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INTERNAL NOTE

A COST EFFECTIVENESS ANALYSIS OF FIRST WAVE OCA ATTACKS USING GROUND LAUNCHED MISSILES

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PREFACE

This Internal Note has been written in support of a Rand Project AIR FORCE study addressing standoff weapons (RPN 3334). It presents a cost effectiveness analysis of a specific type of offensive counterair mission. That mission is the quick response attack of the operating surfaces at a typical Warsaw Pact airbase using ground launched missiles. The objective of the attack is to do some specified level of damage to the operating surfaces to keep them from being used. Different levels of damage are specified, and the costs of doing the job using four different types of missiles are compared. The least cost system is identified as a function of the level of damage desired.

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A COST EFFECTIVENESS ANALYSIS OF FIRST WAVE OCA ATTACKS USING GROUND LAUNCHED MISSILES

This memo reports on the resources which must be given up in peacetime to insure that we have a specific military capability should war occur. In order to make meaningful comparisons, we will define the capability we desire (the mission) and then compare what the costs are to do that job using different systems. The objective is to provide a simple, transparent analysis which has some relevance to the real world.

THE MISSION

The military capability which this Note addresses is ability to crater enemy landing/takeoff surfaces within a short time (launch preparation time plus cruise missile time-of-flight or less) of the receipt of authority to attack the enemy's territory, and to do this without having to use aircraft (which may be needed for other tasks and which may have a comparatively restricted launch rate). This Note assumes that such a capability is useful and that the only questions which need to be answered deal with which system is necessary to do such a mission. The final analysis of the wisdom of such a "canned" response to the start of hostilities will requires a campaign analysis. Jack Ellis has been working on such an effort in an independent part of the standoff weapons study.

The mission, then, is to produce some predetermined minimum number of craters in each of the 3000' x 50' minimum clear operating strips which are available at each of 28 main fighter bases. Each base has one 8000' x 200' runway and a single 8000' x 80' taxiway which can be used for takeoff surfaces. These numbers are roughly representative of the Warsaw Pact target set. The number of craters "required" to complete this mission is left to the discretion of the decisionmaker (the reader in this case) due to our lack of knowledge as to how long is required to repair any given number of craters and the overall impact on the war that such a delay in airfield operations produces.

THE SYSTEMS

Four systems have been selected as candidates for this mission; their characteristics are shown in the table.

The delivery accuracies of each of the systems are specified in a companion IN entitled *Some Effectiveness Assessments of Standoff Weapons Against Airfield Takeoff Surfaces*. That Note also details the weaponeering used to develop the effectiveness measure.

The payload of each of the candidates has been adjusted so that the ranges are roughly comparable. The adjustments have been based on the work done by Bill Krase. Each of the systems is intended to be a quick-response, single-shot system; the cost estimates do not allow for missile reloads, munitions storage facilities for these reloads, reload equipment nor the personnel to conduct sustained combat operations. If subsequent analysis indicates that this capability is desirable, additional resources will be needed to acquire this added capability.

A fixed basing system was chosen for these missiles. The reason for this choice is twofold: given the limited objectives of the mission, such a basing mode is likely to be of significantly lower cost than mobile alternatives and the practicality of mobile basing schemes for the larger missiles is questionable at best. The fixed basing system

Table 1

STANDOFF WEAPONS FOR RUNWAY ATTACK

	Payload (KEP/BKEP)	Range nm)	Gross Wt. (lbs)
Large AXE (BOSS)	384	443	57871
Large AXE (C-4 w MARV)	352	425	55590
Small AXE (PII)	58	432	17387
Cruise Missile (Ground Launched MRASM)	22	440	3200

uses vertical silos to protect the missiles prior to launch. Silo design (and cost) reflects a level of protection (1000 psi) which will require an unambiguous crossing of the nuclear threshold if nuclear weapons are to be used to counter the system.

COSTS

In accordance with our overall cost methodology, the costs estimated for the proposed systems are the 15-year life cycle costs (R&D, Procurement and Operations) for the target acquisition ability, command and control, firing unit TO&E and ammunition (missiles) needed to perform the mission. Target acquisition and command and control costs are assumed sunk except for those necessary to "connect" the proposed system to the existing C^3I structure. The cost estimates are based on the cost modeling work done for the standoff weapons study and are reported in an IN entitled *Cost Estimates for Selected Standoff Weapons* and a companion WD entitled *Ground Launched Standoff Weapons Systems: Unit Force Structure Designs, Cost Data, Transportability and Deployment Analysis*.

EFFECTIVENESS

The effectiveness measures for each of the systems--the minimum number of craters in the clear strip--have been based on the TSARINA model. In the analysis, KEP and BKEP craters are assumed to be comparable. In the interests of simplicity, only the runway and taxiway at each of the 28 bases was considered as the target. Pre- and post-launch survivability has not been considered in the absence of a convincing argument that there are real differences between the systems. The two large AXE weapons uniformly distributed their packs of submunitions along the runway; the small AXE was targeted on two cuts per runway (one cut per missile) as was the cruise missile (two cuts per missile). Weapon pattern radius was adjusted to account for target dimensions and each vehicle's accuracy. Preliminary weaponeering analysis indicated that these attack schemes were near optimal given the delivery constraints of the proposed systems.

CONCLUSIONS

The results of the analysis are presented in Figure 1. Total system cost is plotted as a function of the average number of craters in the minimum operating strip at each of the 28 airbases. Once the level of damage (number of craters) has been determined, it is possible to compare the cost of the system (missile force) required to do this job with the various types of missiles. Although the functions are discrete (adding one more missile per airfield adds 28 missiles to the force), I have connected the points with lines to aid in visually sorting out the data, and have taken some liberty with accuracy in hopes that the display may be less confusing. It displays the total 15 year life cycle cost for even increments of ten craters.

