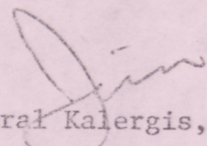


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DRAFT

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Dear General Kalergis,

I read the ARSV case history with interest and have no disagreement with the description of the events leading to the recent decision to terminate the contracts, nor do I object to any of the proposed lessons learned. Concept formulation time of four and one half years is unquestionably too long. The unsuccessful hybrid development program was justifiably criticized. User inspection could have been accomplished several months earlier. While controversies between prominent personalities will no doubt persist in the future, as in the past, they should be resolved if possible.

In my view, however, the most fundamental and important lesson learned is the need to define defensible operational capabilities which are derived from a sound, widely-accepted military concept of employment. This is "step one" and, in retrospect, the step which has proved most vulnerable. We began with an assumption that we needed a better version of the M114. Under the pressure of constrained resources and the demand for priorities, that assumption now appears to be unsound.

The assumed concept was that a dedicated scout vehicle needed a mobility differential over enemy and friendly main force units in order to transport its human scout to a position from which he could gain and maintain visual contact with enemy forces. Top priority was assigned to the reconnaissance mission and mobility was designated as the primary requirement. USAREUR, the ultimate user, lost interest because its military

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BY BAKERZ ON 26 MAR 87

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requirements were more weighted toward security than reconnaissance. Today even the utility of the ARSV as a reconnaissance vehicle is challenged. The mobility differential sought after is marginal, particularly when compared to the dramatic mobility differential inherent in an air scout. Also, the reconnaissance/intelligence gathering capability of any proposed scout vehicle should clearly offer more STANO capability and ease of dismounted operations than the current prototypes.

I doubt that any COEA that is asked to measure the effectiveness of candidate systems against an unsound military concept can produce a sound analysis. Thus, I hesitate to say that a thorough COEA would have helped us. Even a rudimentary COEA, if it is based on a sound concept can offer greater insight into the ARSV problem than Booz-Allen's effort. Attached, as an example, is a very simplistic COEA comparing the ARSV (tracked version) with the MICV. It indicates the MICV as a better choice, and while the concept used gives special weight to the reconnaissance/intelligence and firepower characteristics of the two vehicles, it is apparent that the MICV is a better choice under any weighting of the selected characteristics.

The solution, I believe, is to strengthen the pre-ROC phase of our materiel acquisition process. The tactical concept must be clearly derived from and described in an accepted scenario. Any technical

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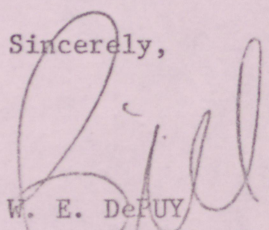
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innovation or new item with which we lack experience should be put in our hands for a while so that we can develop a clear concept of how we would like to use it. Our recent efforts to acquire remotely piloted vehicles is a case in point. Parallel activity by AMC to clarify the cost implications can provide us with the dollar figures to do a precursor COEA before we get to the ROC.

A final point that did not surface in the ARSV efforts but which is a lesson learned from COBRA-TOW OT II is the need to express our operational requirements in terms of operational performance floors rather than developmental performance goals. The COBRA-TOW program was prejudiced and almost killed because our OT II results were less than the QMR's <sup>Kill</sup> probability of .75.

In summary, we need to do a better job of determining and accurately describing the military concept of employment and the level of performance required. This is a complex, demanding challenge particularly in a period of rapidly rising costs and technological change. Since we cannot economically pursue all of the developmental choices facing us, our acquisition system must be more disciplined and our choices increasingly selective.

Sincerely,



W. E. DePUY  
General, United States Army  
Commanding

1 Incl  
As stated

Lieutenant General James G. Kalergis  
Assistant Vice Chief of Staff  
Department of the Army  
Washington, D. C. 20310

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ARSV

VS

MICV

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PURPOSE OF ARSV

"... TO INCREASE SIGNIFICANTLY OUR CAPABILITY TO GAIN INTELLIGENCE  
INFORMATION ON THE BATTLEFIELD AND TO PREVENT SURPRISE ATTACKS FROM  
ENEMY GROUND FORCES. . ."

