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S1038CN-183 (DADR)

MEMORANDUM

25 Feb 58

COR

Arrow Weapons System - Genie Capability

1 OCH 1/1-63 calls for a "nuclear head capability" for Arrow weapons. At present the Genie unguided rocket is the only air-to-air weapon which carries a nuclear warhead. Consequently, when Sparrow 3 was cancelled by Air Council on 16 May 57, it was decided to retain a Genie capability in the Astra 1 system as a back-up for Sparrow 2, although AMTS remarked at the time that the RCAF should wait for a guided nuclear missile and meanwhile plan only for Sparrow 2.

2 Recent information now indicates that the USA have developed a nuclear warhead which should be compatible with the present series of air-to-air guided missiles as regards size and safe launch range. Consequently, the USAF has initiated a crash programme to modify the Falcon GAR 1 to accept this warhead as armament for the F102 (with possible later modifications to the Falcon GAR 3 for the F101 and F106 as a replacement for Genie). It was also learned that the USAF does not intend to proceed with improvements to Genie.

3 DADR staff have recently expressed serious doubts as to the wisdom of proceeding with a Genie capability for the Arrow, and these are summarized as follows:

- (a) Because Genie is an unguided rocket which employs a pre-set time fuze, it must be launched at a specific range with an interceptor heading error of less than one degree. It is therefore completely dependent on continuous AI range for successful launch. Also, the kill probability of this weapon is directly affected by the range at which the interceptor must launch the weapon in order to achieve a safe escape from radiation effects of the explosion. A DSE study (ZED 58/5 dated 14 Feb 58) shows that the problem of safe escape versus desired kill probability becomes critical in the case of the Arrow at M1.5 attacking a Bison target (subsonic) at 50,000 feet regardless of the attack approach angle or AI acquisition range.
- (b) The estimated overall effectiveness of the Arrow armed with Genie as compared with Sparrow 2 shows a superiority of only 11% under ideal conditions, due to the generous tolerance in launch range, GCI placement and interceptor launch heading errors inherent in the Sparrow 2 missile. However, under more realistic conditions of ECM, the effectiveness of Genie rapidly drops below that of Sparrow 2, as shown in the following table taken from a study made in Aug 57.

*condemned. Perhaps your current study  
is also this, though it may not  
specifically deal on development time  
is problem of Sparrow 2/nuclear weapon.*  
W.B./k  
28/2

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Arrow

	<u>Sparrow</u>	<u>Genie</u>
No ECM	0.50	0.61
ECM v GE only	0.43	0.53
ECM v AI only	0.34	0.01
ECM v GE and AI	0.29	0.00

On this score alone, the value of Genie as armament for the Arrow is questionable.

- (c) Provision of a Genie capability for the Arrow has imposed complexities in design of the Astra system which would not otherwise exist; also, a proposal expected from AVRO by 1 May 58 may reveal that supersonic launch complicates design of a suitable weapons pack for Genie.

4

In summary:

- (a) Genie was designed primarily as armament for subsonic interceptors, and the USAF appear to be making every effort to replace it as soon as possible with a nuclear guided missile of the current series, followed by a much more advanced air-to-air missile for interceptors of the 1963 era.
- (b) Immediate cancellation of the Genie requirement would greatly simplify design of the Astra 1 system, eliminate the need for a special Genie pack, and would in practical terms only penalize the effectiveness of the Arrow in regard to a two-pass capability.
- (c) It now appears reasonable to assume that the Sparrow 2 could be modified to accept a suitable new type of nuclear warhead without changing the basic missile characteristics.
- (d) To exploit the full potential of ultimate versions of the Arrow, United States programmes for a new generation of greatly improved nuclear air-to-air missiles should be closely monitored.

*Incorrect. Sparrow figures above apply to a salvo of 2 Sparrows per pass.*

*7 May 58 HAN R/L ADR 2-5*

5 It is therefore urgently recommended that Air Council be requested to reconsider their decision to retain a Genie capability in the Astra 1 system as recorded in the minutes of the 262nd Meeting of Air Council on 16 May 57.

② DADR

*as stated. It is noted that Genie capability will Astra if only 6" requires an adequate missile capability for F.C. system.*

*I don't feel we can drop Genie until we know the effect on the Astra 1 system.*

*on both the following decisions: (a) using 2 AI or more (b) increasing of an Astra 1 pack*

*by 8 and as shown to (c) on*

*21/3*

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