These figures implicitly compare the effectiveness which results from a dollar's worth of increased accuracy to that from a dollar's worth of increased payload. At the lower damage levels (20 craters or less), the more accurate systems (GLMRASM) are the least cost force, and therefore the most cost effective. Above this level of damage, the C-4 w MARV AXE (a paper system) or the PII (a hardware system) begin to show increasing dominance. The BOSS system (using the accuracy we have assessed for this concept) is not a contender until three or four missiles per runway are used (30 to 40 craters). Even then it is not superior to the PII. For the large AXE to to become superior to the PII, two improvements will be required; first, the cost of the program will have to be lowered to that which we are projecting for the C-4 w MARV system, and second, the accuracy will need to be improved. Neither improvement by itself is sufficient to make the large AXE superior to the PII at the damage levels considered in this analysis.

ADDITIONAL CONSIDERATIONS

The most effective weapon to attack taxiways and sod strips may not be the same as that for runways due to the unique demands these other operating surfaces make on weapons to defeat them. More accuracy may be needed for the taxiways, while greater payload may be necessary to adequately defeat the sod strips. If this proves to be correct, a mixed force may be the best option. Because of the mission requirement to crater the operating surfaces within a short period of time, a shoot-look-shoot firing doctrine was not used. Since this is a more effective way to employ weapons than a salvo, it may be the most effective way to conduct follow-on attacks. This firing doctrine works best with a highly accurate missile with a small payload. This again may argue for a mixed force if the cost advantages of the additional production run for follow-on attack missiles do not outweigh the greater efficiency of the accurately placed, small payload.

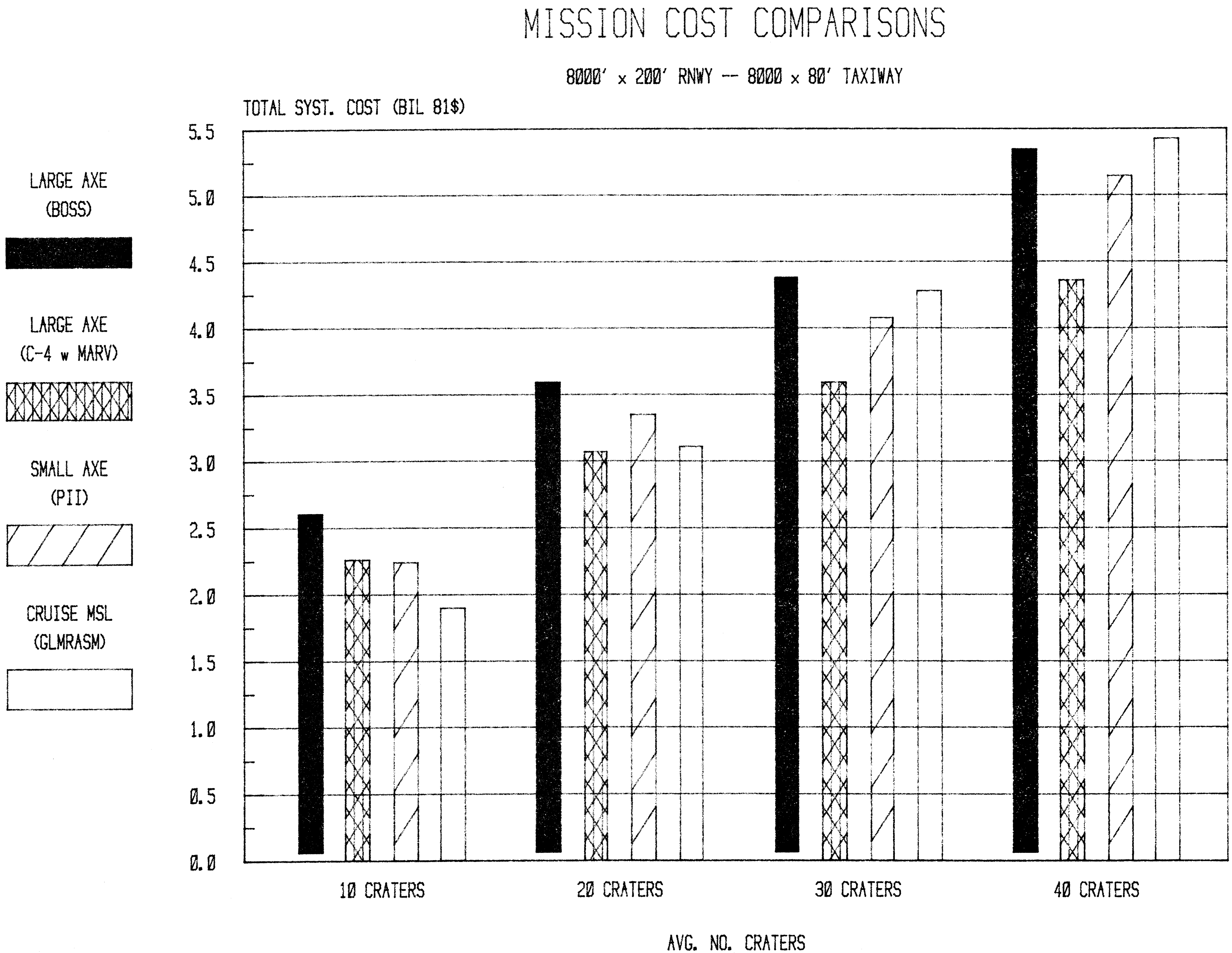

Fig. 1 -- Mission Cost Comparisons