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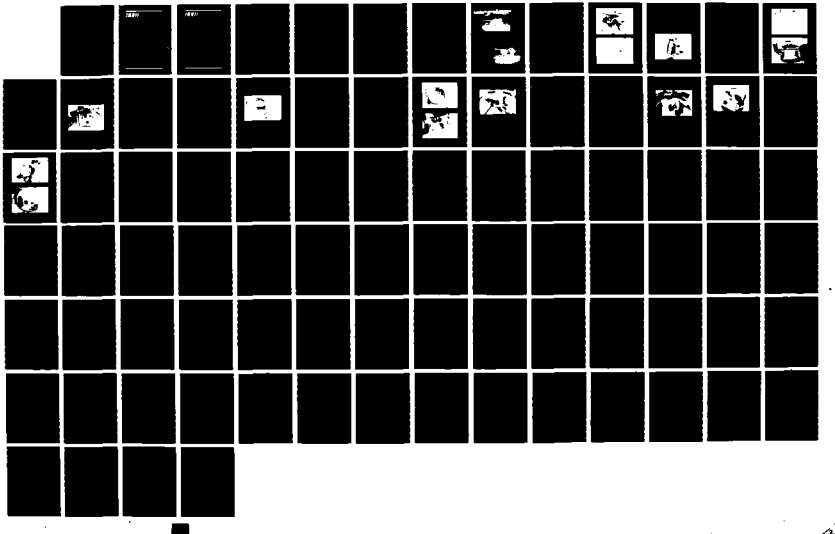

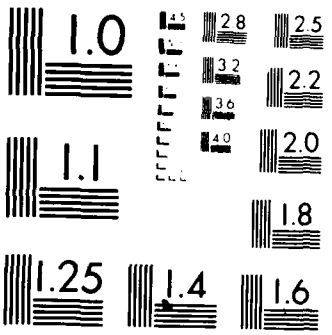

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Human Factors Engineering Data Base Development for Armored Combat Vehicles and Analyses of Three NATO Tank Systems

Volume IV - Human Factors Engineering Analysis of the French AMX-13 Light Tank

July 3, 1986

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VOLUME IV

HUMAN FACTORS ENGINEERING ANALYSIS OF THE FRENCH AMX-13 LIGHT TANK

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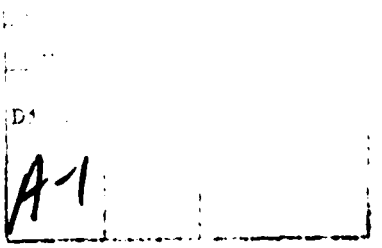

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CHAPTER I

HUMAN FACTORS ENGINEERING ANALYSIS OF THE FRENCH AMX-13 LIGHT TANK

A. FRENCH AMX-13

1. Development

The French Army began development of the AMX-13 light armor vehicle, shown in Figure I-1, following the end of the Second World War. Design work started in 1946 with the first prototype system completed in 1948/49. The AMX-13 entered service with the French Army in 1953. The primary objective of the AMX-13 was to perform within the operational environment as a tank destroyer or reconnaissance vehicle. It is important to note that the original design intent of the AMX-13 was to design the system to accommodate crews of only 5 feet, 8 inches in stature.

2. Description

The hull consists of all-welded steel construction with a maximum thickness of 1.575 inches (40 mm). The driver's station is positioned at the front of the hull on the left. Directly to the right is a 50FAM Model 8 GXB eight cylinder, water-cooled gasoline engine developing 250 hp at 3200 rpm. The turret is located toward the rear of the hull, with the commander's station located on the left and the gunner's station located on the right.

The AMX-13 contains torsion bar suspension, five road wheels, idler located at the rear, drive sprocket positioned at the front, and three track support rollers. The first and fifth road wheel stations are provided with a hydraulic shock absorber system. The gearbox is manual and consists of five forward and one reverse gears with a Cleveland-type differential system.

The turret is based on the French-designed oscillating type and consists of two parts. The lower part is located on the turret ring and consists of two trunnions on which the upper part located on top of the turret is mounted. The top of the turret can be elevated or depressed in

