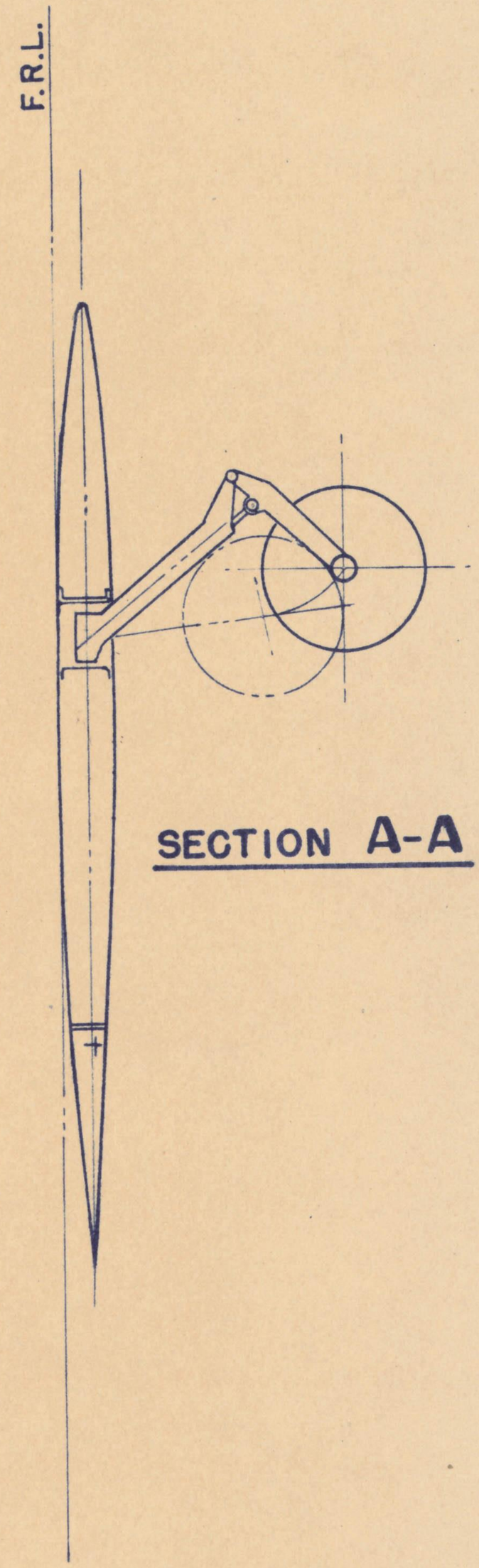
National Archives of Australia
NAA: A1196, 1/501/667

PLATE. 3.

National Archives of Australia NAA: A1196, 1/501/667

FIG. 4.





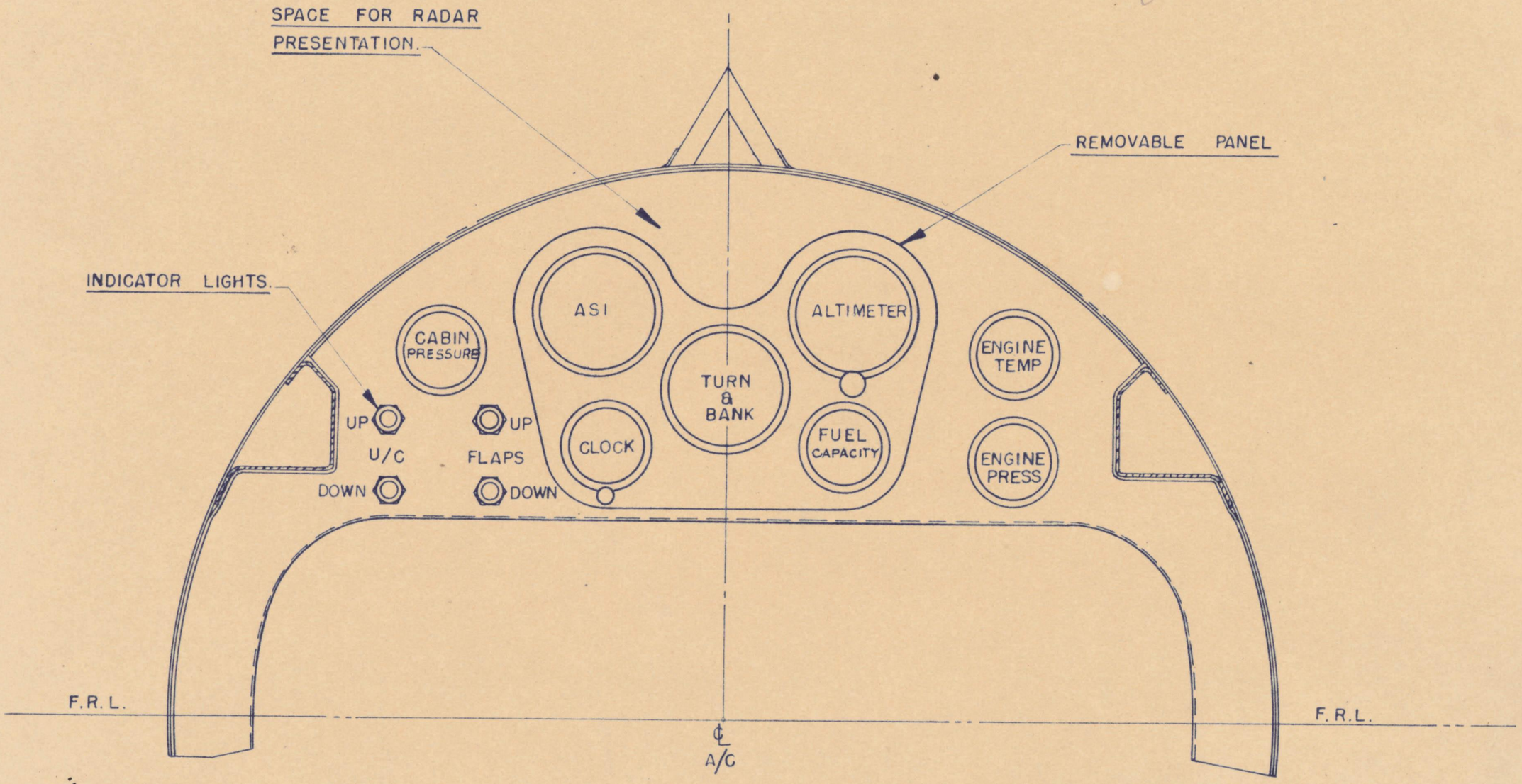
SECTION A-A

UNDERCARRIAGE STOWAGE.

National Archives of Australia NAA: A1196, 1/501/667

FIG. 5.

VFR only?



INSTRUMENT PANEL.

4-132-2 Sheet No. 19

National Archives of Australia NAA: A1196, 1/501/667

GENERAL DATA

WING DATA

Area - Gross	135.0	ft.^{2}
Nett	108.0	ft.^{2}
Span	15.0	ft.
Chord	9.0	ft.
Aspect Ratio	1.67	
Airfoil Section	N.A.C.A. 64A007	
Taper Ratio	1.0	
Sweepback	45.0°	

FLAP DATA

Type	Plain	
Area (Total	13.5	ft.
Span (Per Flap)	3.0	ft.
Chord (normal to hinge)	1.59	ft.
Angular Movement	0° Up 40° Down	

National Archives of Australia

NAA: A1196, 1/501/667

AILERON DATA

Type	Plain	
Area (Aft Hinge - Total)	10.5	$ft.^2$
Span (Per Ail.)	3.0	ft.
Chord (normal to hinge)	1.24	ft.
Angular Movement	20° Up 20° Down	
Differential	0°	

FUSELAGE DATA

Length	31.0	ft.
Max. Dia.	3.0	ft.
Max. Frontal Area	7.70	$ft.^2$

National Archives of Australia

NAA: A1196, 1/501/667

HORIZONTAL TAILPLANE DATA

Area	28.0	ft.^{2}
Span	8.0	ft.
Chord	3.5	ft.
Aspect Ratio	2.28	
Air Foil Section	N.A.C.A. 64A007	
Taper Ratio	1.0	
Sweepback	45.0°	
Angular Movement	0° Up 10° Down	

ELEVATOR DATA

Area (Aft Hinge)	7.0	ft.^{2}
Span	8.0	ft.
Chord (normal to hinge)	0.62	ft.
Angular Movement	30° Up 20° Down	

National Archives of Australia NAA: A1196, 1/501/667

VERTICAL TAILPLANE DATA

Area (Nett)	18.0	ft.^{2}
Height from F.R.L.	4.0	ft.
Chord	6.0	ft.
Taper Ratio	1.0	
Airfoil Section	N.A.C.A. 64A008	

RUDDER DATA

Area	6.0	ft.^{2}
Span	3.0	ft.
Chord (normal to hinge)	1.42	ft.
Angular Movement	30° Left 30° Right	

National Archives of Australia NAA: A1196, 1/501/667

UNDERCARRIAGE DATA

Track	8 ft. 6 ins.
Wheelbase	8 ft. 0 ins.
Kinetic energy landing	460,000 ft. lbs.

National Archives of Australia

NAA: A1196, 1/501/667

WEIGHT SUMMARY

1. **STRUCTURE**		
1. Wing		270
a) Skin (0.036")	105	
b) Ribs	38	
c) Webs, doors	18	
d) Spars	29	
e) Stringers	22	
f) Fittings	22	
g) Ailerons & Balance	16	
h) Flaps	20	
2. Tailplane		70
a) Skin (0.051")	33	
b) Ribs	6	
c) Stringers	7	
d) Root Spar	4	
e) Fittings	8	
f) Elevators	12	
3. Fin		60
a) Skin (0.081")	24	
b) Ribs	4	
c) Stringers, Spars	9	
d) Fittings	7	
e) Rudder	16	
4. Fuselage		226
a) Canopy	27	
b) Dorsal	14	
c) Skin, Stiffeners	116	
d) Formers	49	
e) Fittings (Misc.)	10	
f) Insulation	10	

National Archives of Australia NAA: A1196, 1/501/667

5. Undercarriage		150
(i) Main		
a) Tyres, Tubes	16	
b) Wheels, Brakes	26	
c) Legs, Axles	47	
d) Jacks	4	
e) Brakes	8	
f) Up, Down Locks	4	
(ii) Nose		
a) Tyres, Tubes Wheels (2)	14	
b) Leg Axle	25	
c) Jacks	3	
d) Up, Down Locks	3	
6. Controls		64
a) Stick	5	
b) Pedals	7	
c) Aileron System	7	
d) Elevator System	8	
e) Rudder System	8	
f) Tailplane Screwjack	20	
g) Flaps		
i. Jacks (2)	5	
ii. Control	1	
h) Engine	3	
Total Structure		840

II. POWER

1. Liquid Oxygen - Alcohol Unit RM1 XLR-11-RM-5.		344
a) Combustion Units and Valves	210	
* b) Turbo pump	90	
* c) Steam generator and Starting Tank	38	
d) Turbine Speed Control Valve	6	

National Archives of Australia NAA: A1196, 1/501/667

2. Oxygen System		69.0
a) Oxygen Tank 0.036" Gauge	28.0	
b) Insulation Fibre-glass @ 0.63 lb/ft.^{2}	28.0	
c) Pressure Refuelling Connection and Dump Valve	8.0	
d) Pressure Relief Valve	3.0	
e) Vent Line 1" O.D. and Couplings	0.8	
f) Transfer Pipe 2" O.D. and Couplings	1.2	
3. Alcohol Water System		22.4
a) Bag Tank @ 0.16 lb/ft.^{2}	12.0	
b) Pressure Refuelling Connection and Pump Valve	5.0	
c) Pressure Relief Valve	2.1	
d) Vent Line 1" O.D. and Couplings	0.8	
e) Transfer Pipe 2" O.D. and Couplings	2.1	
f) Filter	0.4	
4. Nitrogen System		30.1
a) Bottles	20.0	
b) Charging Connection	0.2	
c) Reducing Valves (2)	5.2	
d) Non Return Valves (2)	1.0	
e) Tank Connections (3)	0.6	
f) Piping		
4 feet 1" O.D.	0.6	
3 feet $\frac{3}{8}$" O.D.	0.4	
g) Couplings	2.1	

National Archives of Australia

NAA: A1196, 1/501/667

5. Hydrogen Peroxide System 3.5

a) Tank 0.036	2.0
b) Filler	0.4
c) Drain	0.3
d) Piping 1" O.D. and Couplings	0.8

Total Power 469

III. SERVICES

1. Electrical 44

a) Batteries	21
b) Battery Supports	1.5
c) Wiring	7.5
d) Plugs	3
e) Switches	3
f) Circuit Breakers	8

2. Air System 12

a) Bottles 2 @ 60 cu. ins.	3.4
b) Piping	2.4
c) Valves	2.5
d) Air Filter	0.7
e) Pressure Reducing	1.3
f) Relief Valve	0.5
g) Charging Connection	0.2
h) Non Return Valves	1.0

3. Oxygen System 14

a) Bottles	12
b) Regulator, Piping	2

National Archives of Australia NAA: A1196, 1/501/667

4. Instruments		16
a) A.S.I.	0.7	
b) Altimeter	1.3	
c) T. & B.	2.0	
d) Clock	0.3	
e) E2A Compass	0.3	
f) Fuel Contents Indicator	0.7	
Transmitter	1.4	
g) Rocket Temp. Indicator	0.8	
h) Cabin Pressure	0.5	
i) Fuel Pressure	0.6	
j) U/C, Flap Indic.	0.4	
k) P8 Compass	2.6	
l) Lines, Fittings	4.4	
Total Services		86

IV. FIXED EQUIPMENT

1. Armament		11
a) 2 Racks for 3 Rockets each	8	
b) Firing, Fusing, etc.	3	
2. Radio		10
a) V.H.F. Microphone	2.0	
Wiring	0.5	
Aerial	1.0	
b) Radar	6.5	
Total Fixed Equipment		21

National Archives of Australia NAA: A1196, 1/501/667

V. FURNISHINGS		80
a) Ejection Seat	70	
b) Rear Vision	0.3	
c) Safety Belt	3.9	
d) Instrument Board	2.5	
e) Miscellaneous	3.3	
Total Furnishings		80
TARE WEIGHT		1496
VI. SERVICE LOAD		
a) Communications Set	8	
b) Radar & Sight	125	
c) Crew & Pressure Suit	200	
d) Armament 6 off 3 in. Oerlikon type rockets	132	
e) Oxygen	1560	
f) Water-alcohol	2040	
g) Hydrogen Peroxide	70	
h) Potassium Permanganate	6	
		4141
ALL UP WEIGHT		5637
LANDING WEIGHT		1829

No fuel No ammunition.

Wing loading 13.5 lb/ft.^{2}

* These weights have been proportioned on those achieved in the.- Walter H.W.K. 109-509C. Unit.

National Archives of Australia NAA: A1196, 1/501/667

PERFORMANCE.

