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ANALYSIS OF ARMED RECONNAISSANCE SCOUT VEHICLE OPERATIONS

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1. Though the ARSV effort appears likely to go the conventional development route (if at all), the problem has considerable interest as a vehicle for amplifying our Tactical Warfare analysis approach in the functional areas of Maneuver and Intelligence. Further, the need for a comprehensive understanding of how vehicle performance characteristics will affect mission accomplishment, and how mission accomplishment will affect Army tactical capabilities will no doubt be felt as the ARSV project moves "up the line". Still further, an example of this kind may be useful in our future discussions with Army Materiel Command and Combat Development Command Agencies.

2. For these reasons I have spent some little time sketching out the following thoughts on the problem. It appears to me we might spend some effort next year in this direction, though at a lower priority than several of our other projects.

3. The U.S. Army's ARSV Request For Proposal (RFP) states as an objective: "Establishment of firm and realistic performance specifications." It also states -- "The ARSV System required must provide significant improvements over existing command and reconnaissance-type vehicles in at least the following performance areas:

(i). Mobility
(ii). Observation, vision, fire control
(iii). Ballistic protection
(iv). Reliability
(v). Quietness of operation
(vi). Durability
(vii). Maintainability
(viii). Human factors and safety."

As implied by the words "at least" this list is not complete as to the performance areas (e.g., fire power) which must be considered in the design of the vehicle.

4. Certain of the listed performance areas obviously have an impact on each other -- for instance, added ballistic protection will in general decrease mobility and may impair observation. Even within one of the listed areas there may be opposing considerations -- e.g., under mobility, which is more important, speed or the capability to cope with conditions of low trafficability?

5. Just which of the many theoretical questions that can be posed are of importance to the practical matters of vehicle design is a question to be answered during the design process. It is of little use to compare the advantages of mobility to those of ballistic protection unless the designer needs a decision on the permissible weight of armor plate. When he does need such an answer, and can express the alternatives in terms of performance characteristics (speed vs. probability of damage by specified enemy fire), the operations analyst gets the question - "Is it better to get there faster, or to get there more safely? Or is it possible the greater speed will do more to reduce vulnerability than will added protection?"

6. Such questions can be answered to a certain level of precision by military opinion based on prior experience. These answers are in fact usually furnished in the form of requirements -- "the vehicle must be capable of a top speed of X miles per hour and have at least Y inches of armor protection." The question recurs, however, when the designer finds he can furnish a small increment of either X or Y and wants to know which is preferred. Or, as is sometimes the case, he can meet the requirement in one respect or the other, but not both. When the alternative increments are small, military opinion as a means of decision breaks down; often there is a split between those who in the past have found speed valuable and those who have seen instances in which armor protection was invaluable. When this occurs an analytic model of the phenomenon can be of great assistance. Such a model should not be viewed as "answering" the question in any precise way, because of the typical sensitivity of such a model to inputs, assumptions, and calculational approximations. The model can, however, by providing a more detailed insight into the relevant factors and furnishing parametric output on their influence, assist the decision-makers in their task.

7. The context of such questions for a combat vehicle must, of course, be its combat utilization, and thus the question becomes one of what speed (vs. lower vulnerability) can contribute to the vehicle's role in battle. The ARSV's role includes functions of intelligence, fire, maneuver, communication, and transportation of combat troops. A search role, requiring gathering and communication of intelligence could well emphasize speed, while the transportation of troops (en route to some ground observation mission) might emphasize ballistic protection. Thus what is needed is some analytic mechanism which can determine the utility of vehicle characteristics in various roles, and also give some evaluation of the contribution of these various roles to the combat worth of the vehicle. That mechanism is, of course, outlined in our "*Anatomy of Combat*" [1]

8. Presumably the principal ARSV role will be as a carrier for the Scout squad of a Reconnaissance platoon. The platoon may be a part of a Reconnaissance troop or squadron. The typical operations of such units are intelligence-gathering, serving as a screening force, or conducting a delaying action. Mechanized infantry units, transported in vehicles such as the Mechanized Infantry Combat Vehicle (MICV), take on the heavier combat tasks. The differing missions lead to differing required characteristics for the two vehicles -- they should complement each other in the transport of soldiers for battlefield tasks.

