SUGGESTED PROJECTS FOR STUDY, OTHER THAN THOSE PRESENTLY ON CONTRACT

ARROW

1. Extension of range to 650 N.M. (app.) Subsonic (Mark 2A)
2. Increase in speed to M = 2.5, in addition to (1) (Mark 3)
3. Increase in Fire Control System acquisition range (Mark 3A)
4. Reconnaissance version study, including refuelling.
5. Study of ultimate development of Arrow (Mark 4), and a study of a zero length launch scheme, i.e., jettisonable cradle launch.

MISSILES

6. Study of anti-ICBM missile, possibly one which can be carried aboard the Arrow.

OTHER PROJECTS

7. Study of ultimate manned interceptor and power plants, as defence against, say, a Mach 3 bomber.
8. Study of supersonic transport vehicle.
9. Study of economic cargo transport.
10. Study of STOL and VTOL projects, other than 606A.

RESEARCH

11. Study of orbiting winged vehicle, versus boost glide, versus ballistic.
12. Study of simple drag re-entry vehicle.
13. General research on propulsion units in conjunction with Orenda, including high energy fuels, nuclear power, etc.

MISCELLANEOUS

14. Possible extension of Manarali studies, or similar projects.

ARROW

1. Arrow 2A - Increase in radius of Arrow to approximately 650 Nautical Miles Subsonic

We have been asked unofficially by the RCAF to consider increasing the range of the Arrow 2 beyond the specification, and, on the work done to date, it appears that we can cram into the aircraft, in its present configuration, sufficient internal fuel for between 600 to 650 nautical miles radius, assuming a typical subsonic mission with supersonic combat. The study work on this has already been carried out, and what we require now is a go-ahead from the RCAF on the design of this Mark 2A.

2. Arrow 3 - Increase in speed to Mach 2.5, in addition to increase in internal fuel, as in (1)

While this has already been studied, the RCAF have not established a requirement for the increased speed. However, on a cursory examination, it appears that speed could be increased to Mach 2.5 by providing a moveable inlet ramp, a change in the nozzle, and development of equipment to take the higher temperatures. We estimate that a radius of action of approximately 420 nautical miles could be achieved on the supersonic mission, and around 300 subsonic, with supersonic combat. Combat altitude in both cases would be something over 68,000 feet. Any further work on this version will require a display of interest by the RCAF in the increased speed.

3. Arrow 3A - Increase in Fire Control System Acquisition Range

To exploit the weapon capability of the Mark 3 Mach 2.5 aircraft, fire control system acquisition range would have to be increased considerably because of higher closing rates. A study should be made of the latest developments, including the Hughes pulse doppler radar techniques, as applied to the Arrow.

The RCAF would obviously have to give their blessing to this study, and establish our need to know, which should be fairly easy on the basis of the visit of General Partridge and Air Marshal Sleman.

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ARROW (cont'd)

4. Reconnaissance Version

A study should be made of a reconnaissance version of the Arrow. This would require data from the RCAF on equipment which would have to be carried in the aircraft, and a brochure could be prepared for their perusal.

5. Ultimate Development of Arrow

A cursory examination has been made on a version of the Arrow to give maximum range and speed within the basic configuration, using wing fuel pods, a new undercarriage, retracted between the pods, additional ramjet powerplants, etc., and further studies on this should be undertaken to check feasibility of pushing the configuration to the limit.

Included in the above study, we should take a look at the possibility of a zero length launch scheme for the Arrow, similar to that used for the F100 zero length launch development work. Messrs Orr and Watson of DRB expressed some interest in this on their recent visit.

MISSILES

6. Study of Anti-ICBM Missile

For some time we have considered the possibility of carrying an anti-missile missile on the Arrow, used as a mother ship, to provide a mobile launching platform, giving better mobility, dispersion, etc. Jim Chamberlin has discussed this subject generally with Dr. Abrams, who is most interested in the basic philosophy. Dr. Abrams suggests that we establish a need to know through the RCAF, since quite a bit of data is available which would be very useful to us in our studies. This requires some discussion between the Company, the RCAF, and DRB, and should be followed up as soon as possible.

OTHER PROJECTS

7. Study of Ultimate Manned Interceptor

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OTHER PROJECTS (cont'd)

This study would consist mainly of a fairly detailed survey to ascertain what we, as a company, consider to be the ultimate manned interceptor development, i.e., the known limits of the present state of the art. Obviously, some threat will have to be assumed, and I understand that a Mach 3 bomber with a limited low level capability at Mach 2 is now considered as the maximum possibility for manned bombers. We would have to investigate optimum aircraft configurations and optimum powerplants, use of high energy fuels, etc., etc. This study would be more in the order of a survey of interceptor possibilities.