In giving emphasis to a low aspect ratio in the interests of stability and control at high speed, some sacrifice in the low speed characteristics has had to be made. Although the gliding angle has been increased, at approach speeds, to a value of 1 in 4.5, by the higher induced drag, this is the same value as recorded on the CA-22 trainer. This latter is, of course, largely due to the drag of the windmilling airscrew.

This approach will be made, flaps down, at a speed of 100 knots with touchdown at 10° incidence at 75 knots, ground effect included. This speed corresponds to a C_L of 0.8. The actual stall will occur at a C_L of 1.25, and that at an angle of 24°.

At take off, both the flaps and the tailplane trim will be used. The aircraft will unstick at 110 knots after a run of 200 yards. Level flight will be held until the airspeed approaches 500 m.p.h. when the pull up to a vertical position will be made. This will take all lift off the surfaces, thereby removing the induced drag and an increasing acceleration will occur as the rocket thrust increases and the weight diminishes. This would in the limit reach a value of 1.6 g.

In levelling out, the tailplane will again be used until the speed falls below M = 1.0 at the beginning of the cruise.

All control surfaces will be of a plain unbalanced type and manually operated.

National Archives of Australia NAA: A1196, 1/501/667

The range of stick force per g at 600 p.m.h. will vary from 12 lb. at S.L. to 3 lb. at 55,000 ft.

The rate of roll at the approach speed will be 8°/sec. per pound of stick force and at 600 m.p.h. will vary from 2.7°/sec. at S.L. to 22°/sec. at 55,000 ft. per pound of force.

This favourable loading is due, in the main, to the low damping of the low aspect ratio wing.

A plot of the effect of Mach number on this rate of roll is given in fig. 29.

The tailplane actuating jack will give a rate of movement of 7° per second which will correspond to 3 g per second at 55,000 ft.

In level flight at the maximum speed, the low aspect ratio and the sweep will give gust accelerations of only 30% greater than those experienced in standard twin engined transports.

Due to the short time of flight at high speed, no allowance for temperature control of the cockpit will be made, other than a layer of glass wool insulation.

The speed for the best gliding angle, 1 in 10, will range from 460 m.p.h. at 55,000 ft. to 150 m.p.h. at S.L.

In order to verify the L/D ratios, the aerodynamic centre location, the downwash and the tail effectiveness, small flying models have been constructed. These have been flown from a catapult adjustable for various flight conditions.

In the light weight condition or carrying a small amount of fuel, the aircraft can be aerotowed. At 120 m.p.h., 130 H.P. will be required for this purpose. This should considerably simplify the flight testing and provide an economical means of transporting the aircraft.

A number of curves and figures which amplify the foregoing details will be found at the rear of this report.

———

National Archives of Australia

NAA: A1196, 1/501/667

PERFORMANCE

(I.C.A.N. CONDITIONS)

Take-Off Speed		110 Knots
Ground Run		200 Yards
Climb (Incl. T.O.)	10,000 ft.	35 sec.
	20,000 ft.	50 sec.
	30,000 ft.	62 sec.
	40,000 ft.	73 sec.
	50,000 ft.	82 sec.
	60,000 ft.	90 sec.
Max. Speed in Vertical Climb at 60,000 ft.		730 Knots
Landing Speed		75 Knots
Ground Run		250 Yards

National Archives of Australia

NAA: A1196, 1/501/667

INTERCEPTION.

Four simplified means of interception are presented in figures 7 to 10:

Three cases cover a collision course, and one, closure from the rear.

Varying degrees of deflection attack may, of course, be made.

In each case, full thrust is used to reach bomber altitude, this time, including take off, being a matter of 90 seconds.

During this time, a bomber capable of 600 m.p.h. would cover only fifteen miles.

With one minute allowed between radar indication of the bomber position and course and the time of take off, the location of both fighter and bomber at interception can be seen in fig. 7.

Interception in this way would represent a guided missile technique with the advantage that deflection of the missile by jamming could not occur.

Closure at the longer ranges is made at a reduced speed of 600 m.p.h. (M = 0.91).

This speed gives an endurance of eleven minutes at this altitude. Any increase in this speed would not only make judgment of distance difficult, but would make the turning radius prohibitive.

National Archives of Australia NAA: A1196, 1/501/667

A range of 70 miles permits a return glide to the take off base. The mean gliding speed will be 300 m.p.h. at 1 in 10.

The aircraft has 15,000 ft. in hand over the point of landing in each case.

Considering 245 miles as the practical limit of warning of an aircraft at 55,000 ft., and again providing one minute's delay, interception can be made at the maximum range of 100 miles. In this case, landing would be made at an alternative base.

In the fourth case, fig.10, the fighter turns towards the bomber when approximately two miles away. This means that with a 3g turn it will arrive in a pursuit position three miles behind, travelling at 500 m.p.h. In the turn, it will decelerate to this speed initially. However, by increasing thrust, it will be able to hold the turn at 3g at this speed until in line with the bomber. By applying full thrust, giving an acceleration of 2.5g, the speed will increase to 650 m.p.h. and, holding this speed, closure to within rocket range will be made in 24.5 miles or 2.5 minutes.

It is important to note that the acceleration of a typical jet fighter fitted with a reheated Avon RA7 engine would be, at this altitude, $\frac{1}{8}$g.

The advantage of the rocket fighter in this situation is, therefore, most marked.

Indeed, it would not be possible for a jet fighter to maintain a 3g turn at this speed for more than a few degrees without considerable deceleration.

An armament of six 3 inch air-to-air rockets of Oerlikon or "Mighty Mouse" type is suggested. These may be fitted with proximity fuses.

The method of stowage and ejection proposed can be seen in fig. 6.

The rockets are ejected freely into the air stream and each rocket will fire in turn as it clears the tip structure, the total time of ejection being 1/10 second.

This will involve a thrust of 400 lbs. in the air operated jack.

National Archives of Australia NAA: A1196, 1/501/667

Each rocket will have a transverse velocity, the maximum in the inside rocket being 18 ft/sec. This lateral component can, if required, be corrected by setting the rockets, tips inward, at a small lateral angle to the aircraft centreline, depending upon the range most to be used.

Spacers between the rockets will ensure that each rocket is held securely for the very small fraction of time, 1/100 second or less, between emerging from the structure and firing.

The structure which is interposed between the jack and the inside rocket will take the place of the jettisonable cover when the action has been completed.

Provision has also been made for a radar sight and 125 lbs. has been allowed for this, as suggested by the M.o.S. This is presumably the equipment for a standard fighter.

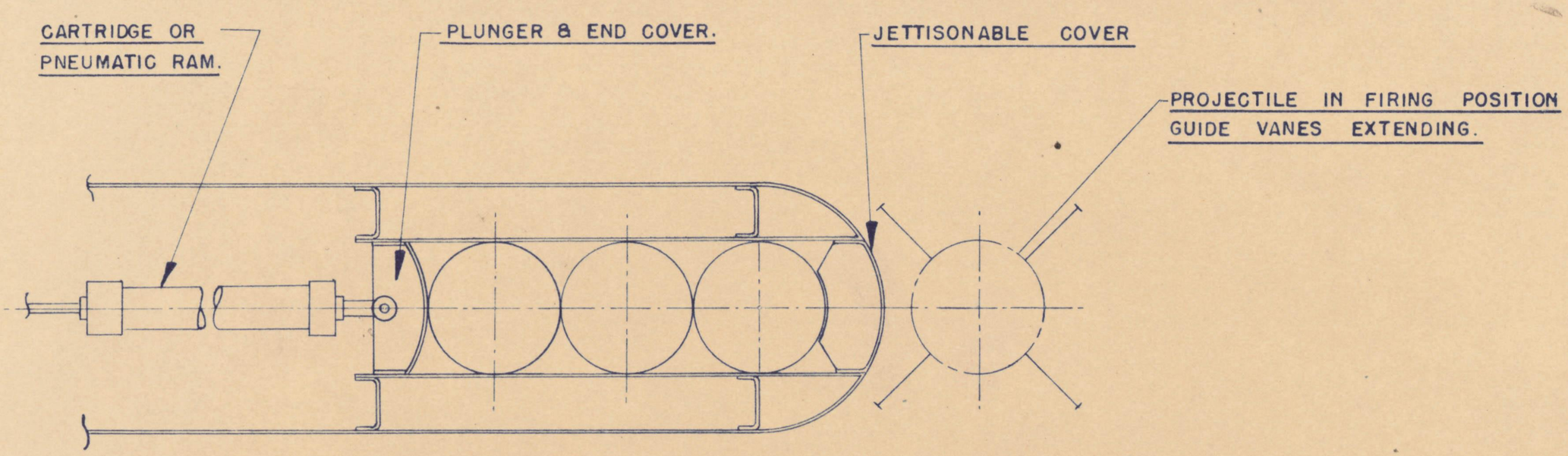
The Ryan Aero Co., U.S.A., have developed airborne radar equipment for installations where space and weight are at a premium, and in particular for guided missiles.

By the use of subminiature components with a short life, as would be consistent with equipment for interception purposes only, a substantial saving in size and weight is claimed. It would be as well to bear in mind any equipment of this sort.

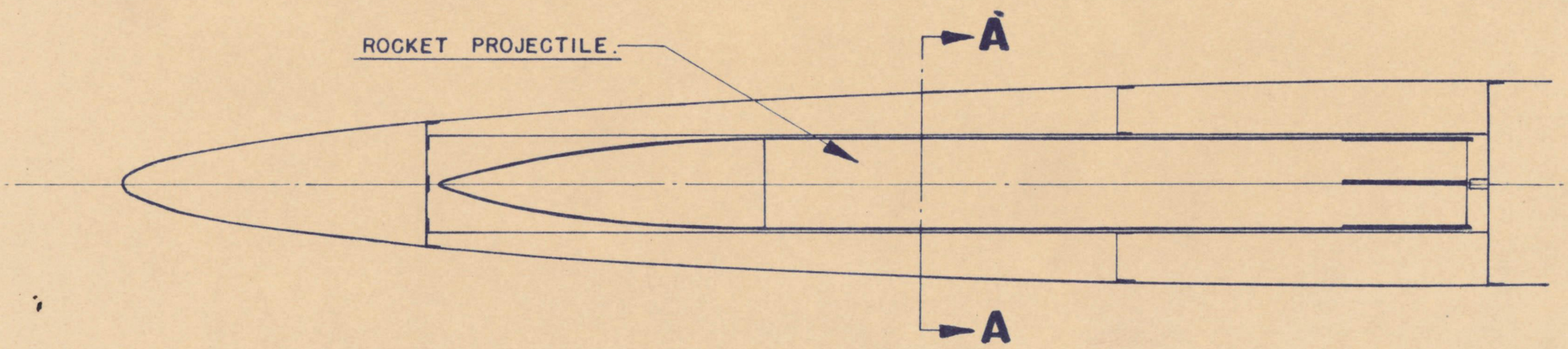
It must be stated, in summary, that with the available acceleration of 2.5g at combat weight, and with a general configuration which will give a very good critical Mach number, aerial combat at this altitude and at high subsonic speed will be comparable to that of the jet fighter at considerably lower levels.

National Archives of Australia NAA: A1196, 1/501/667

FIG. 6.



SECTION A-A
(ENLARGED SCALE)



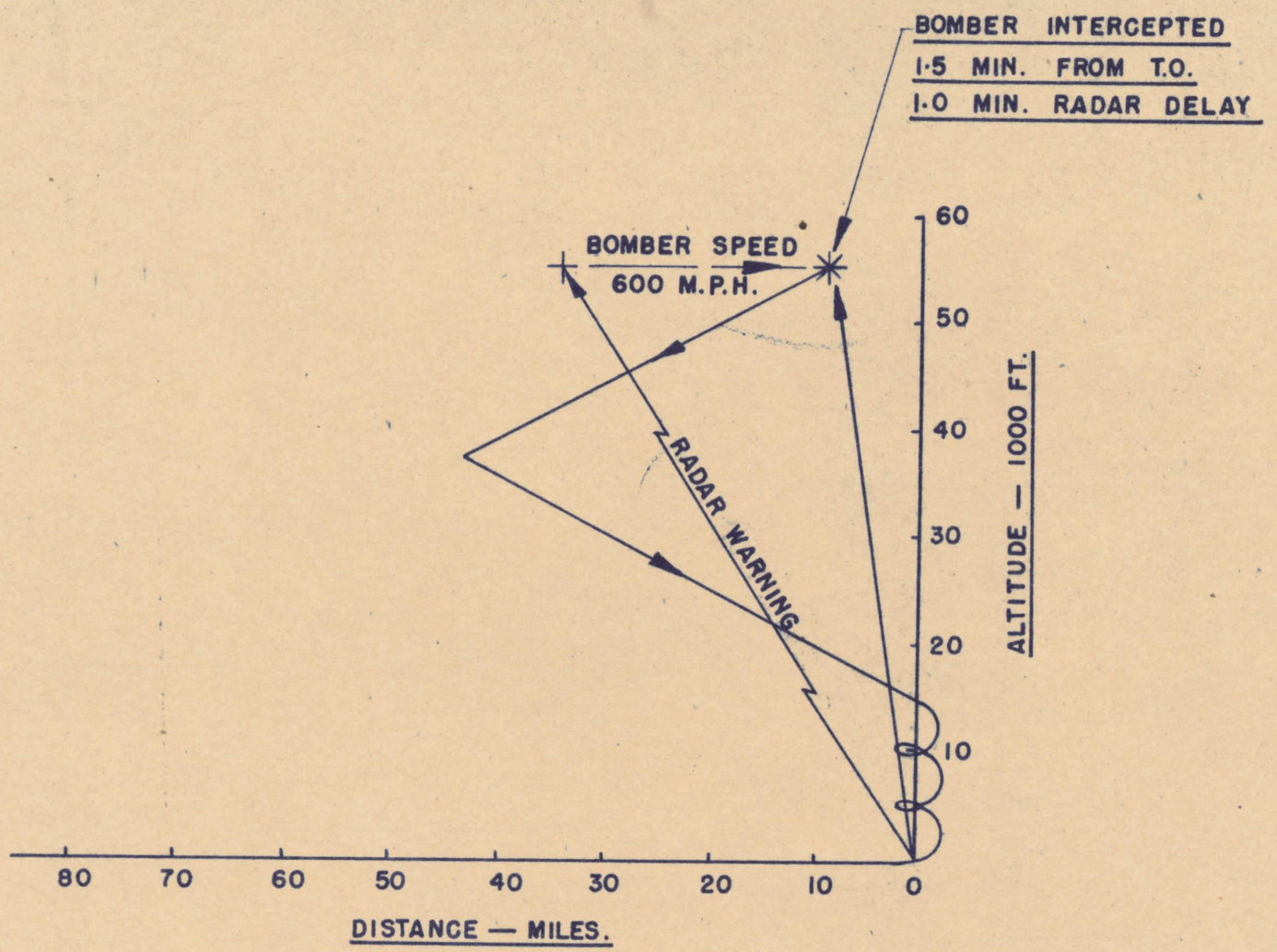
SUGGESTED INSTALLATION – ROCKET PROJECTILE UNITS IN WING TIP.

