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REPORT OF THE ARMY SCIENCE BOARD

SINGGARS REVIEW GROUP

Statement of the Problem

To determine the basis and validity of the SINGGARS-V threat and to relate the threat to the System Design and Program Development Strategy.

Observations

1. An affordable new radio is badly needed.
2. Examination of the postulated threat for SINGGARS-V indicates:
  - a. There is no hard information on any Soviet threat equipment development beyond R-330 (possibly improved), especially a transponder jammer.
  - b. No analysis has been done based on realistic scenarios on "M" jammers on "N" nets.
  - c. Even imaging projected U.S. ECM plans, the most advanced won't counter FH in a transponder mode.
  - d. Imaging advanced U.S. technology (6.1 and 6.2) is the only basis for projecting an adequate transponder jammer.
  - e. From risk and cost standpoints barrage jamming is likely to be the Soviet choice for FH ECM.
3. Reasons why Soviets will likely decide not to go to transponder jamming are:
  - a. FFH will defeat the transponder jammer.
  - b. Soviets can't go to frequency hopping in their own communications development and use transponder jamming since they would jam their FH transmissions.

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c. Jammers self interfere with each other since each jammer requires a receiver unless the jammers are separated in frequency and/or time, thus making each jammer less effective.

d. Soviets would probably have to lockout in their transponder jammer their communications frequencies. We would then be able to find out the Soviet communications order of battle.

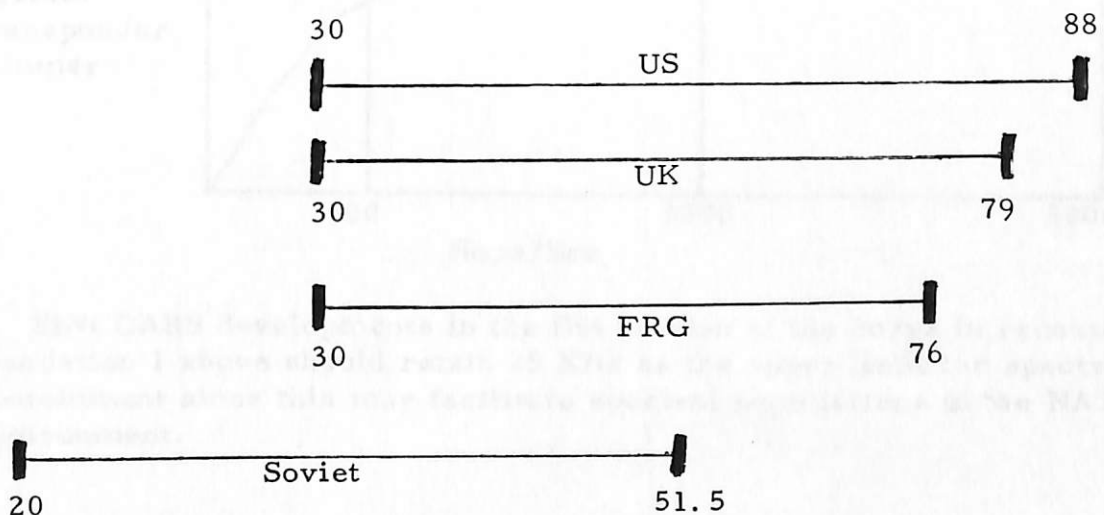
e. U.S. could decoy or saturate Soviet jammers by using U.S. radios or special purpose jammers.

f. High unit cost.

g. A transponder jammer makes an outstanding target for DF'ing, ARM weapons, spoofing, overloading and self jamming; and hence is highly vulnerable.

4. Since barrage jamming is the most likely choice for Soviet response to FH, we need to develop the capability, doctrine and training to counter such threat.

5. The lack of symmetrical overlap in spectrum usage between NATO and Soviets implies opportunity for Soviets to jam without self disruption. The Soviets can jam the 51.5 to 88 MHz band and not interfere with their communications. Thus without lockout of the 51.5 to 88 MHz band the FH systems will be badly degraded under these circumstances and a lockout of 51.5 to 88 MHz will lower the AJ capability of SINCGARS.