"... PLANNING QUANTITY OF 1147 VEHICLES, WHICH WOULD EQUIP THE  
BASELINE EUROPE POSITIONED FORCE. . ."

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(SOURCE: DCP)

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RELATIVE WORTH (RW)

$$RW = \frac{\text{RELATIVE EFFECTIVENESS (RE)}}{\text{RELATIVE COST (RC)}}$$



RELATIVE EFFECTIVENESS (RE)

- MOBILITY

- PROTECTION

- FIREPOWER

- RECONNAISSANCE/INTELLIGENCE

- RAM



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MOBILITY

|                                       | ARSV (TRACKED)         | MICV                    |
|---------------------------------------|------------------------|-------------------------|
| HORSEPOWER/WT RATIO<br>(GROSS HP/TON) | 30 to 1                | 22 to 1                 |
| XC RIDE                               | *Rougher at X-C Speeds | *Smoother at X-C Speeds |
| HIGH WHEEL TRAVEL                     | * 12"                  | * 14"                   |
| LOW GROUND PRESSURE                   | * 5.4 psi              | * 7 psi                 |
| HIGH GROUND CLEAR                     | * 16"                  | * 19"                   |
| OBSTACLE CLIMBING                     | * 30"                  | * 36"                   |
| SWIMMING (FREEBOARD)                  | * 6"                   | * 2"                    |
| SPEED (LAND/WATER)                    | * 51 mph/4-6 mph       | * 46 mph/4-5 mph        |
| ACCELERATION (0-30mph)                | * 12.8 sec             | 17 sec                  |
| SPEED 10% SLOPE                       | * 23.4 mph             | 18-22 mph (QMR)         |
| **AIR TRANSPORTABILITY<br>(CH-47C)    | MARGINAL               | NO                      |
| TURNING RADIUS                        | * PIVOT                | * PIVOT                 |
| ROAD RANGE (MILES)                    | * 280                  | 300-350 (QMR)           |

\* Demonstrated performance

\*\*Not now a requirement.

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PROTECTION

|                                  | ARSV                                                                              | MICV                                                                 |
|----------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|
| OVERHEAD (ARTY)                  | 155 HE                                                                            | 155 HE                                                               |
| BOTTOM (MINES)                   | 1.15 <sup>#</sup> TNT                                                             | 12.6 <sup>#</sup> TNT                                                |
| FRONT/SIDE/REAR<br>(SMALL ARMS)  | 14.5 @ 600m<br>7.62 point blank                                                   | 14.5 @ 300m                                                          |
| SILHOUETTE (sq ft: front/flank)  | 46.3/97.4                                                                         | 73.3/141.6                                                           |
| CREW VIGILANCE<br>(DAY OR NIGHT) | crew of 3                                                                         | crew of 3 ; plus<br>2-6 scouts<br>(more close-in day/night security) |
| VEHICLE NOISE                    | Requirement is for vehicle<br>not to be heard at 600m<br>at idle, 1000m while X-C | No Requirement                                                       |

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PROTECTION (SILHOUETTE)

PROBABILITY OF HIT ( $P_H$ ) BY 73 MM

| ATTACK<br>ANGLE | TARGET | RANGE |       |
|-----------------|--------|-------|-------|
|                 |        | 600M  | 1000M |
| 0°              | ARSV   | .52   | .06   |
|                 | MICV   | .66   | .11   |
| 30°             | ARSV   | .73   | .12   |
|                 | MICV   | .79   | .15   |
| 60°             | ARSV   | .73   | .13   |
|                 | MICV   | .80   | .18   |

ASSUMPTIONS: (1) WEAPON ZEROED IN ON CENTER OF MASS OF FULLY EXPOSED TARGET; (2) TRACKED VERSION OF ARSV USED; (3) VEHICLES STATIONARY.