FIG. 6.

4-132-2 Sheet No. 3

National Archives of Australia NAA: A1196, 1/501/667

FIG. 7.



INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION A-132-2

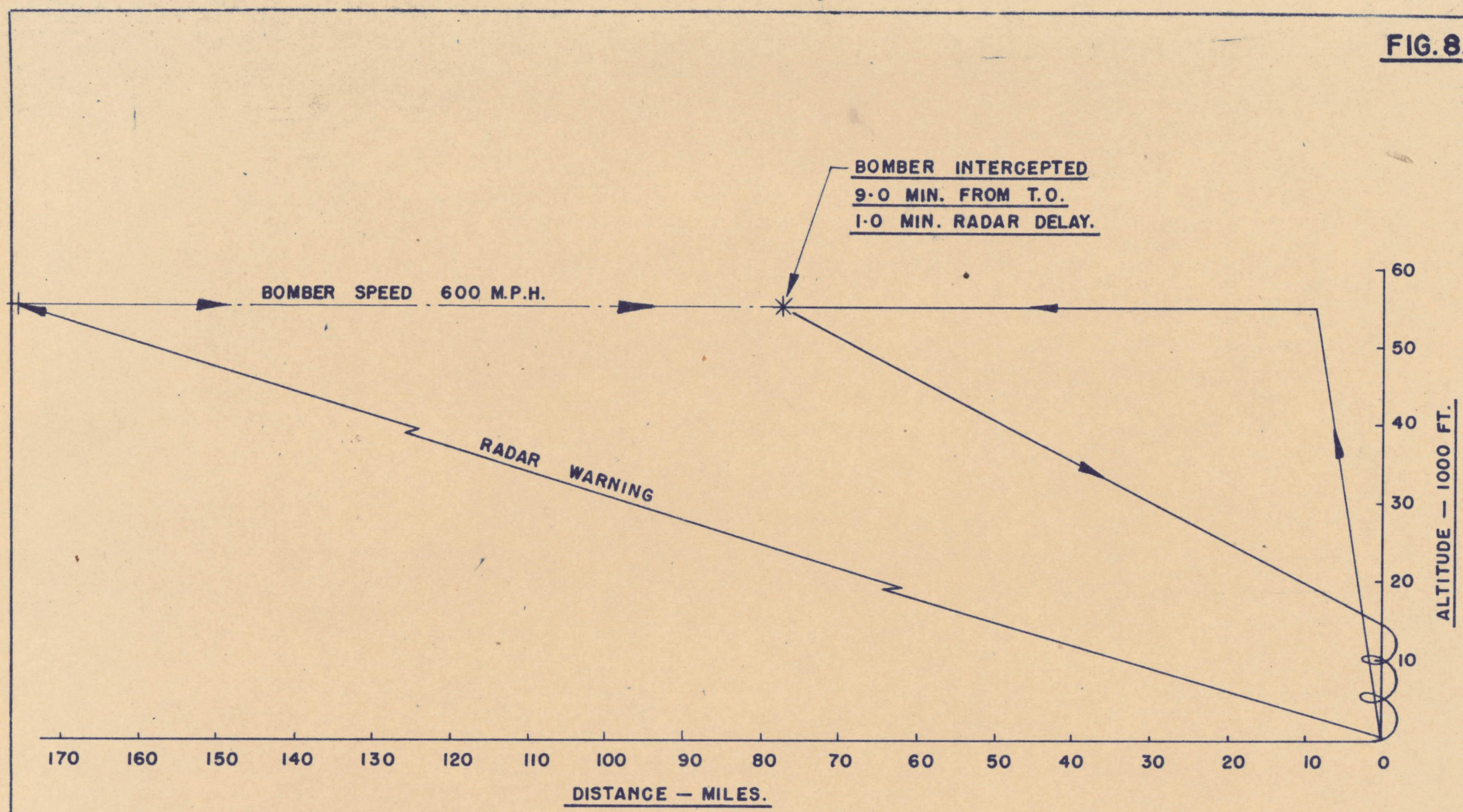
SHEET No. 38

National Archives of Australia

NAA: A1196, 1/501/667

M 304.

FIG. 8.



INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

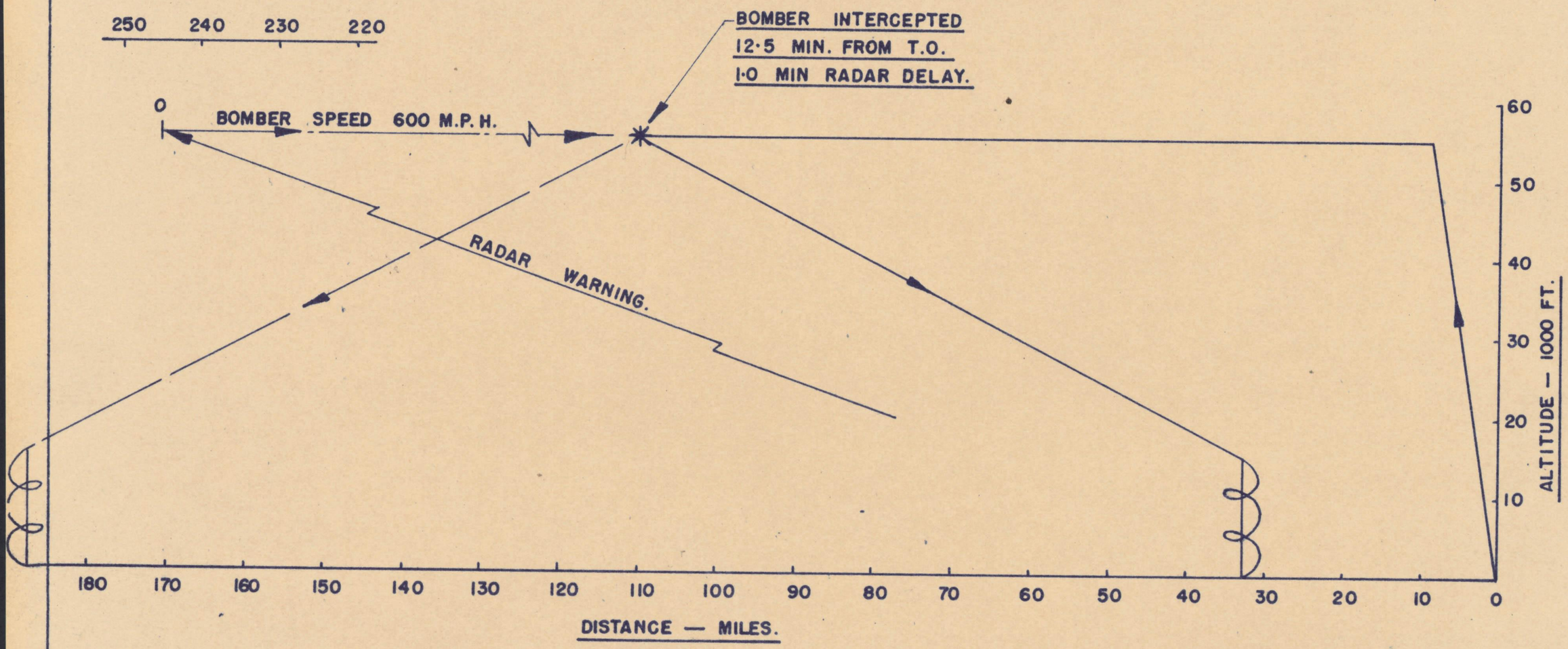
SECTION A-132-2

SHEET No. 39

National Archives of Australia NAA: A1196, 1/501/667

M 304

FIG. 9.



INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION A-132-2

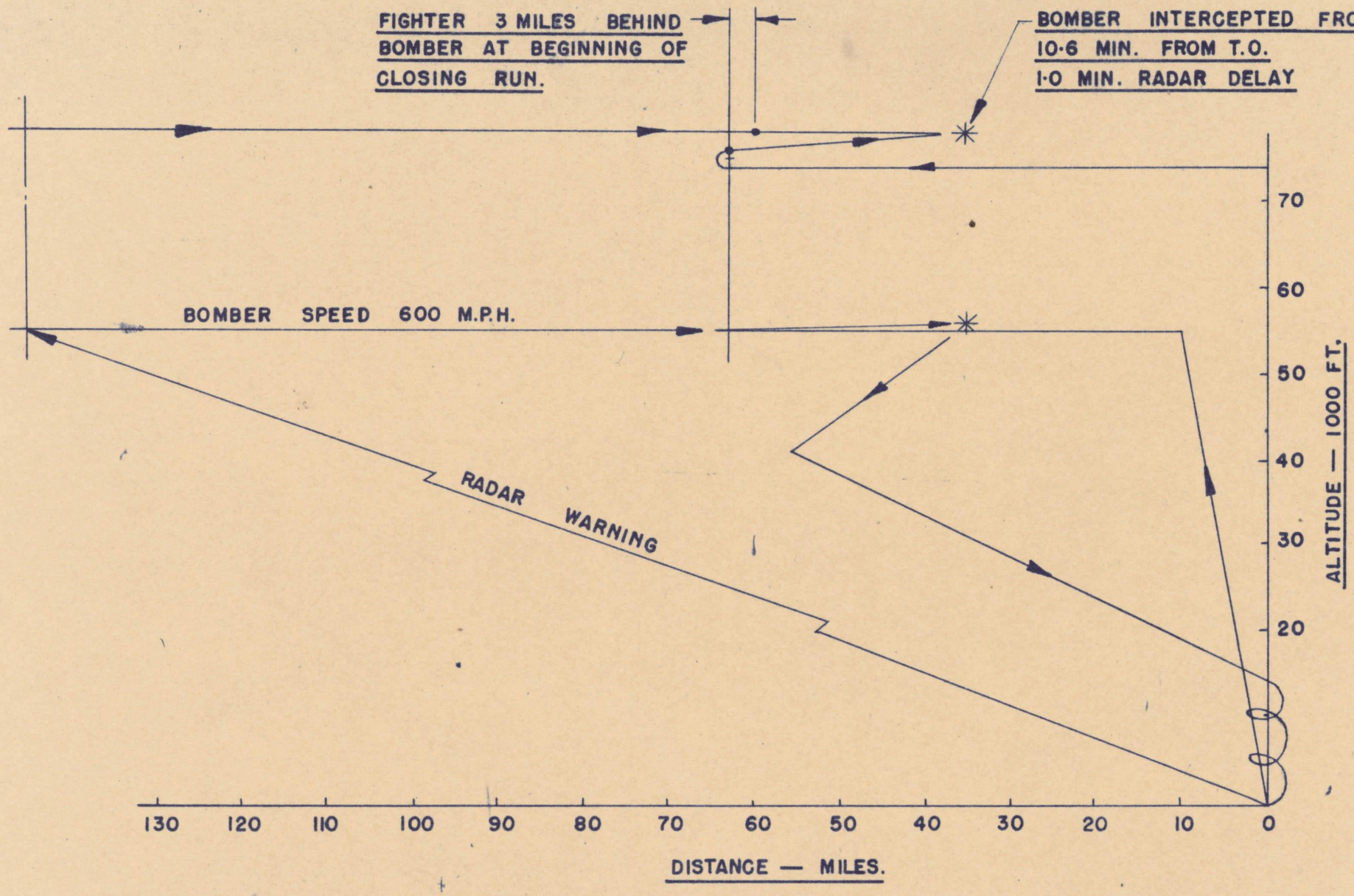
SHEET No. 40

National Archives of Australia

NAA: A1196, 1/501/667

M 304

FIG. 10.



REAR INTERCEPTION DIAGRAM.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION A-132-2
SHEET No. 41

National Archives of Australia
NAA: A1196, 1/501/667

SECTION A-132-2

SHEET No. 42

AERODYNAMIC DATA.

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

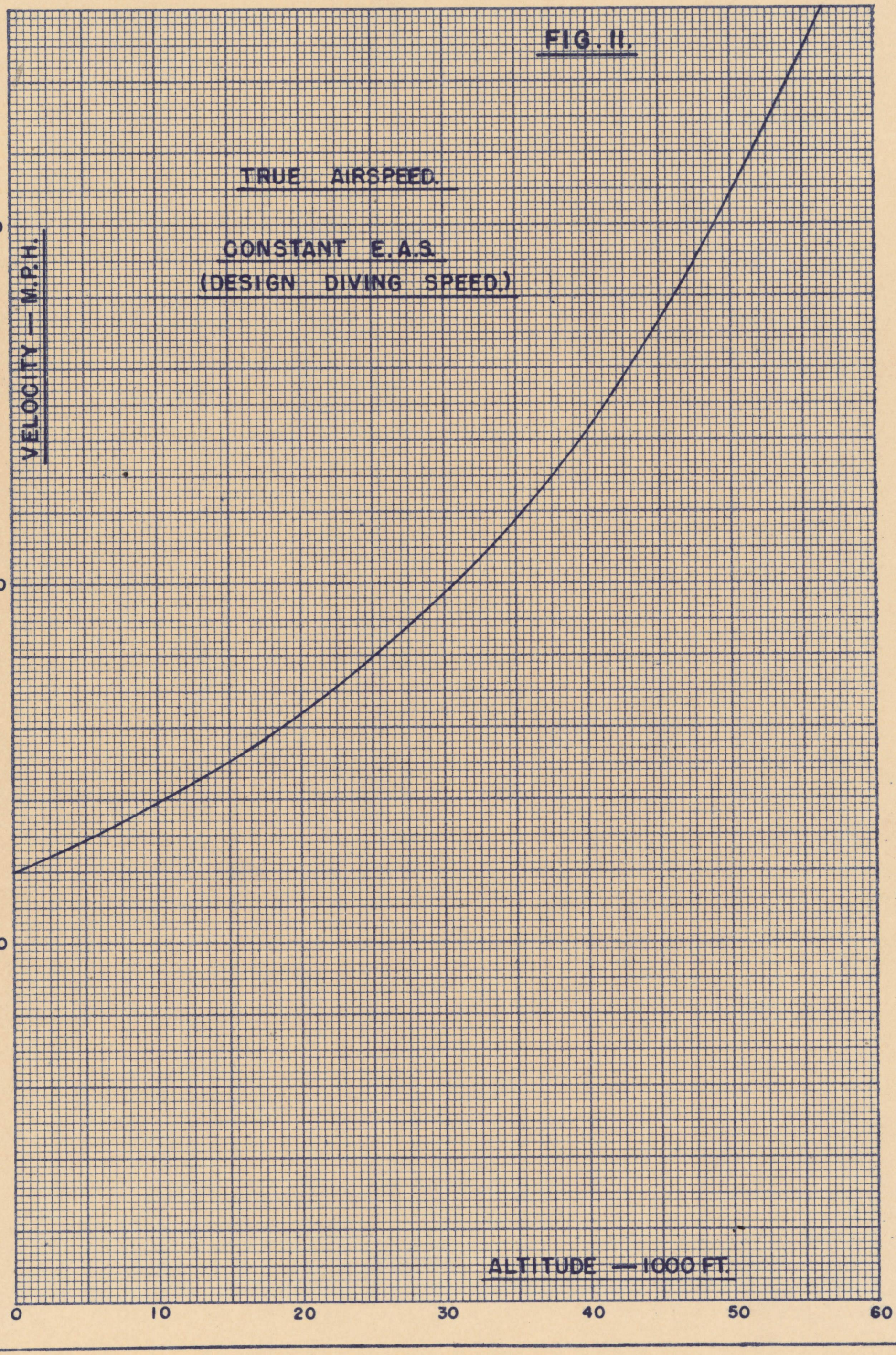
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 43

DATE:

FIG. II.