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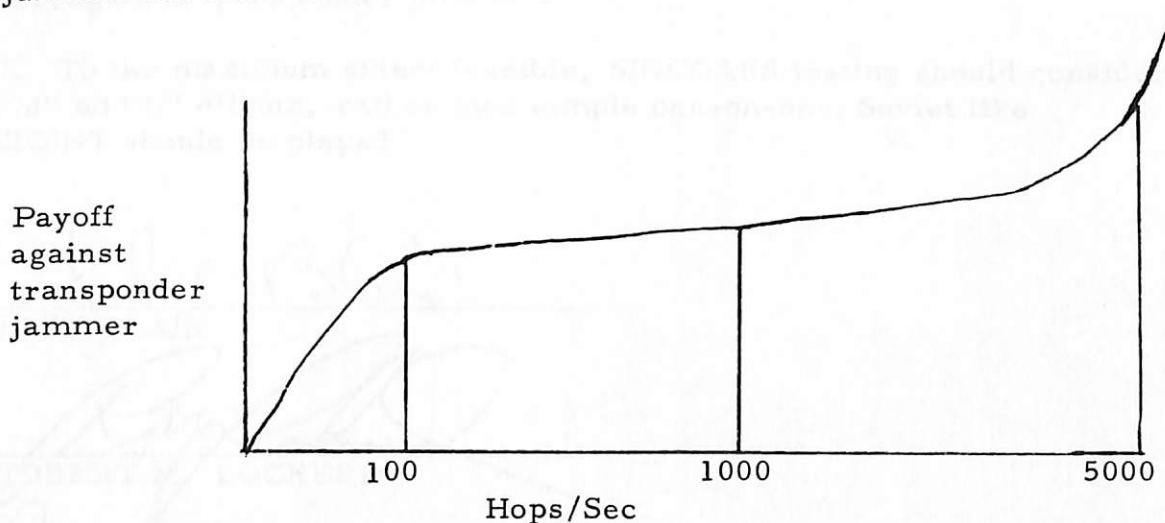
. Any FH severely complicates the Soviet SIGINT and ECM problem and takes both out of the manually operated mode. We may miss a crucial advantage by not having all radios capable of at least an inexpensive very low rate (a few/sec - determined by cost) FH, which would completely obsolete existing COMINT/ECM and give both AJ and privacy against unsophisticated opponents - in peacetime training, crises and wartime.

7. Spectral containment to within 25 KHz bandwidth for RSI and NATO interoperability is desirable.

#### Recommendations/Conclusions

1. High rate FH (e. g. ,  $> 3$  K hops/sec) to gain speed of light protection is not justified by any threat we envision likely to be fielded by the Soviets. Work on FFH should be continued only as a technology backup unless its cost is determined to be competitive with the SFH technology.

The following curve is an intuitive projection of the payoff expected with frequency hopping radios operating in a transponder jammer environment.



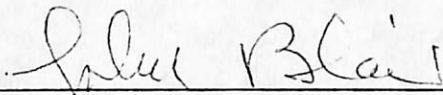
2. SINCGARS developments in the flat portion of the curve in recommendation 1 above should retain 25 KHz as the upper limit for spectrum containment since this may facilitate spectral negotiations in the NATO environment.

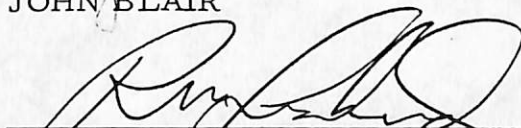
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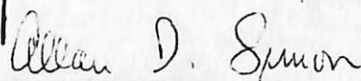
The Group felt that while faster FH would provide some improved performance in an ECM environment the curve above shows that the performance improvement is gradual and small as the hop rate increases from one hundred to several thousand per second. Only when the hop rate is so high, about 4000/second, that the speed of light limits the jamming signal from reaching the receiver during the hop period is there a major further improvement.

4. SINCGARS should proceed as rapidly as possible with the program as defined before the threat change.
5. While not a direct topic of the study, an evaluation of including at least minimum integral hopping (few hops/sec) capability in all SINCGARS radios for basic ECCM and privacy capability should be done as rapidly as possible. Both SINCGARS cost and Soviet reaction should be considered. Higher hop rates would continue to be available by add-on module as in the current approach.
6. More emphasis should be placed on projecting the deployed SINCGARS scenarios and use of doctrine; in particular, problems such as ability to attack (locate and destroy, jam, overload, etc.) barrage and transponder jammers.
7. To the maximum extent feasible, SINCGARS testing should consider "M" on "N" effects, rather than simple one-on-one; Soviet like SIGINT should be played.

  
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