SE ON 10 - FIRE CONTROL SUBSYSTEM ENGINEERING DEVELOPMENT

10.1 AI Radome

10.1.1 The reference is RCAF Plant Representative Status Report No. 19, Section 10, dated 19 Feb 58.

10.1.2 The current state of radome development is as described in BBC Report No. 1216, "Preliminary Design and Development Report Arrow II Program" dated 21 Jan 58, referred in para 10.1.3 of the above reference. Based on this report, discussion between BBC, TRG, AVRO and RCA has led to a minimum specification on the Arrow II radome. This has been formalized as a "Class B" radome in RCA Drawing No. 8940240A and also in AVROCAN Specification E-411, Issue 2, which are very similar. Radomes to these specifications reflect the state-of-the-art and are adequate for Sparrow II.

10.1.3 The "Class A" radome of RCA Drawing No. 8940240A corresponds to the requirements for the ASTRA system firing Genie. Comparison of the requirements for the Class A and Class B show the permissible deviation from ideal to vary from being the same to being three times as stringent for Class A as for Class B. Obviously, no simple generalization will adequately treat the situation. However, for purposes of discussion, assume that, on the average, the Class B radome introduces twice the error permitted the Class A radome. If it is also assumed that the AES contains ten other error sources of the same size as the Class A radome, which remain unchanged, then doubling the error contribution of the radome will increase the total error (root of the sum of the squares) by 12 percent. Or assuming a normal distribution, it will reduce the probability of kill due only to this factor to 95 percent (of that using the Class A radome).

10.1.4 Another adverse effect of the reduced radome quality was apparent in the simulation results. The time required for attainment of the desired course was, in general, appreciably longer. This was caused by over-correction and consequent overshooting the desired course so that two or three crossovers occurred before steady on-target heading was obtained. This would be extremely detrimental under ECM conditions when the target acquisition distance was reduced.

10.1.5 The Class B radome transmission specification has also been relaxed (from 85 percent minimum of Class A) to as low as 70 percent. The effect of this is to reduce the range by about 10 percent.

10.1.6 The acceptance of the Class B radome also carries with it the assumption that a lower coupler gain will be used. The velocity error of the loop will be, of course, larger by reason of the lower gain for the general case of the manoeuvering target.

10.1.7 Summarizing the losses resulting from the acceptance of the Class B radome instead of Class A:

(a) From the simulation data, it is evident that more time will be required to get "on course". The amount of time required is dependent upon many

factors, but 15 seconds appears to be a reasonable average figure.

(b) Assuming a closing rate of Mach 2 and 5 mile reduction in target acquisition range, there is a loss of 15 seconds of time.

(c) Reduction of kill probability to 95 percent of Class A value.

10.1.8 Stated in other terms, the interceptor will come to a collision course about 30 seconds later with the Class B radome than with the Class A, during which time the target may initiate evasive action and/or countermeasures and the kill probability will be reduced to 95 percent of the Class A value.

10.1.9 It is, therefore, strongly recommended that a radome development program be undertaken by AVRO to make radomes available to the Class A specification at a date compatible with evaluation for Genie capability.