National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

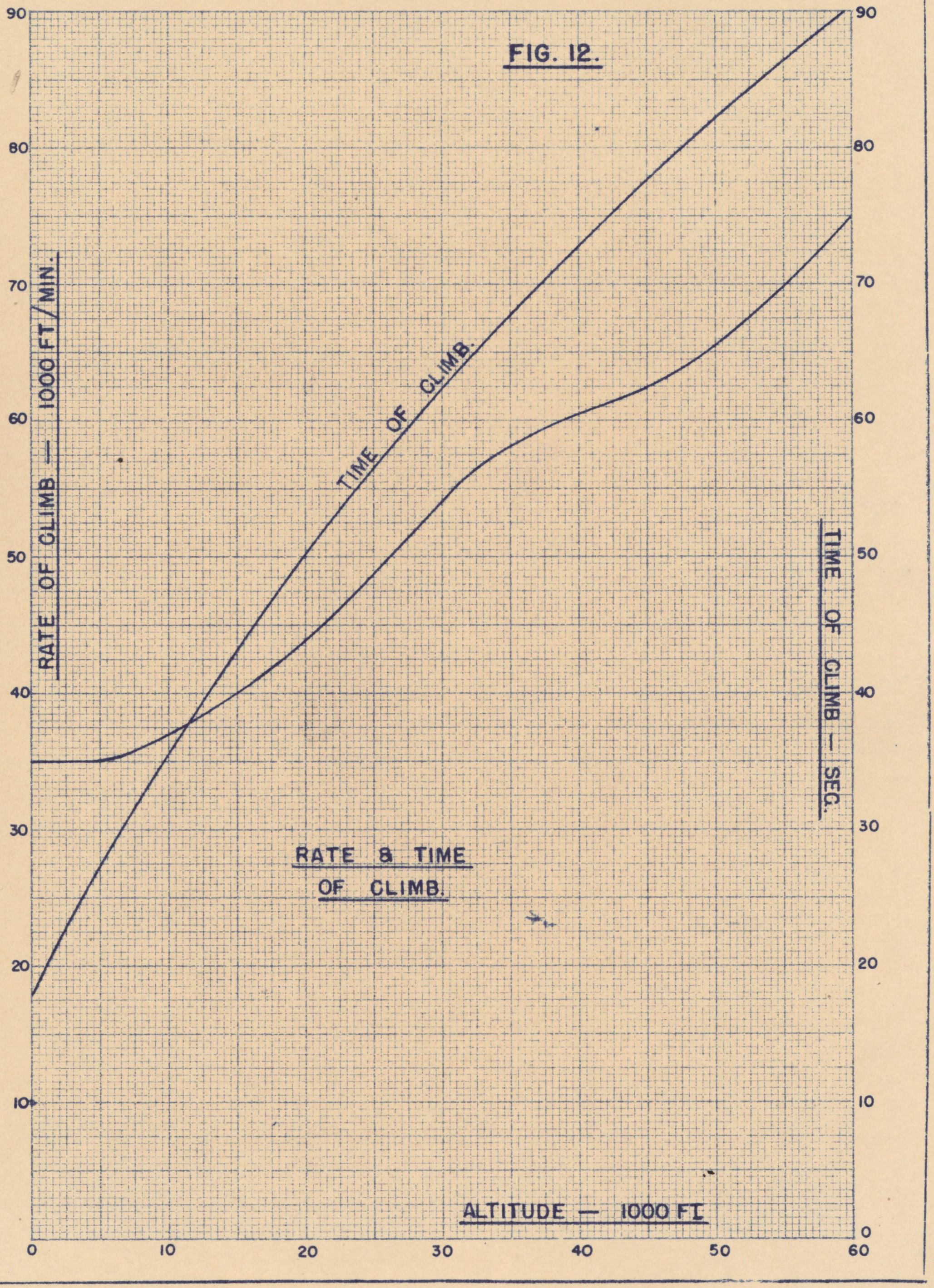
CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2
Sheet No. 44

DATE:

FIG. 12.



National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 45

DATE:

FIG. 13.

GLIDE SPEED.

MAX. $\frac{L}{D}$

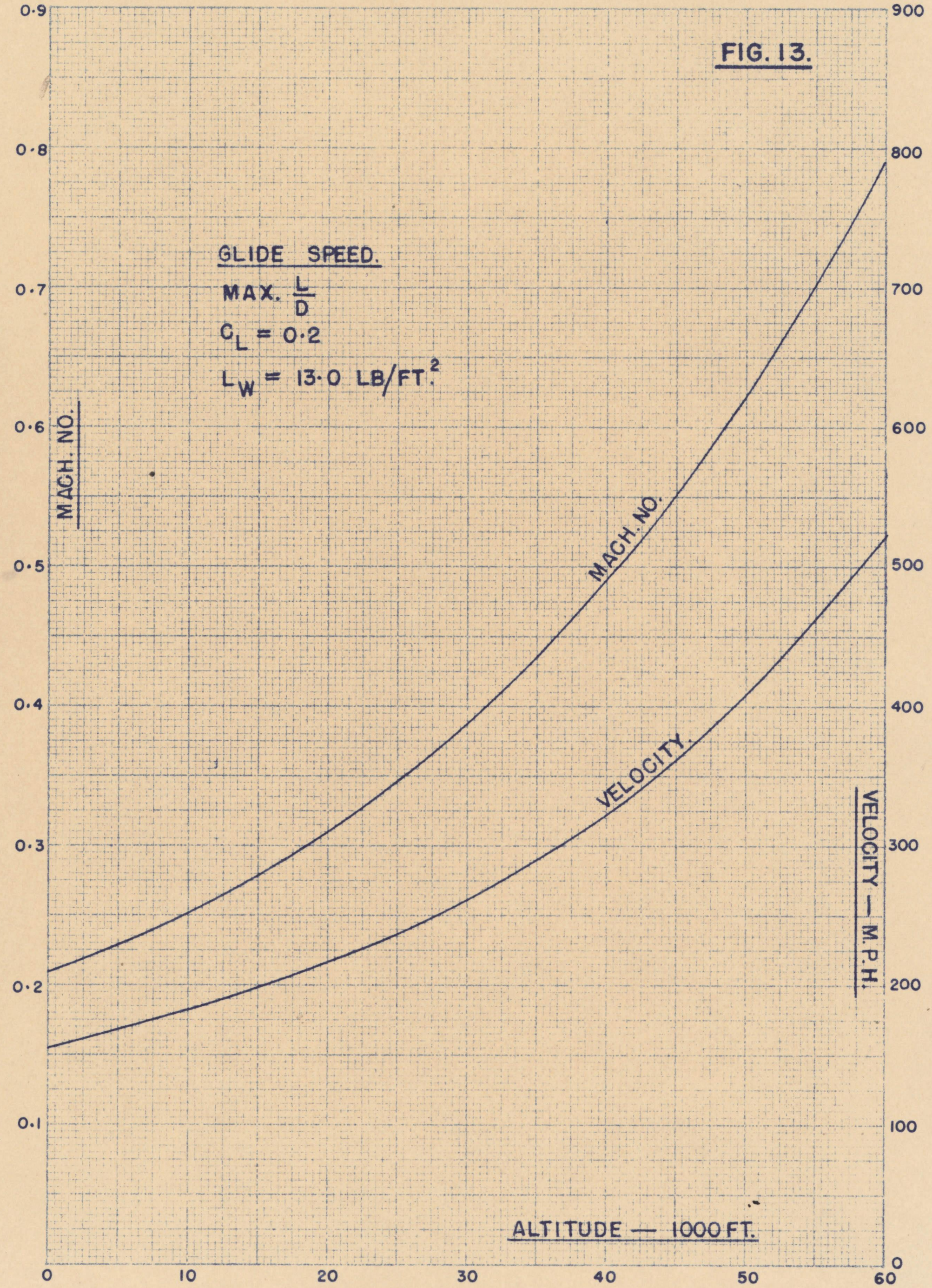
$C_L = 0.2$

$L_W = 13.0$ LB/FT.^{2}

MACH. NO.

VELOCITY — M.P.H.

ALTITUDE — 1000 FT.



M 325
National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

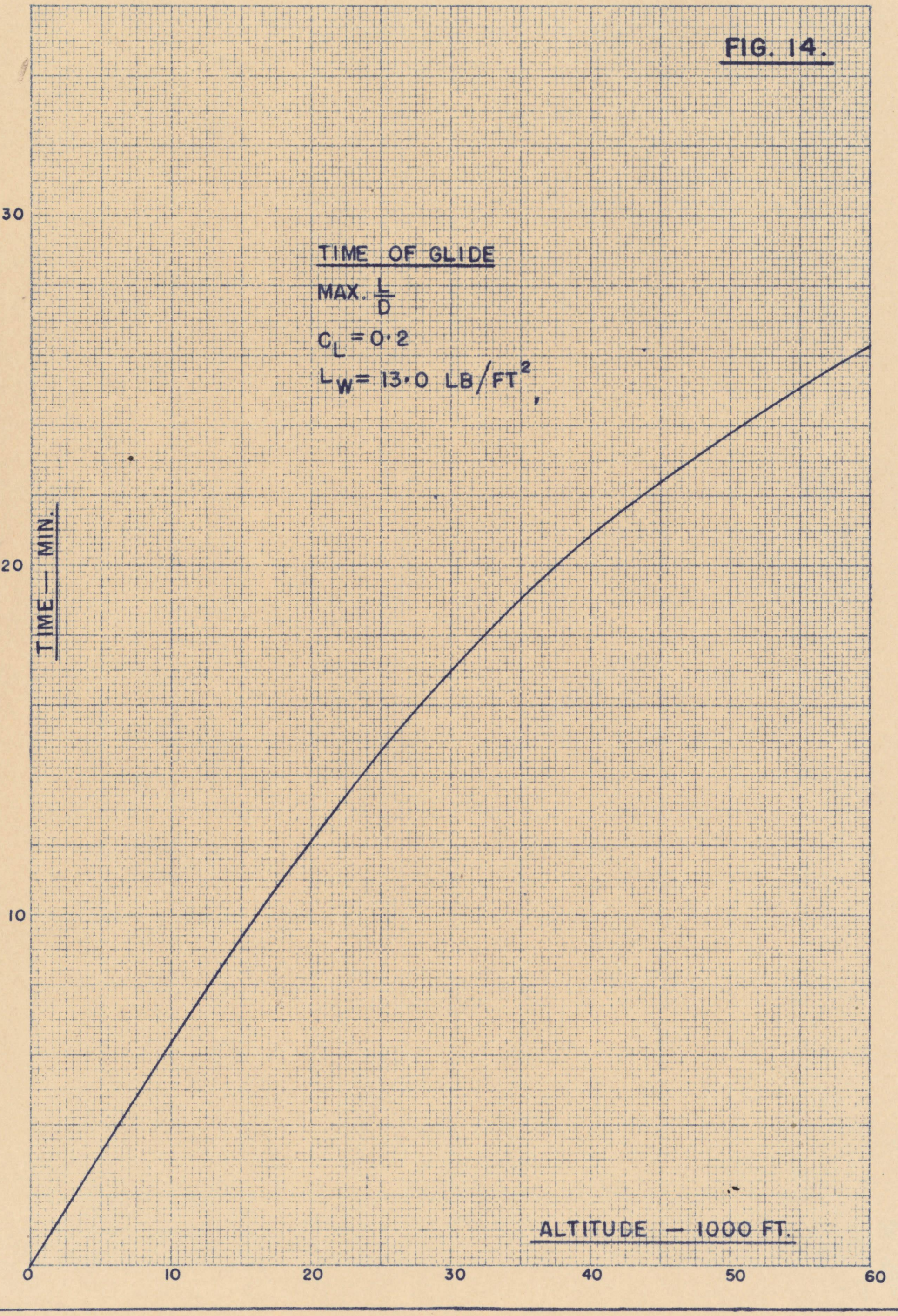
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 46

DATE:

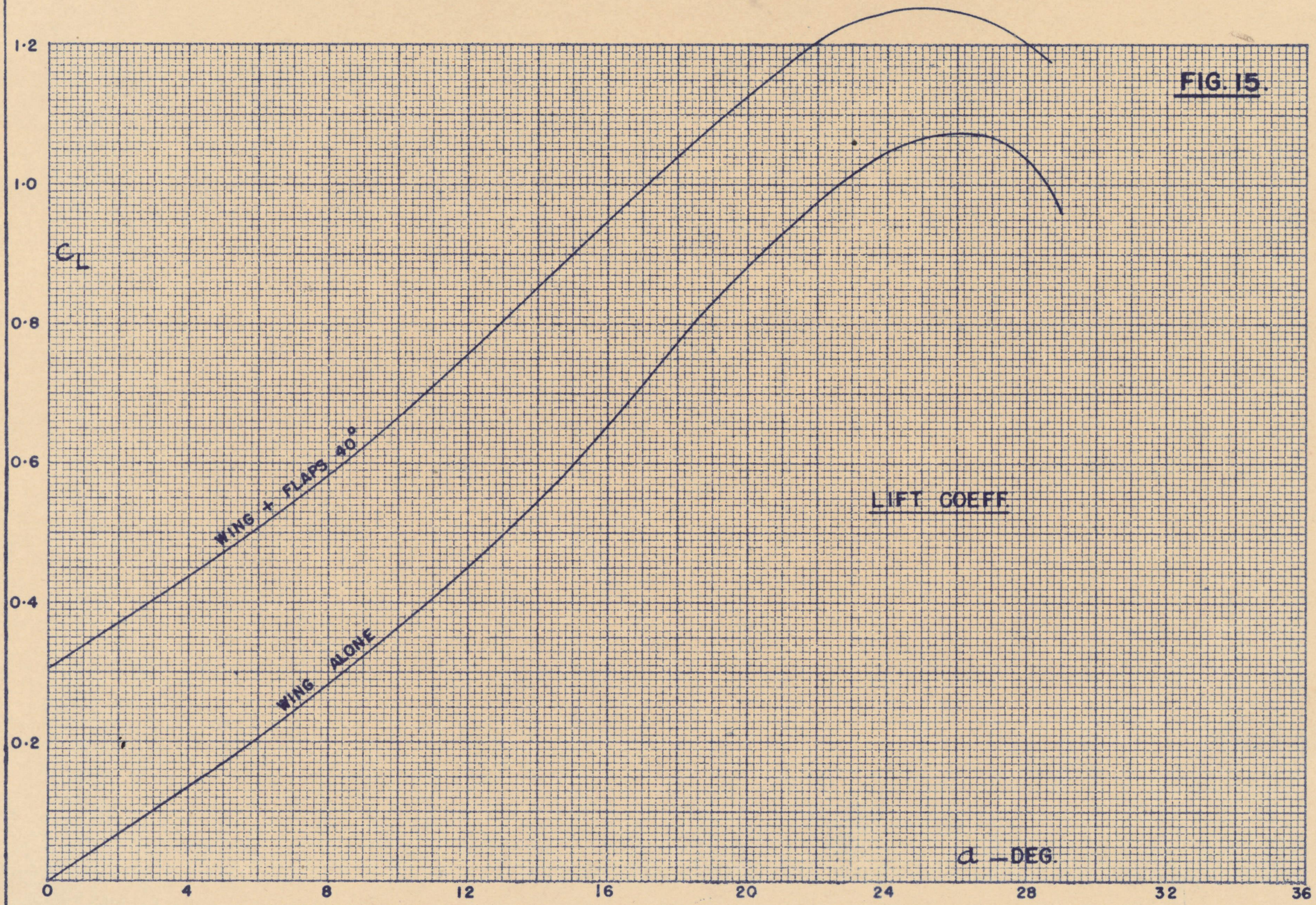
FIG. 14.