(SOURCE: AMSAA QUICK ANALYSIS)

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FIREPOWER

|                                                               | ARSV                                                                     | MICV                                                                                                                               |
|---------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| ANTI-LIGHTLY ARMED VEHICLE                                    | Bushmaster (stabilized)<br>(AP)                                          | same; plus more ammo<br>capacity, more storage<br>room for TOW, DRAGON,<br>mines, etc.                                             |
| ANTI-PERSONNEL                                                | 1. Bushmaster (stabilized)<br>(HE)<br>2. M60 on pintle                   | 1. same; plus more ammo<br>2. co-ax M60<br>3. M60 on pintle<br>4. Firing port wpns                                                 |
| ANTI-AIR<br>(turret slew rate & gun<br>elevation/depression ) | 90 degrees/sec<br>+ 65 degrees<br>- 20 degrees                           | 60 degrees/sec<br>+ 65 degrees<br>- 10 degrees                                                                                     |
| RECONNAISSANCE-BY-FIRE                                        | can recon in 2 directions<br>(BM & M60)                                  | same; plus more ammo/<br>more weapons                                                                                              |
| AMMO STORAGE                                                  | 500 rds of 20mm<br>2000 rds of 7.62                                      | 1250 rds of 20mm<br>2200 rds (minimum) of 7.62                                                                                     |
| ADAPTION TO SENSORY/<br>DETECTION DEVICES                     | Day/Night Fire Control System<br>Azimuth Indicator/Elevation<br>Quadrant | Day/Night Fire Control System,<br>w/o the Azimuth Ind/Elev Quad;<br>but w/ room for systems for<br>add. wpns & dismounted elements |

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RECONNAISSANCE/INTELLIGENCE

If mobility and protection  
are held constant, R/I  
becomes a function of:

|                                                                                       | ARSV                                                                                                     | MICV                                                                                                                                         |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| CREW SIZE                                                                             | Vehicle Cdr<br>Driver<br>Observer                                                                        | Vehicle Cdr<br>Driver<br>Gunner; plus<br>2-6 scouts (or<br>radio/radar op, etc.)                                                             |
| EQUIPMENT (a function<br>of space, i.e. STANO,<br>RADAR, Sensory, DF<br>equip., etc.) | Driver's night<br>vision goggles<br><br>Compatible with<br>Combat Vehicle<br>Night Vision<br>System QMR* | Driver & Commander's<br>night vision goggles<br><br>Room for a combination<br>of STANO, sensors, DF<br>equip, low-level inter-<br>cept, etc. |

\*PM says storage for these systems is provided, but size of vehicle and storage space are obvious limitations.

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R - A - M

|                               | ARSV                                   | MICV                                   |
|-------------------------------|----------------------------------------|----------------------------------------|
| *SYSTEM AVAILABILITY          | 86%                                    | 82%                                    |
| SYSTEM MAINTENANCE RATIO      | 0.3 man hrs/operating hr               | 0-0.4 MH/OH                            |
| ENGINE/POWER TRAIN DURABILITY | 37% probability of lasting<br>6000 mi. | 50% probability of<br>lasting 6000 mi. |
| **AUTOMOTIVE RELIABILITY      | ***1000 mean miles before<br>failure   | 975 mean miles<br>before failure       |
| IMPACT OF COMMONALITY         | N/A                                    | Significant<br>(see next page)         |

\* Defined as "achieved" avail.

\*\* M113 = 765 m/mi failure

\*\*\* Not agreed upon between  
AMC/LOGG/ARMOR Sch.

