Report

1- Application of pulsed - C.W. radar to study of rockets & other large ~~ballistics~~ projectiles ballistics

2- A method of determing ~~average~~ average miss-distance of a salvo of air to air ~~fired~~ rockets

3- An exact method of determining miss distance of air to air rockets-

3- Proposed ~~four~~ target configurations for rocket firings

In the development of instrumentation for use ~~of~~ in determination of miss-distance of air to air rockets in support of projects APG-ADA 54A + APG-ADA 49-A-4 several techniques were evolved which should have very wide application to ballistics studies. The most promising of these is the use of pulsed radar to obtain continuous positional data of rockets. So far as I know ~~this method has~~ the use of radar in ballistics studies has been limited ~~to~~ ground to doppler sets for determination of velocity + acceleration during ground firings.

~~The~~ Application of pulsed radar is simple and straight forward with a short pulse set in the aircraft painting the rockets and displaying ~~the~~ range data on an A presentation. This could be displayed as well by a 'J' presentation with an increase in range without sacrificing resolution

but it would make ~~late redact~~ record reading more

difficult -

~~there~~ As just stated the method is straight forward with the only trick being the ~~reception~~ ~~of~~ rockets having sufficent cross section for a usable return. That returns from a rocket was consistently ~~the~~ large enough to be usable was somewhat of a surprise to me and apparently many others. ~~It~~

All rockets used in these tests were ~~various~~ models of the NOTS 2.75" FFAR. Since its body cross-section is only 5.9 ~~4~~ in^2 and its fins provide only a few in^2 more several people have expressed the opinion that ionized exhaust gases play a primary role in reflection but this does not seem to be the case since no abrupt changes take place in signal return during or after burnout. See appendix I ~~Rather~~ ~~Don't~~ Rather it seems that ~~in~~ ~~f~~ under free space conditions radar sets achieve

sensitivities not commonly realized. For instance R.D. ~~[illegible]~~ report being able to track 20 mm projectiles for more than a thousand yards with ~~the~~ G-33 radar.

~~First of primary concern~~ All of the work done in bypass for tracking of rockets has been with standard airborne sets in X band. Preliminary work was done with the G-40 ~~in~~ (.5 μ sec pulse 40 KW peak Ant L of only a few degrees) but the majority has been done with G-30 (.4 μ sec pulse 5 KW peak and [illegible]° 1B antenna angle). While these sets in their present configuration with the addition of ~~video amps.~~ & A presentation could be used it would be more desirable to build or modify existing sets for instrumentation use. ~~Modifications should be the~~ Desirable features are short pulse length (on the order of .1 microsecond to improve resolution, broadening of I.F.'s to ~~maintain~~ maintain ~~pulse~~ time / rise on shape.

pulse edges, wide band video amplifiers ~~for the~~
~~loss~~ for pulse fidelity, clanking circuits or other
changes to / eliminate ringing in the IF's which would
~~obscure~~ blanket short ranges, ~~the~~ changes in
the duplexer (T.R. + A.T.R. tubes) to decrease
switching time which would also obscure short range-

Of primary interest in rocket ballistics are velocity
and acceleration. All of this data can be obtained
from radar alone. The Appendix carries a detailed
description of a possible configuration while ~~the~~
~~main~~ only general outlines will be discussed here.

~~became that we~~ An airborne set ~~of~~ X band
set of 10 KW peak with an antenna angle of
10 degrees, ~~would~~ with .1 u sec. pulse would be
an ideal ~~one~~ set up. ~~Next must be added~~ a
video amp of at least 12 m.c. and preferably
20 or more with sufficient gain to give a deflection
of at least half inch ~~deflection~~. ~~the~~ This should
be presented vertically of a 5" high intensity

V.

scope which has a linear ~~vertical~~ horizontal ~~sweep~~ sweep.

This sweep should be capable of being delayed and/or expanded to cover any range or segment of range desired. Repetition rate should be about 1 K.C.

Information from the scope ~~should~~ will recorded by an oscillographic camera moving the film continuously past the scope in the direction of its vertical deflection at a rate of about 100 ins/sec. Video information will be recorded as a series of lateral traces on the film.

At the end of the run