National Archives of Australia
NAA: A1196, 1/501/667

M 325

FIG. 15.



PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

DATE:

A-132-2
Sheet No. 47

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 48

DATE:

FIG. 16.

PITCHING MT.

$C_{M_{0.25\,C}}$

0·12
0·08
0·04
0
−0·04
−0·08
−0·12
−0·16

WING ALONE

WING + FLAP 40°

0 0·2 0·4 0·6 0·8 1·0 1·2

C_L

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

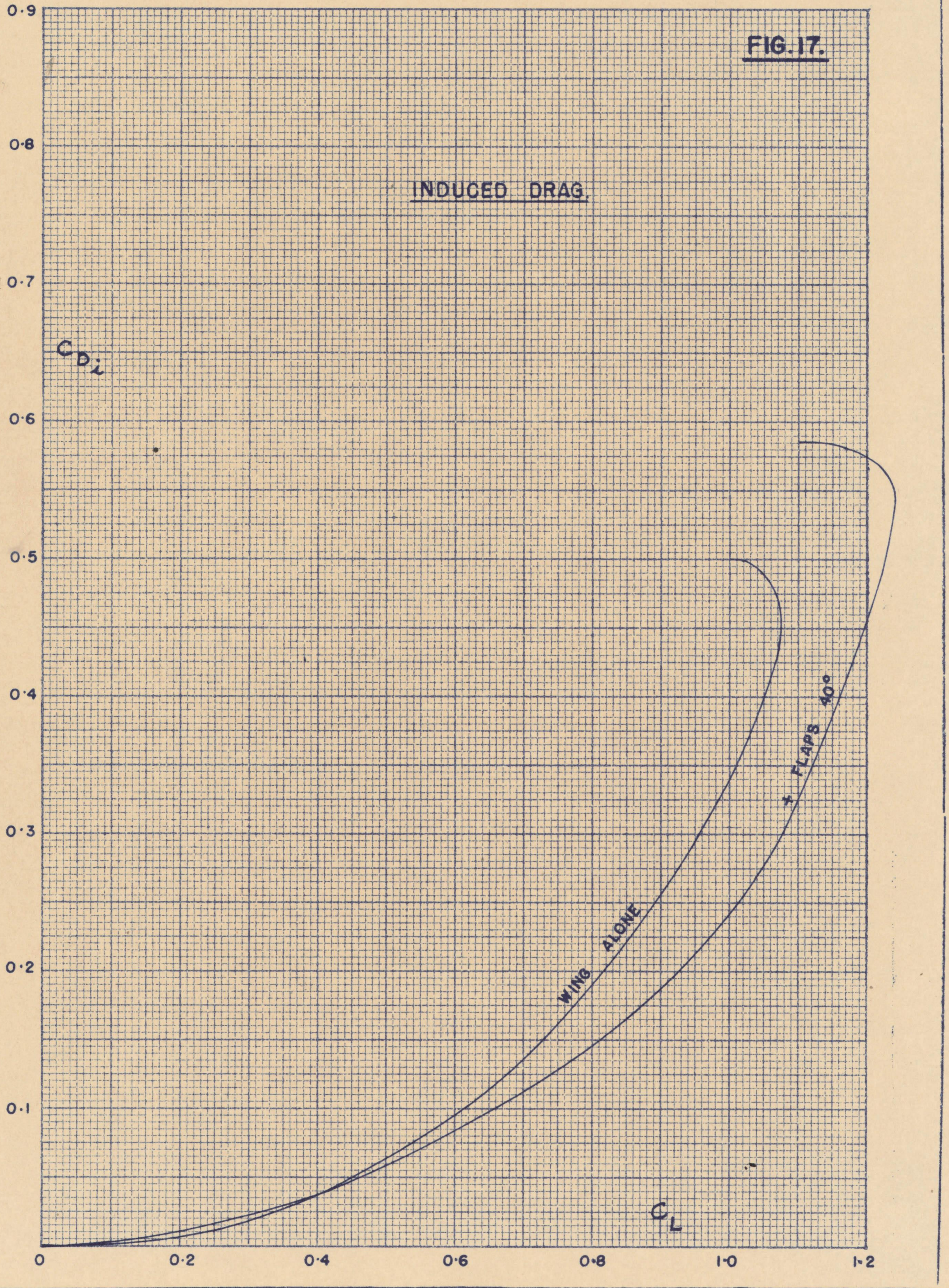
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 49

DATE:

FIG. 17.

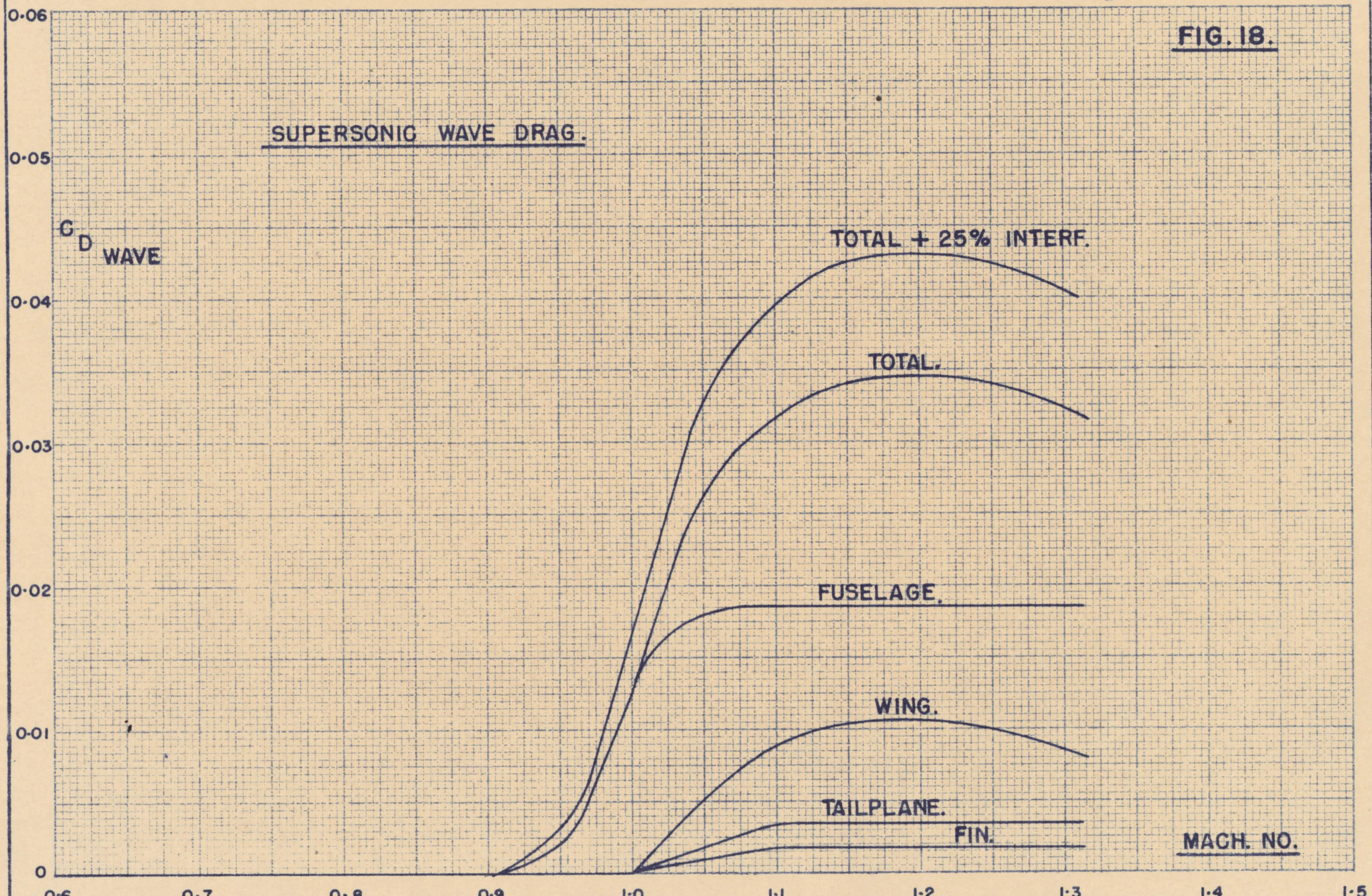


National Archives of Australia
NAA: A1196, 1/501/667

M 325

FIG. 18.

SUPERSONIC WAVE DRAG.



PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

DATE:

Sheet No. 50

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

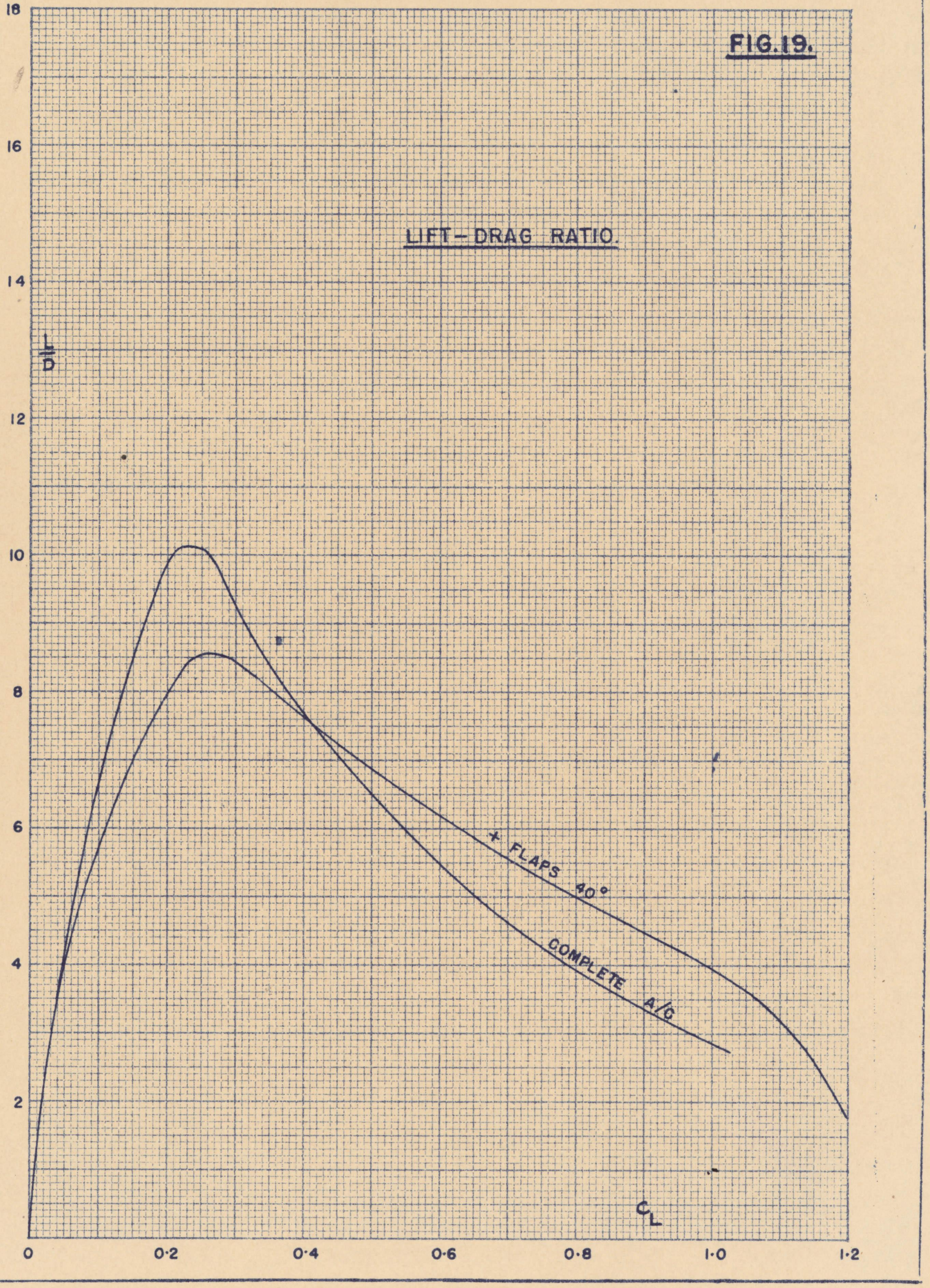
A-132-2

Sheet No. 51

DATE:

FIG.19.

LIFT-DRAG RATIO.