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## IMPACT OF COMMONALITY

- REDUCED LOGISTIC DOWNTIME (LARGER FLEET - LARGER STOCKAGE OF LINE ITEMS - GREATER SUPPLY SATISFACTION).
- SIGNIFICANT REDUCTION IN SUPPORT REQUIREMENTS (PUBLICATIONS, TRAINING, TRAINING HARDWARE, TESTING, SEPARATE LINE ITEMS).
- INCREASED MAINTENANCE EFFECTIVENESS AT SUPPORT LEVEL (GREATER FAMILIARITY AND EXPERIENCE AMONG REPAIRMEN).



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RELATIVE EFFECTIVENESS

SUMMARY

| CHARACTERISTIC | KEY-POINTS                                                                                          | CONCLUSION           |
|----------------|-----------------------------------------------------------------------------------------------------|----------------------|
| MOBILITY       | MICV smoother at XC speeds;<br>ARSV has better acceleration.                                        | Essentially<br>equal |
| PROTECTION     | MICV is tougher; ARSV has<br>smaller silhouette.                                                    | Essentially<br>equal |
| FIREPOWER      | MICV has more ammo storage<br>for BM, more small arms; can<br>be adapted to carry TOW.              | MICV                 |
| RECON/INTELL   | MICV can carry more STANO/<br>commo equipment; can carry<br>scout team(s) for dismounted<br>action. | MICV                 |
| R A M          | ARSV has higher RAM require-<br>ments in some areas; MICV has<br>larger crew to perform maint.      | Essentially<br>equal |

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# RELATIVE EFFECTIVENESS

(RELATIVE WEIGHTS OF FACTORS)

## RECONNAISSANCE MISSION

WT

RECON/INTELL

5

MOBILITY

3

PROTECTION

2

FIREPOWER

2

R A M

2

14

## SECURITY MISSION

WT

FIREPOWER

5

PROTECTION

3

MOBILITY

2

RECON/INTELL

2

R A M

2

14



RELATIVE EFFECTIVENESS

(ADJUSTED WEIGHTS)

RECON/INTELL - 3.5

FIREPOWER - 3.5

MOBILITY - 2.5

PROTECTION - 2.5

RAM - 2.0



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RELATIVE EFFECTIVENESS:  $\frac{\text{MICV}}{\text{ARSV}}$

$$\text{RE} = \frac{3.5(\text{R/I}) + 3.5(\text{FIREPOWER}) + 2.5(\text{MOBILITY}) + 2.5(\text{PROTECTION}) + 2(\text{RAM})}{14}$$

$$\text{RE} = \frac{3.5(>1) + 3.5(>1) + 2.5(1) + 2.5(1) + 2(1)}{14}$$

$$\text{RE} = \frac{>3.5 + >3.5 + 2.5 + 2.5 + 2}{14}$$

$$\text{RE} = \frac{>14}{14} = >1$$

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$$\text{RELATIVE COSTS} = \frac{\text{MICV}}{\text{ARSV}}$$



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COSTS

(constant 1974 dollars-thousands)

Size of Buy

Per Unit Cost w/BM (1

Per Unit Cost w/o BM (1

Per Unit Cost w/BM (2

| ARSV    | MICV(both) | MICV    |
|---------|------------|---------|
| 1147    | 2333       | 1186    |
| \$275.1 | \$217.7    | \$266.7 |
| \$210.5 | \$176.7    | \$203.9 |
| \$225.7 | \$196.8    | \$226.9 |

1) Includes sunk RDT&E, PEMA, spares, remaining RDT&E.

2) Excludes sunk RDT&E, but includes PEMA, spares, remaining RDT&E.

