

19 February 1958

Sir Roy H. Dobson, C.B.E., J.P.,
Managing Director,
A.V. Roe & Company Limited,
Greengate, Middleton,
MANCHESTER, England.

Dear Sir Roy:

The following is a preliminary shot at looking at the Arrow with reference to G.O.R. 339.

Basically, of course, the requirements for the Arrow and G.O.R. 339 are different, the Arrow being designed for high speed, high altitude, high 'g' capability, and G.O.R. 339 being designed more towards a tactical role, with low altitude capability, short runway length, etc., being the prime requirements. However, I certainly agree with you that if we show that the Arrow would go even part way to meeting the G.O.R. 339 requirement, we should do so on the chance that its existence as an airplane at the time that G.O.R. 339 is required could make a lot of difference.

In the two days that we have had since your 'phone call we have obviously only been able to do a very cursory check, but these are my conclusions based on this.

1. The present Mk 2 aircraft is very limited in range at low altitude, but, with the addition of about 8,500 lbs. of fuel carried in the armament bay, and a drop tank, assuming that the drop tank is jettisoned after climb, and the bomb is semi-submerged, we can increase the range to about 450 nautical miles, including the 200 nautical miles at low level (1,500 ft.). While G.O.R. 339 asked for a supersonic capability at low altitude, we have shown on Chart 1 a speed of Mach .9, since we could only get to $M = 1.09$ at sea level, due to structural limitations, and this is an almost unuseable transonic area, and we would have a penalty on range of about 100 miles.

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The all-up weight would be around 71,000 lbs. and the runway length required would be somewhere in the order of 7,000 ft. which is, of course, much longer than the 3,000 ft. quoted in the specification, and it is not too easy to do anything about this on the Arrow, since jet flap, etc., would involve considerable redesign, and the benefit, in any case, would only be small.

2. We have had a very preliminary look at what we would have to do with the Arrow to come as close as we possibly can to G.O.R. 339 which, basically, would involve the following:

- (a) We would have to add approximately 38,000 lbs. of fuel. This would be achieved by installing two large fuel tanks at semi-span on each wing, also filling up every bit of available space in the aircraft, such as the space between intakes and fuselage, most of the armament bay, and also installing the long range belly tank.
- (b) To accomodate this increased weight we would have to completely redesign our undercarriage arrangement, and would probably retract the undercarriage (which would obviously be much larger than the present one) fore and aft into the wing pods.
- (c) We would have to do quite a bit of beefing up on the structure, increasing the outer wing skin thickness and the inner wing joint, and do some fuselage strengthening where extra fuel is carried in the fuselage.
- (d) We would install the high pressure ratio Iroquois engine to give us better fuel consumption at low altitude.

With the above basic changes we could probably get close to the 1,000 nautical miles that is called for in the specification, provided that we carried out the low level portion at Mach .9 and operated at around 3,000 ft. altitude. The gross weight of this version would be around 110,000 lbs. It would have a very high stalling speed, somewhere in the order of 230 miles per hour at maximum gross weight, and I believe that we would have to have JATO for take-off. We have estimated very roughly that without JATO the take-off run would be over 13,000 feet. With JATO this

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this would be reduced to around 7,000 feet, which is of course, still away above the requirement.

I hope that I have been able to give you a reasonable date for discussion in the limited time available, and, if you wish, we would be glad to proceed further with this study if you think it is worthwhile. I am attaching two charts showing the basic Arrow 2 capability against G.O.R. 339, and also a chart showing what we might expect with the pretty major modifications that I have mentioned.

The first aircraft is still going reasonably well. We are hoping to run engines today, since we have had such a blizzard in the last two days that we were not able to trim the engines, due to side-flow on the intakes. When this particular job is through we have about another five days of final buttoning up and inspection, and we are hoping to start the high speed taxi runs towards the beginning of next week. On any of these runs Zura could, of course, go aviating. I will try to keep you posted about every two days.

I have no idea where the rumor that Zura had actually tried to take off came from since, as I mentioned in the telephone conversation, we have been on control system simulation for the last three weeks with the aircraft firmly tied down in the hangar. Incidentally, the simulation went reasonably well, and I think that Zura is now feeling very much happier about it and is itching to fly.

It was a very pleasant surprise, Sir Roy, to hear your voice again and I hope that you will be coming out to visit us very soon. Please let me know if you would like me to go any further on the G.O.R. 339 business.

Best of luck,

Sincerely,

JCF

J.C. Floyd,