National Archives of Australia M 325
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

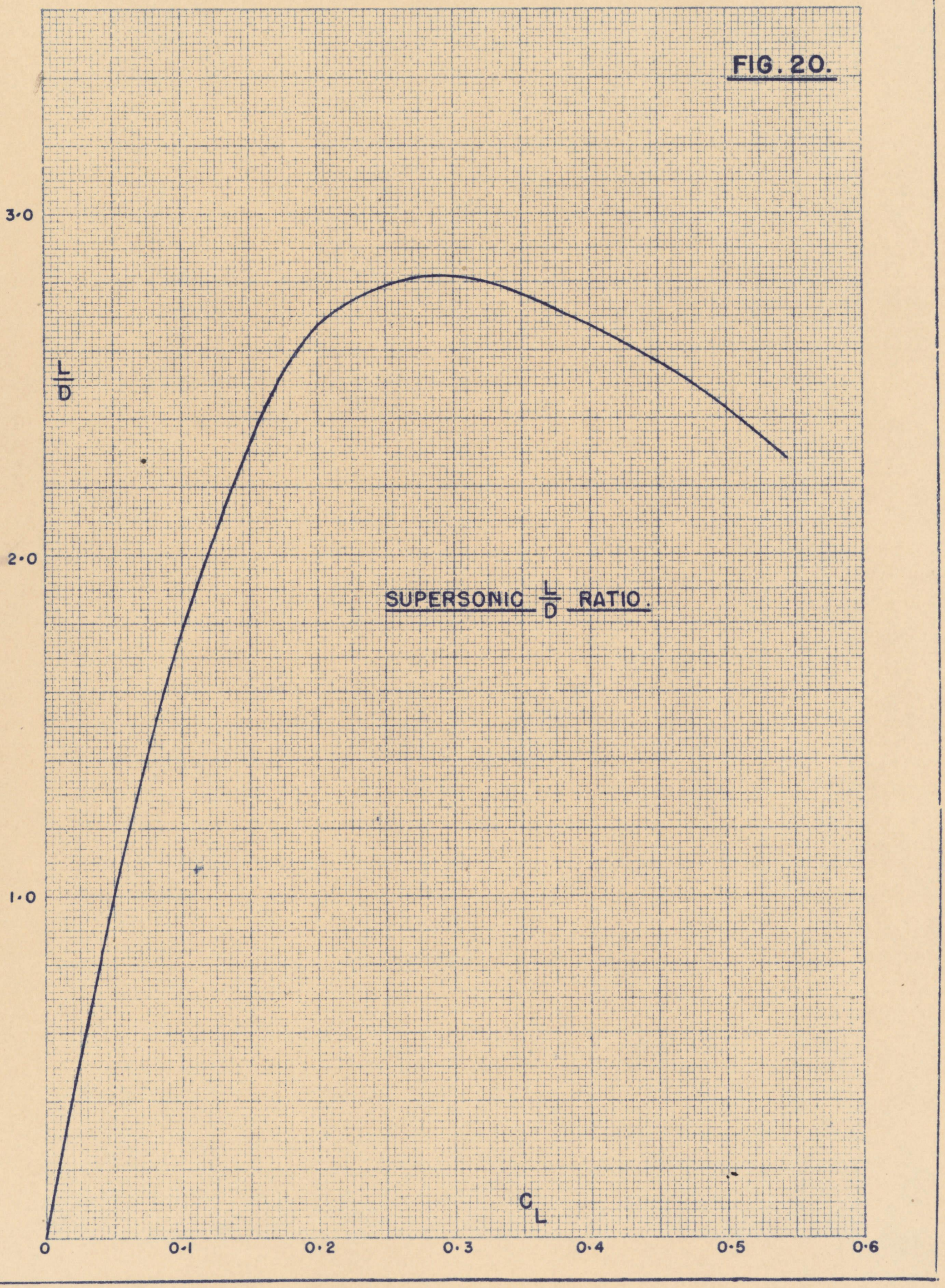
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 52

DATE:

FIG. 20.



National Archives of Australia
M 325
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

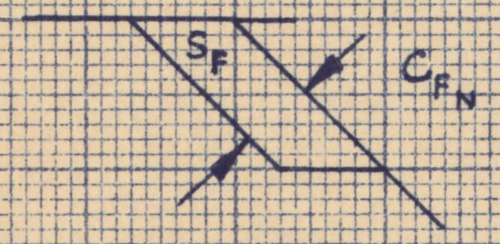
Sheet No. 53

DATE:

FIG. 21.

FLAP HINGE MT.

$$C_H = \frac{H}{q S_F C_{F_N}}$$



FLAP ANGLE 40°

C_H

0·4
0·2
0
− 0·2
− 0·4
− 0·6
− 0·8
− 1·0

0 0·2 0·4 0·6 0·8 1·0 1·2

C_L

M 325

National Archives of Australia

NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 54

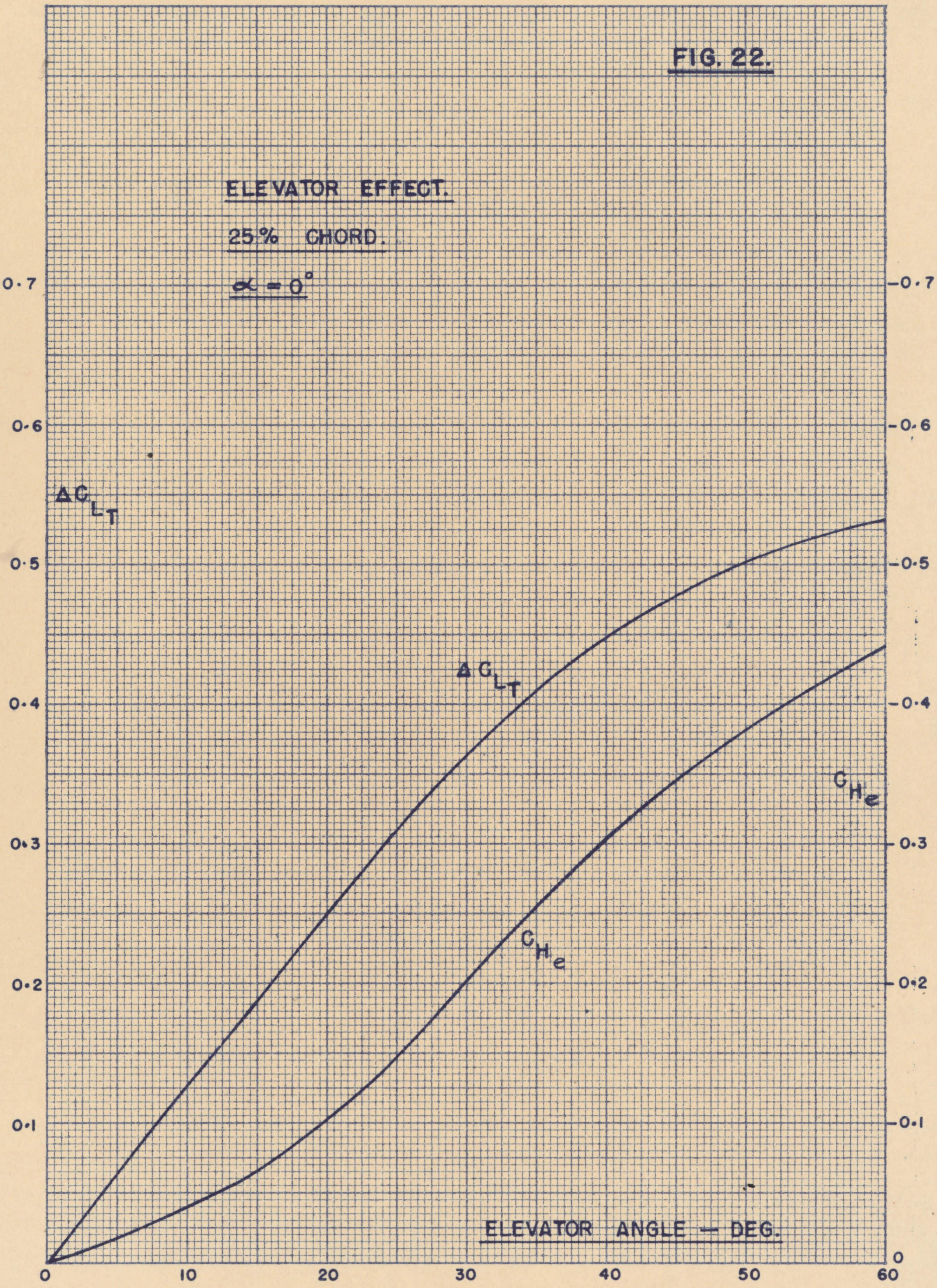
DATE:

FIG. 22.

ELEVATOR EFFECT.

25% CHORD.

$\alpha = 0°$



National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 55

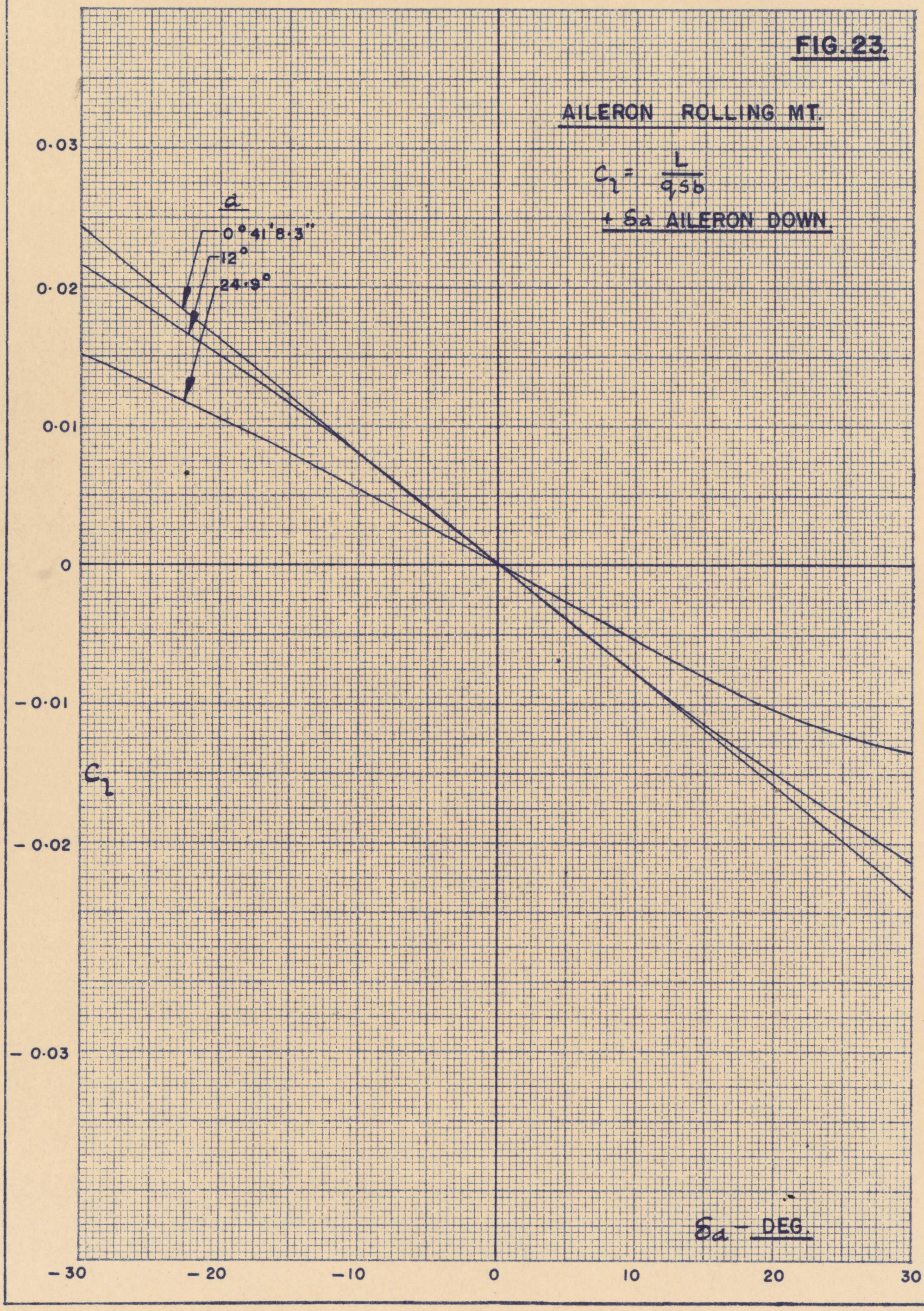
DATE:

FIG. 23.

AILERON ROLLING MT.

$C_l = \frac{L}{qSb}$

+ δa AILERON DOWN



M 325

National Archives of Australia NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

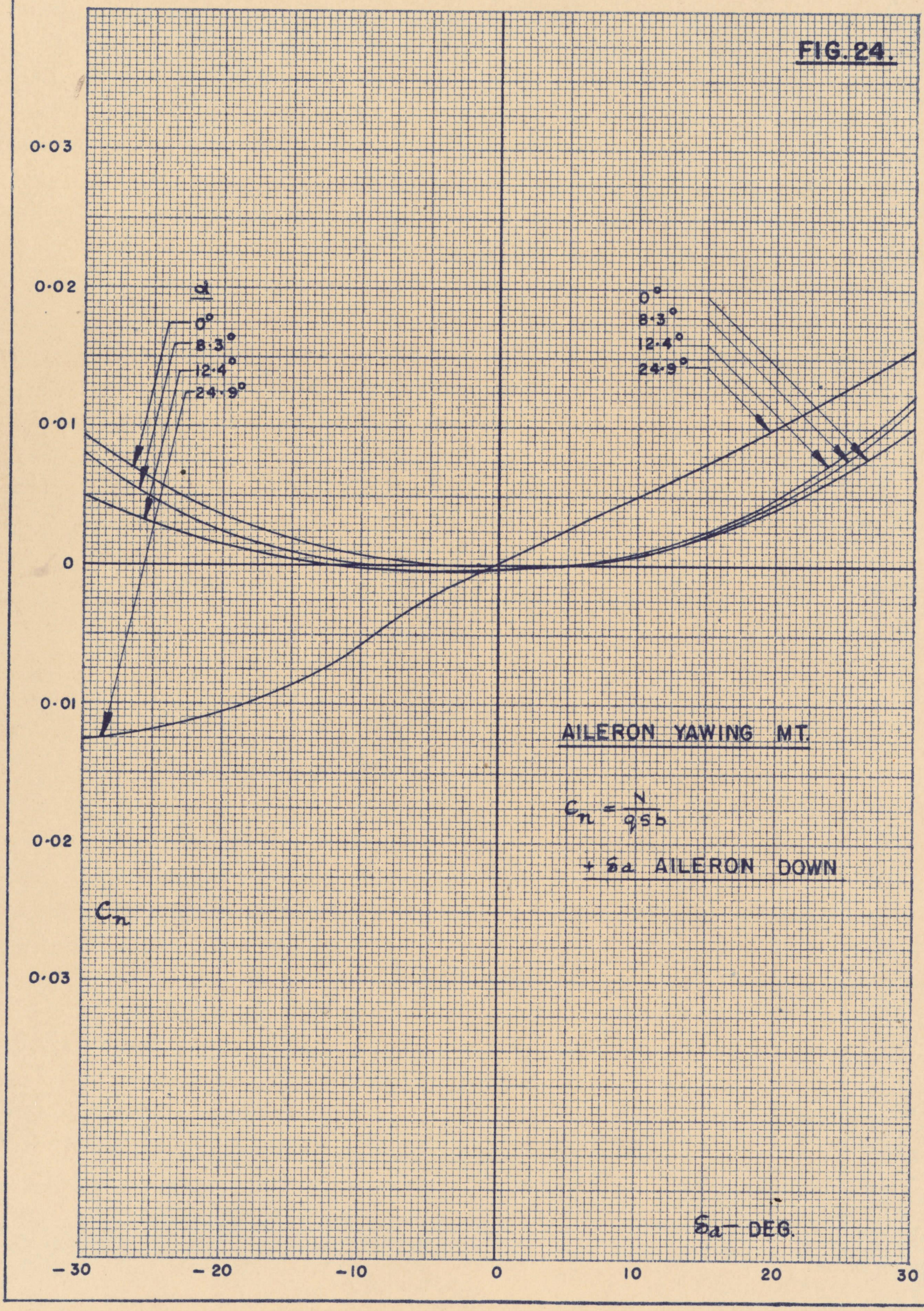
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 56

DATE:

FIG. 24.