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SAVINGS

(Constant 1974 Dollars-Millions)

MICV COMMON BUY W/BM

|                |           |
|----------------|-----------|
| Procurement    | \$40.6    |
| RDT&E*         | 27.9      |
| Initial Spares | <u>.2</u> |
|                | \$68.7    |

\*RDT&E Program Cost Avoidance  
(Excludes Sunk RTD&E)

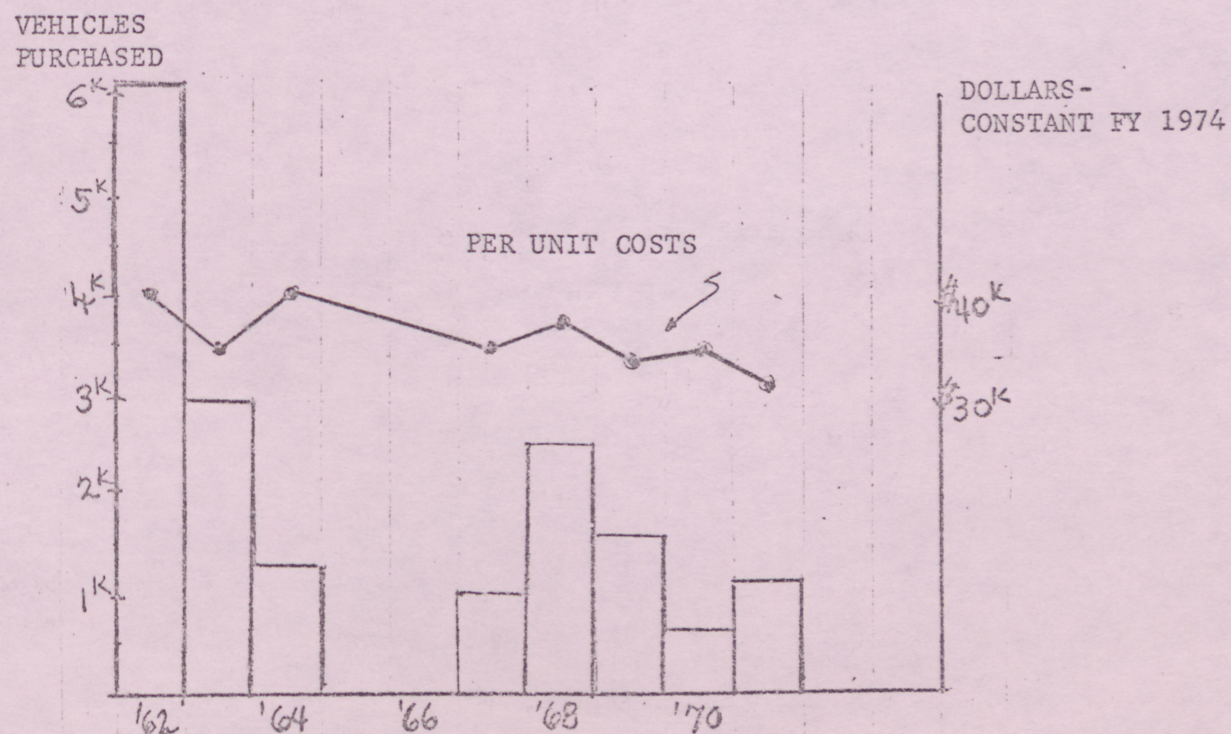
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# COST HISTORY OF M113s



TOTAL ARMY PURCHASES OF M113 & M113A1 = 17,413

(TOTAL WORLD-WIDE SALES (M113 CHASSIS) = 45,000)



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RELATIVE COSTS

$$\frac{\text{MICV}}{\text{ARSV}} = \frac{196.8}{225.7} = .872$$

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RELATIVE WORTH

$$\frac{RE}{RC} = \frac{>1}{.872} = >>1$$

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OBSERVATIONS

1. THE RELATIVE PRIORITY OF CHARACTERISTICS FOR THE ARSV AND MICV AS LISTED IN THE QMRs ARE: MOBILITY, FIREPOWER, AND PROTECTION.  
(ARSV QMR p.15; MICV QMR p.32)

2. THE BOOZ-ALLEN COEA ON THE ARSV WAS STRUCTURED SO THAT MOBILITY WAS THE PRIME DETERMINANT OF RECONNAISSANCE EFFECTIVENESS. BOOZ-ALLEN CONCLUDED:

"MOREOVER, THE . . . RESULTS STRONGLY SUGGEST THAT HIGH MOBILITY VEHICLES WITH AN EFFECTIVE CAPABILITY TO MAKE OBSERVATIONS ON THE MOVE ARE PARTICULARLY EFFECTIVE IN RECONNAISSANCE MISSIONS."