9. Section 9, Chapter 3 of Reference 1 describes methods which can be used in the analysis of elemental tactical situations. These methods should be used to evaluate the performance of ARSV's of varying characteristics in a number of typical situations in selected map terrain. In order to enable delineation of the difference between ARSV and MICV, two tasks are included which are generally more suitable for the latter vehicle. The selected tactical situations are:

a) Reconnaissance (intelligence-gathering) over a considerable area against light opposition.

b) Reconnaissance against heavy opposition with the mission of developing enemy locations and order of battle.

c) Delay of attacking force.

[1] Reference 1. See THE ANATOMY OF COMBAT, on our Website at: www.TheAnatomyOfCombat.com

d) Mobile defense on prepared line (not "fortified"). (This mission probably more pertinent to MICV.)

e) Attack of a prepared line. (This mission also more pertinent to MICV.)

10. The utility of various performance characteristics in each of the above situations can be directly calculated in terms of the objective function over some appropriate parametric range of the characteristic. (It should be remembered that these values are for comparative purposes only; the uncertainties of input will preclude regarding them as a genuine forecast of tactical performance.) The performance characteristics credited to present combat vehicles of the types under study should be used as a norm for comparison of the added combat effectiveness of conceptual vehicles.

11. Each of the engagement situations listed above can be considered a miniature "scenario" (See Figure 3-2, Reference 1). The military objectives are different for each of the five, and the other scenario variables will be treated as follows:

a) Political Constraints -- Not applicable at this level. Time pressures will exist, and be reflected in the objective value assigned, but these are ascribed to military, rather than political considerations.

b) Environment -- In order to hold down the total number of variations, only one basic terrain area, set in western Germany will be employed. Night and weather variations (affecting both mobility and observation) will be specified

c) Red Force -- Various numbers and types of opposing elements will be interjected into each "scenario" (at least two alternatives in each case).

d) Blue Force -- In scenario a) (Para. 8) the ARSV operating alone will be considered. In all five scenarios comparisons will be made for the elements of a mechanized infantry platoon (including MICV), and those of a Reconnaissance Platoon. The latter will be taken as currently existent in the ROAD division -- viz., a platoon headquarters in ARSV, a four-ARSV scout section, a tank section, and a support section. The "elements" entering into course-of -action calculations will be combat vehicles including crews; capabilities of the dismounted crews will not be studied in detail.

12. The above procedure is expected to produce quantitative evidence as to the relative desirability of various operating characteristics in each of the five scenarios. It is not to be expected that the relative desirability of characteristics will be the same in each scenario; certainly they should be different in scenarios d) and e) (Paragraph 9), which represent MICV missions.

13. Certain of the listed performance factors (e.g., maintainability) are not strongly determinative of the objective value realized in tactical situations such as are modeled in these "scenarios". Rather these factors establish the "cost" to the utilizing force of the piece of hardware (ARSV which is used to gain that value. This "cost" is measured in terms of the friendly force effort required for support of the vehicle and its crew. (See Chapters 3, 5, and 6 of Reference 1). The overall effectiveness or "productivity" of the vehicle is measured by the objective value realized divided by the cost of the effort.

The method for estimation of input effort incorporated one major assumption ("well-designed force") and several arbitrary ground rules for spreading cost (in effort) among very dissimilar elements. For the analysis of the ARSV (or the MICV) it should be possible to be somewhat more precise, since we need only compare the "costs" of armored troop-carrying vehicles, current and conceptual. The precision of the analysis will be limited to the existing capability to estimate costs in man-hours expended on various support tasks.

Appendix A