M 325
National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

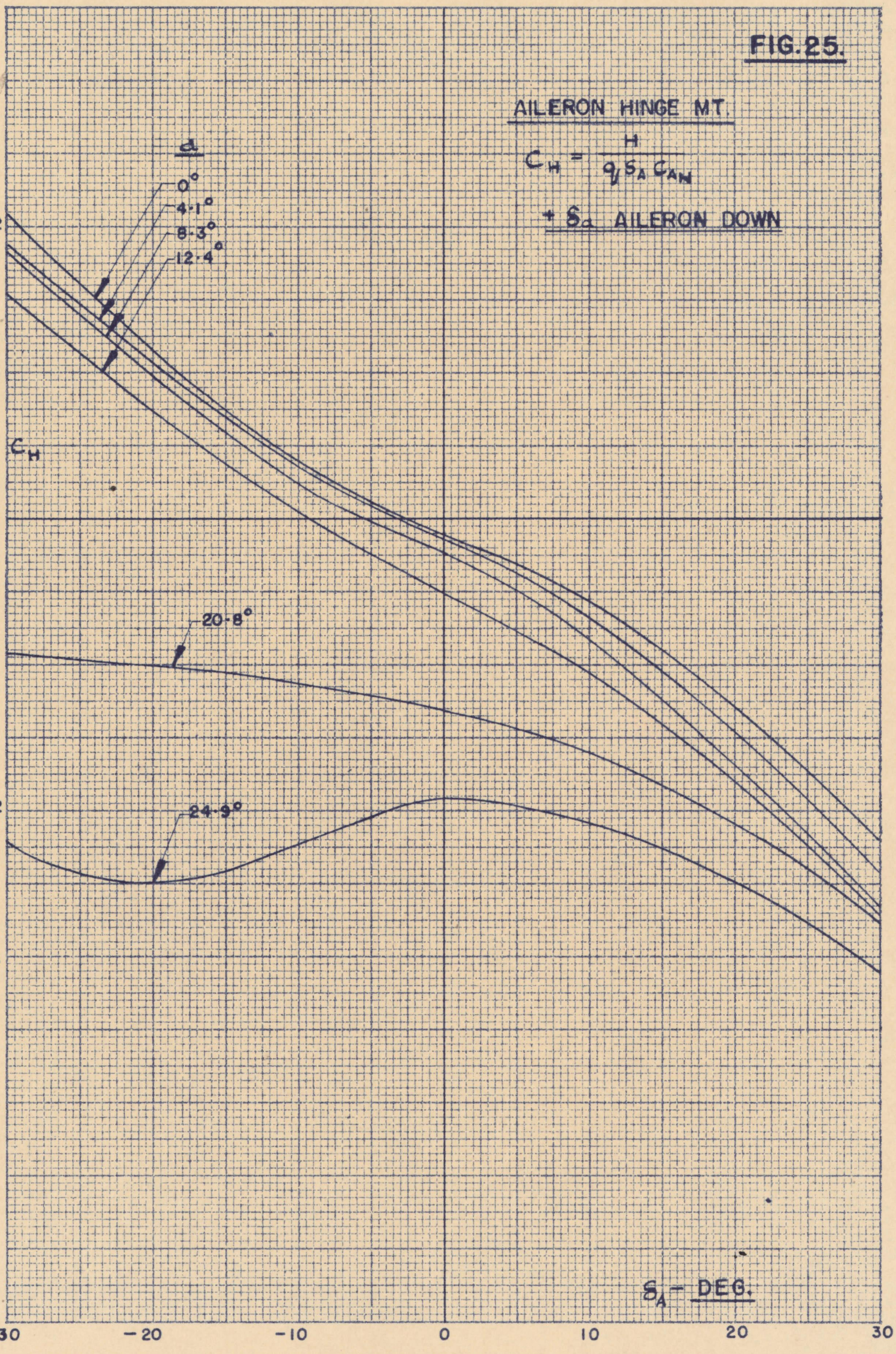
A-132-2
Sheet No. 57
DATE:

FIG.25.

AILERON HINGE MT.

$$C_H = \frac{H}{q S_A C_{AM}}$$

+ δ_a AILERON DOWN



M 325

National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

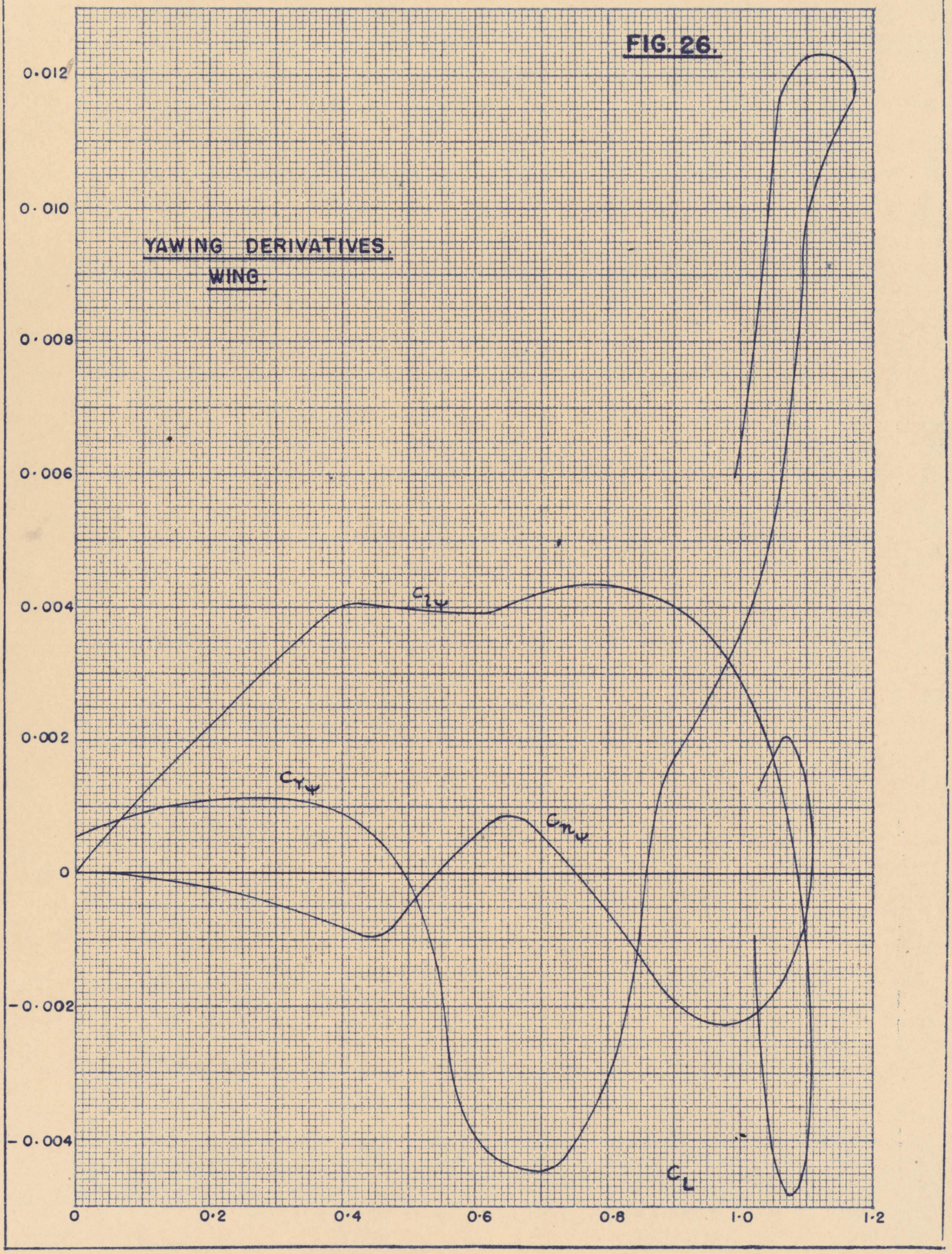
A-132-2

Sheet No. 58

DATE:

FIG. 26.

YAWING DERIVATIVES.
WING.



M 325
National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

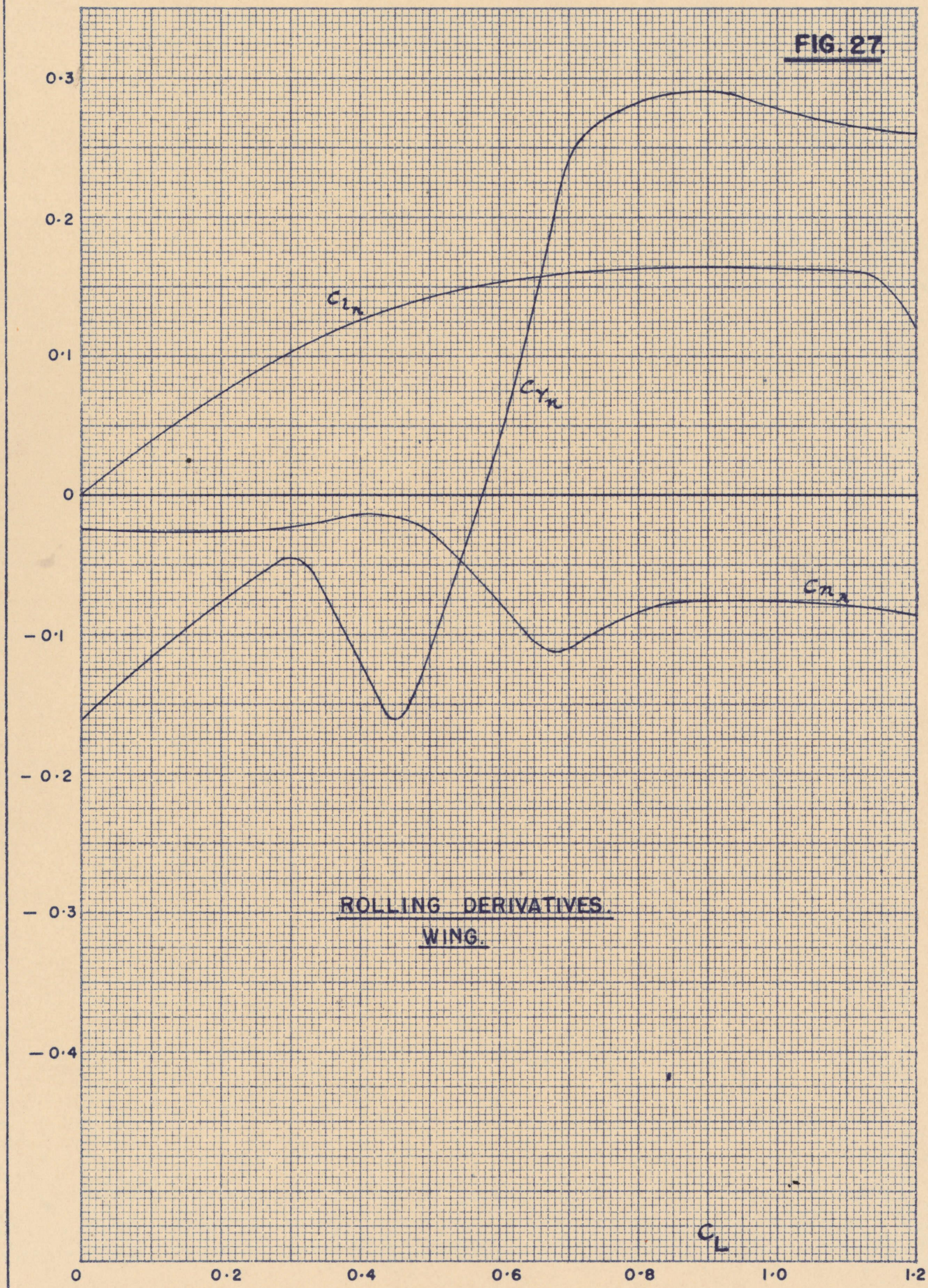
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 59

DATE:

FIG. 27.



ROLLING DERIVATIVES.
WING.

National Archives of Australia
NAA: A1196, 1/501/667

PREPARED BY:

CHECKED BY:

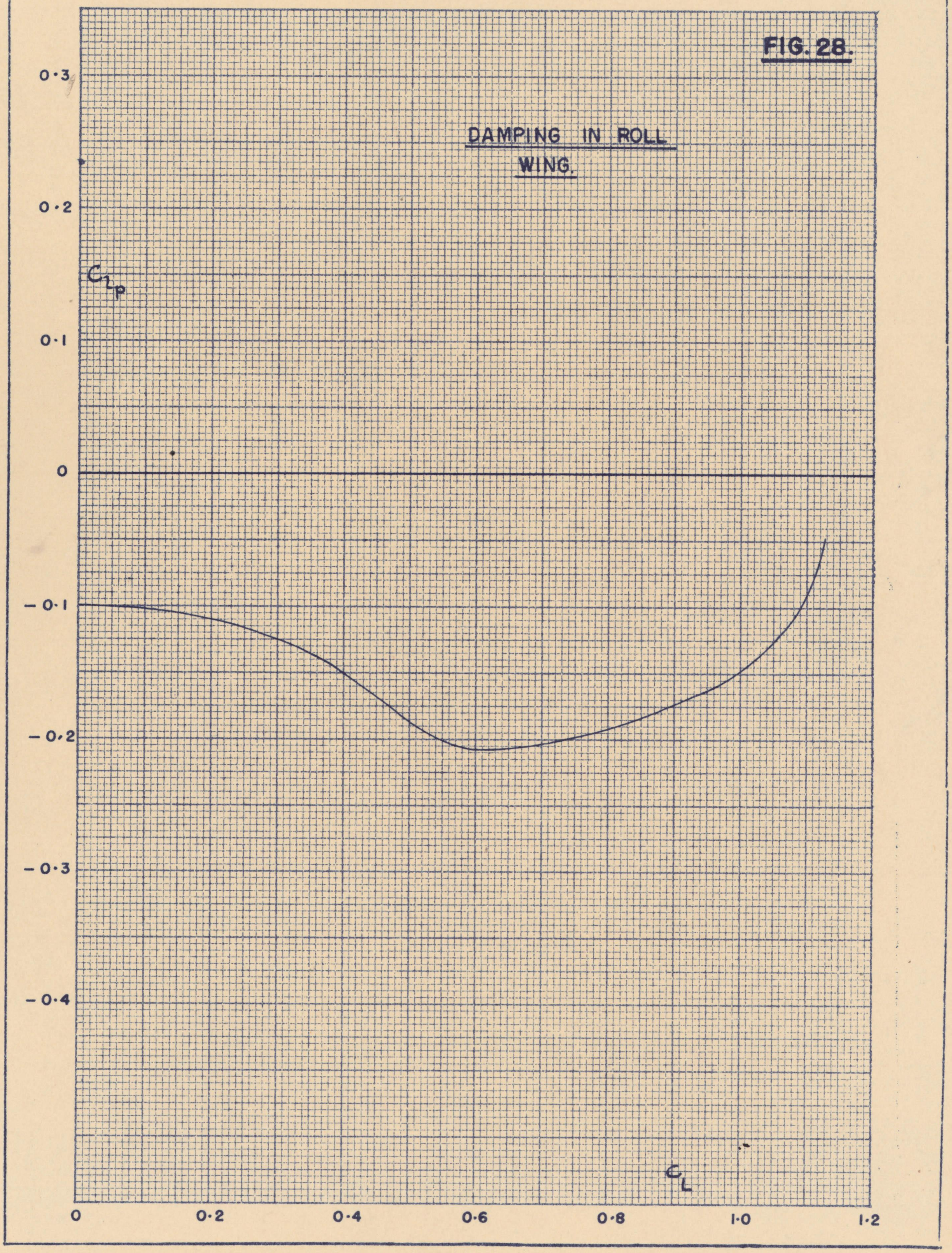
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

Sheet No. 60

DATE:

FIG. 28.