8. Study of Supersonic Transport Vehicle

I do not feel that we are ever likely to be able to sell a supersonic transport, in view of the fact that North American, due to their work on the supersonic X15 and the B70 chemical bomber, Boeing on the 707, and Douglas on the DC-8 will have the edge on everybody with their experience on these projects. However, I do believe that we should do an examination to satisfy ourselves that there are no technical breakthroughs which have been missed, the exploitation of which might give us an advantage over the established transport sellers. The work done by AVRO Manchester on the 730 should be of considerable interest here.

9. Study of Economic Cargo Transport

Here we have to look for a technical breakthrough on powerplants, which will allow us to get down to the 3¢ per ton mile target, which, so far, nobody has achieved. Our work on this will obviously have to be done in conjunction with Orenda.

10. Study of STOL and VTOL Projects, other than 606A

We have been doing a cursory investigation of a number of such projects, including the Goodyear inflatable aircraft, a jump gyro, etc., and should continue these investigations at about the same pace as at present.

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RESEARCH

11. Study of Orbiting Winged Vehicle

It became obvious to us some three or four months ago that it was possible to put a winged vehicle into orbit, and that there was a corridor where normal winged flight was possible between the minimum speed curve, above which it was impossible to sustain lift, and the maximum temperature curve below which the structure gets too hot. Reports by J. Allen in the United Kingdom have also substantiated this. This opens up the possibilities of hypersonic flight with a relatively conventional aircraft of low wing loading (about 20 lb. per square foot), which appears to us to be the easiest way to get a man into the threshold of space and recover him, flying back through the corridor.

We are at present carrying out a study to ascertain the relative merits of the winged vehicle versus boost glide or ballistic techniques. We hope to shortly give a briefing on this and later determine where we should go from there.

The concept has been discussed with John Orr and Gord Watson, who expressed a great deal of interest in it, and suggested that they may like to have a joint study carried out between ourselves and DRB.

12. Study of Simple Drag Re-entry Vehicle

This is a cursory study that we have carried out on the possibility of taking a standard ballistic missile, such as the Atlas, and fitting a 5 foot diameter sphere as the last stage, to ascertain whether it would be possible to get a man into orbit by this method, with a straight drag re-entry. The study is mainly to check the 'g' loading versus the maximum 'g' which a human being can stand, and the possibilities of suitably insulating a spherical body to prevent burn-up or excessive temperature inside the vehicle.

GENERAL RESEARCH

This includes the work that we have been carrying out on a survey of propulsion units, including nuclear power, ducted rockets, etc., and work on high energy fuels, electrogravities, plasma jets, etc.

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MISCELLANEOUS

14. Monorail

This heading is to allow for any further studies on the Monorail, or other than aircraft projects, which we might be asked to study for the A. V. Roe Canada Limited Group as a whole.

MANPOWER AND COST REQUIREMENTS

STUDY	Number presently employed	No. which could be employed	Estimated direct charges	Total cost increase 1958-59 Gov. fiscal year	
1. Arrow 2A	10	100	$ 200,000. (wind tunnel work)	$ 750,000.	
2. Arrow 3					
3. Arrow 3A	Investigation within present Overhead				
4. Arrow-reconnaissance version.	"	"	"		
5. Arrow-ultimate development	--	3		25,000. *	PRG
6. Anti-ICBM missile	3	25		200,000.	
7. Ultimate manned interceptor	--	3	--	30,000. *	PRG
8. Supersonic transport vehicle	--	2	--	15,000. *	IPO + PRG
9. Economic Cargo Transport	--	--	--	-- *	PRG
10 STOL & VTOL Projects	Investigation within present Overhead			*	PRG
11 Orbiting Winged Vehicle	2	2	--	-- *	PRG
12 Simple Drag Re-entry Vehicle	1	1	--	-- *	PRG
13 General Research	1	3	--	20,000. *	PRG
14 Miscellaneous - Monorail, etc.	2	2	--	-- *	PRG

Items 1, 2, 3, 4, and 6 would be carried out in the initial Projects Office and the main office.

*.. Project Research Group would require increase from 6 to 16 men, and budget increase of $90,000 - $100,000.

THIS WAS MY REPORT TABLED AT THE MANAGEMENT COMMITTEE MEETING IN EARLY JUNE 1958.
ALL WAS AGREED EXCEPT MY REQUEST FOR MORE PEOPLE AND MONEY FOR THE PROJECT RESEARCH GROUP, SO MY SIX PEOPLE AND MYSELF ON THE PROGRAMS LISTED UNDER PRG WERE PRETTY BUSY GUYS !!

(JIM FLOYD)