(VOL I - SEC VI - 13)

3. IN NONE OF THE PREVIOUS COEAs WAS CONSIDERATION GIVEN TO THE DRAMATIC MOBILITY DIFFERENTIAL OFFERED BY SCOUT HELICOPTERS. FT KNOX IS NOW ATTEMPTING TO INTEGRATE THEIR INVESTIGATION OF THESE TWO COMPLEMENTARY SCOUT VEHICLES.

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4. THE MOST HEAVILY WEIGHTED FACTORS IN THIS RATHER SIMPLE ANALYSIS (FIREPOWER, RECON/INTELL) ARE THE CHARACTERISTICS WHICH MICV SHOWS THE CLEAREST ADVANTAGE OVER ARSV.
5. THE KEY FACTORS AFFECTING THE OUTCOME WERE THE MICV'S ABILITY TO CARRY MORE AMMO, MORE CREW MEMBERS, AND MORE STANO EQUIPMENT W/O A SACRIFICE IN MOBILITY AND PROTECTION.
6. THE MICV COULD BE "TAILORED" TO EMPHASIZE THE FIREPOWER OR RECON/INTELL CHARACTERISTICS, BY SELECTING WEAPONS, AMMO, OR RECON/INTELL GEAR TO BE CARRIED.
7. REGARDLESS OF THE WEIGHTS GIVEN TO VEHICLE CHARACTERISTICS, THE MICV OFFERS IMPROVED EFFECTIVENESS OVER THE ARSV IN THIS ANALYSIS.
8. WHILE THE PER UNIT COST OF THE MICV IS LOWER THAN THE ARSV, THE SYSTEMS COST OF THE MICV AS A SCOUT VEHICLE WILL BE HIGHER AS ADDITIONAL FIREPOWER AND ACQUISITION CAPABILITIES ARE ADDED.

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DISTRIBUTION REQUIREMENTS FOR ARSV  
AND INITIAL PRODUCTION OBJECTIVE  
OF 1147 VEHICLES

| A. <u>EUROPE POSITIONED:</u>    | <u>ACS</u> | <u>MVR BN<br/>SCT PLT</u> | <u>TOTAL<br/>VEHICLES</u> |
|---------------------------------|------------|---------------------------|---------------------------|
| 1ST ARMD DIV                    | 1          | 11                        | 158                       |
| 3D ARMD DIV                     | 1          | 11                        | 158                       |
| 3D MECH DIV                     | 1          | 11                        | 158                       |
| 8TH MECH DIV                    | 1          | 11                        | 158                       |
| 3/1 MECH DIV                    | 1/3        | 2                         | 46                        |
| 2D ACR                          | 3          | 0                         | 144                       |
| 11TH ACR                        | 3          | 0                         | <u>144</u>                |
|                                 | TOTAL TOE  |                           | 966                       |
|                                 |            |                           |                           |
| B. <u>SUPPORT REQUIREMENTS:</u> |            |                           |                           |
| MAINTENANCE FLOAT               |            |                           | 30                        |
| WAR RESERVE                     |            |                           | 66                        |
| READINESS FLOAT                 |            |                           | 19                        |
| TA EUROPE                       |            |                           | 6                         |
| CONUS TRAINING BASE             |            |                           | <u>60</u>                 |
|                                 | TOTAL      |                           | 181                       |
|                                 |            |                           |                           |
| C. <u>SUMMARY:</u>              |            |                           |                           |
| TOTAL TOE EUROPE                |            |                           | 966                       |
| TOTAL SUPPORT                   |            |                           | 181                       |
| TOTAL DISTRIBUTION              |            |                           | <u>1147</u>               |

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