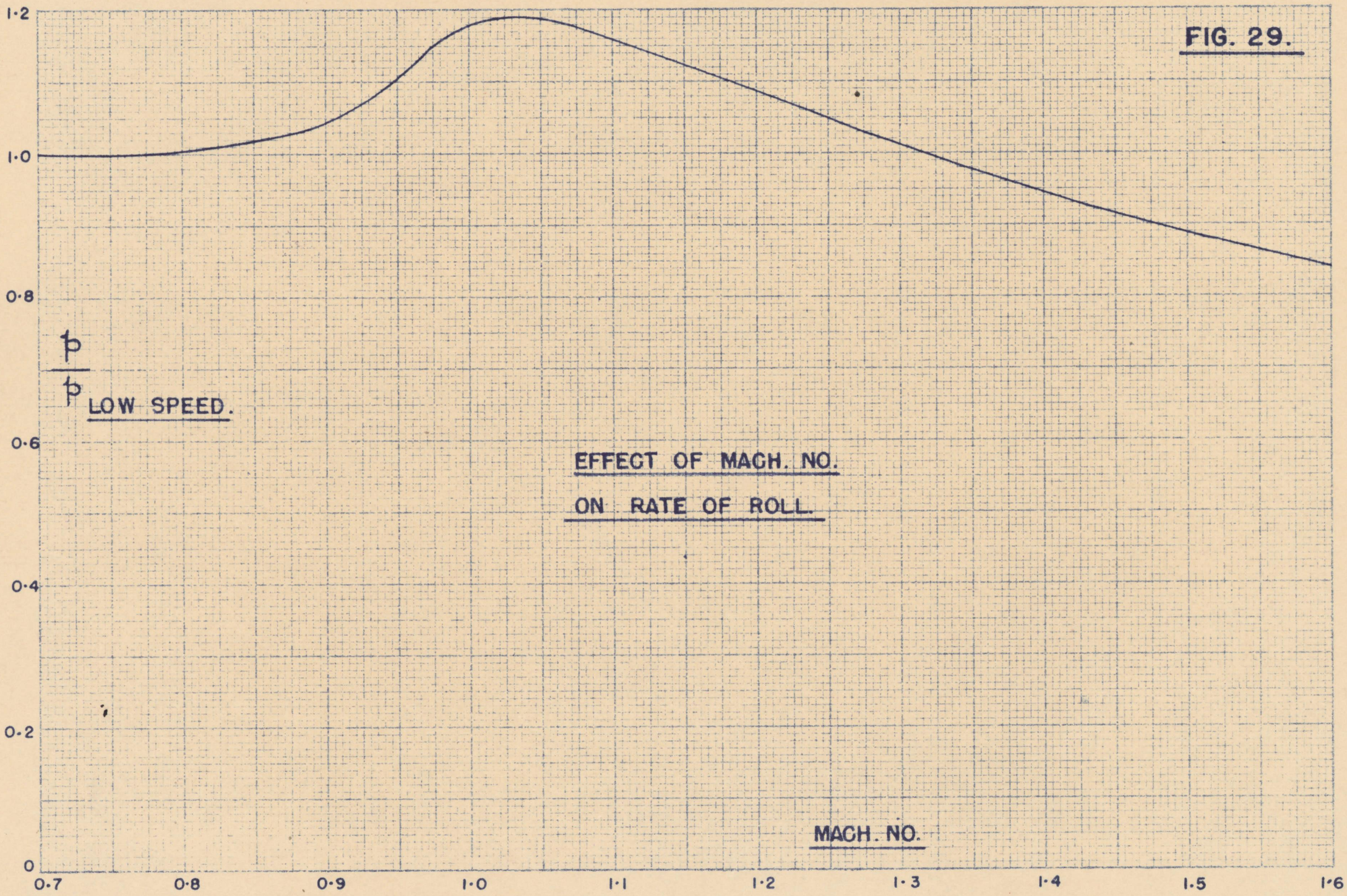


M 325

National Archives of Australia NAA: A1196, 1/501/667

M 325

FIG. 29.



PREPARED BY:

CHECKED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

A-132-2

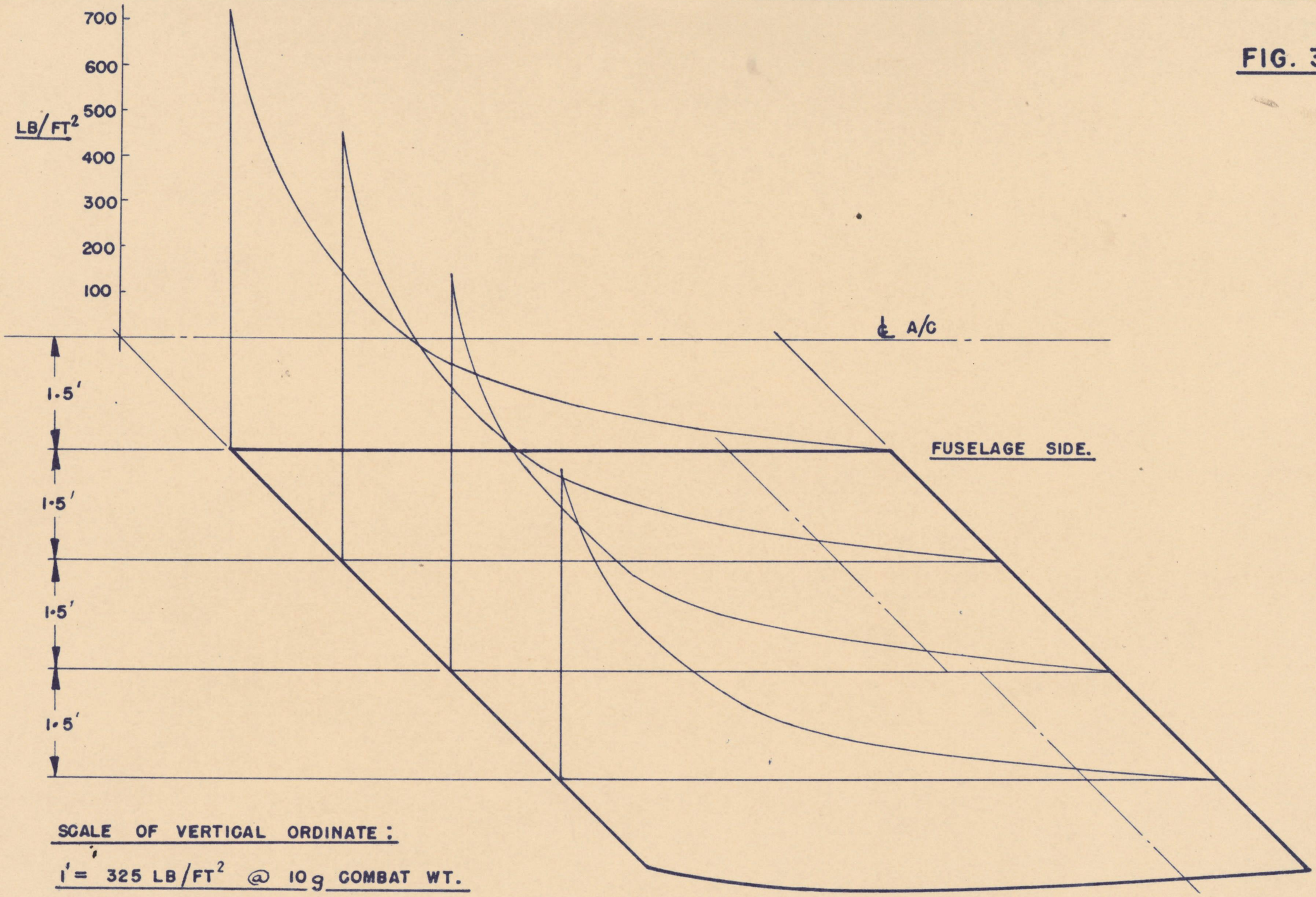
DATE:

Sheet No. 61

National Archives of Australia NAA: A1196, 1/501/667

M 304

FIG. 30.



SCALE OF VERTICAL ORDINATE :

1′ = 325 LB/FT² @ 10g COMBAT WT.

WING LOAD DISTRIBUTION
LOW SPEED.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

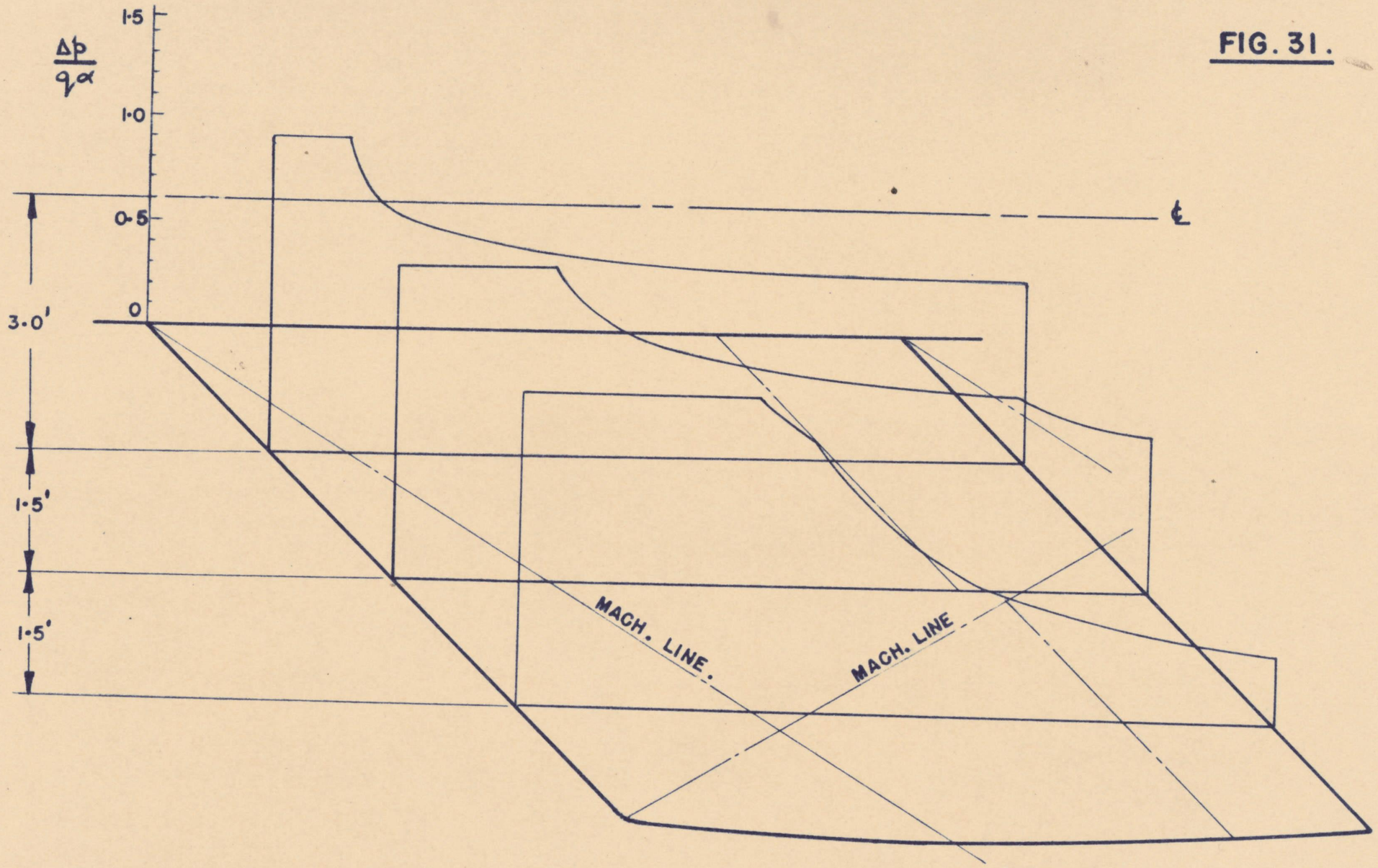
SECTION A-132-2

SHEET No. 62

National Archives of Australia

NAA: A1196, 1/501/667

FIG. 31.



WING LOAD DISTRIBUTION.

M = 1·93

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION A-A.32-2

SHEET No. 63

National Archives of Australia

NAA: A1196, 1/501/667

SUMMARY.

In the layout of the aircraft emphasis has been placed on simplicity, as indeed it is in the engine itself.

In this respect, the short duration of the project assists, for it removes the necessity for complicated cabin pressurising and conditioning equipment, for complex and heavy instrumentation and for extended power supply in the form of generators and pumps.

The small size permits control of the machine with manual effort with the exception of the tailplane. For the latter, a suitable electric jack has already been developed.

This emphasis on simplicity is not only highly desirable from a maintenance and constructional point of view in a period of great complexity in aircraft design, but also necessary to ensure that the basic weight of the aircraft is an absolute minimum.

Much attention has been paid to a detailed estimate of this weight, since, indeed, as in all aircraft, the performance depends so much upon it.

The advantages to be had in combat when using an aircraft with a high critical Mach number and an available acceleration as high as 2.5 g will be evident, particularly when this occurs at 55,000 feet.

National Archives of Australia NAA: A1196, 1/501/667

The ability to be aero-towed when in a light condition on such a modest expenditure of power will not only assist flight trials and the training of pilots, but make the transfer of aircraft a practicable proposition.

As will be appreciated from this report, all aspects of the project have received attention. It is felt that a real case is presented for the rocket fighter.

National Archives of Australia NAA: A1196, 1/501/667

AUSTRALIAN ARCHIVES
A1196 /2
1/501/667
Box: 0005
ACT 1 2 283 2 - 284 1

N8213F FSR
03/02/1994

NS

OPEN

OPENED

OPEN

National Archives of Australia

NAA: A1196, 1/501/667