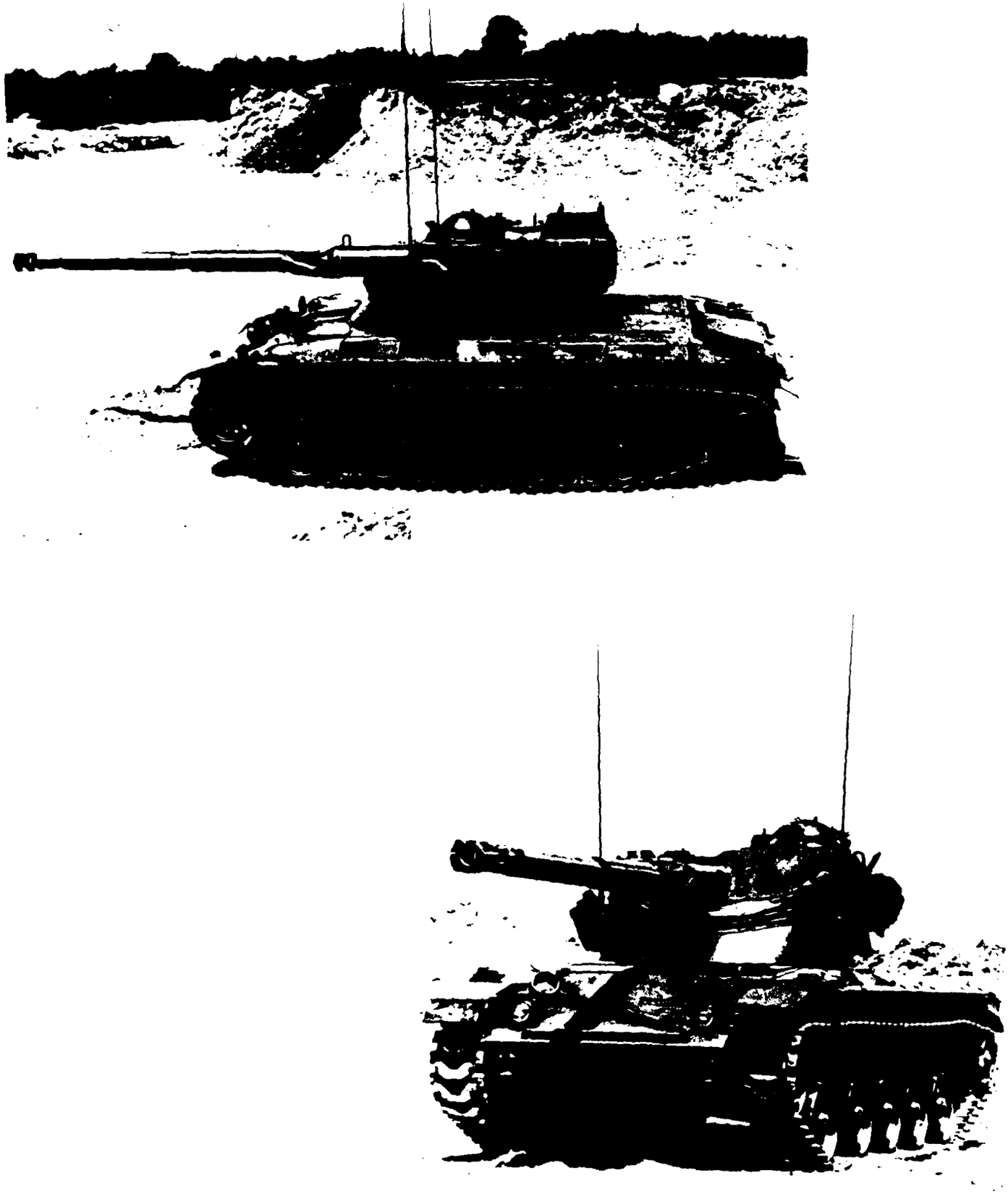

Figure I-1. French AMX-13

conjunction with the gun system that is fixed. This type of design enabled the French to install an automatic loader which reduced the crew size to three. The gun is fed from two revolver magazines with a total of 12 rounds for ready use. Empty cartridge cases are automatically ejected through a hole located at the rear of the turret.

The French Army has refitted the AMX-13 vehicle with a new 90 mm gun firing fin-stabilized rounds. A total of 34 90 mm rounds can be carried. Secondary armament includes either a 7.5 mm or 7.62 mm machine gun (3600 rounds) that is mounted coaxially with the main armament system. Two smoke dischargers are located on each side of the turret section.

The AMX-13 can be equipped with both infrared driving and fighting systems, but is void of amphibious capability and NBC protection systems.

3. Current Status

Currently, the AMX-13 serves Algeria, Argentina, Cambodia, Chile, Dominican Republic, Ecuador, Egypt, El Salvador, India, Indonesia, Kenya, Lebanon, Morocco, Netherlands, Nepal, Peru, Salvador, Saudi Arabia, Singapore, Switzerland, Tunisia, Venezuela, and Vietnam.

The driver's station is located in the front hull, left area. The engine is mounted directly next to the driver's station to the right. Figure I-2 shows the AMX-13 from a front-left perspective.

The gunner's station is located on the right side of the turret. The commander is positioned on the left of the turret. The main gun occupies the space between the turret occupants. Figure I-3 shows the frontal view of the AMX-13 turret.

Like the other vehicles, the AMX-13 was inoperative during the evaluation and was parked in a maintenance warehouse. The turret could be operated using the manual elevation and traverse controls but was restricted to just a few yards movement in either direction.

According to open source literature, elevation is limited to +12.5 degrees, depression to -5.5 degrees, and elevation speed in the powered mode to 5 degrees per second. The turret is traversable 360 degrees with a traverse rate of 533 mils per second.

Figure I-2. French AMX-13, Front Left View

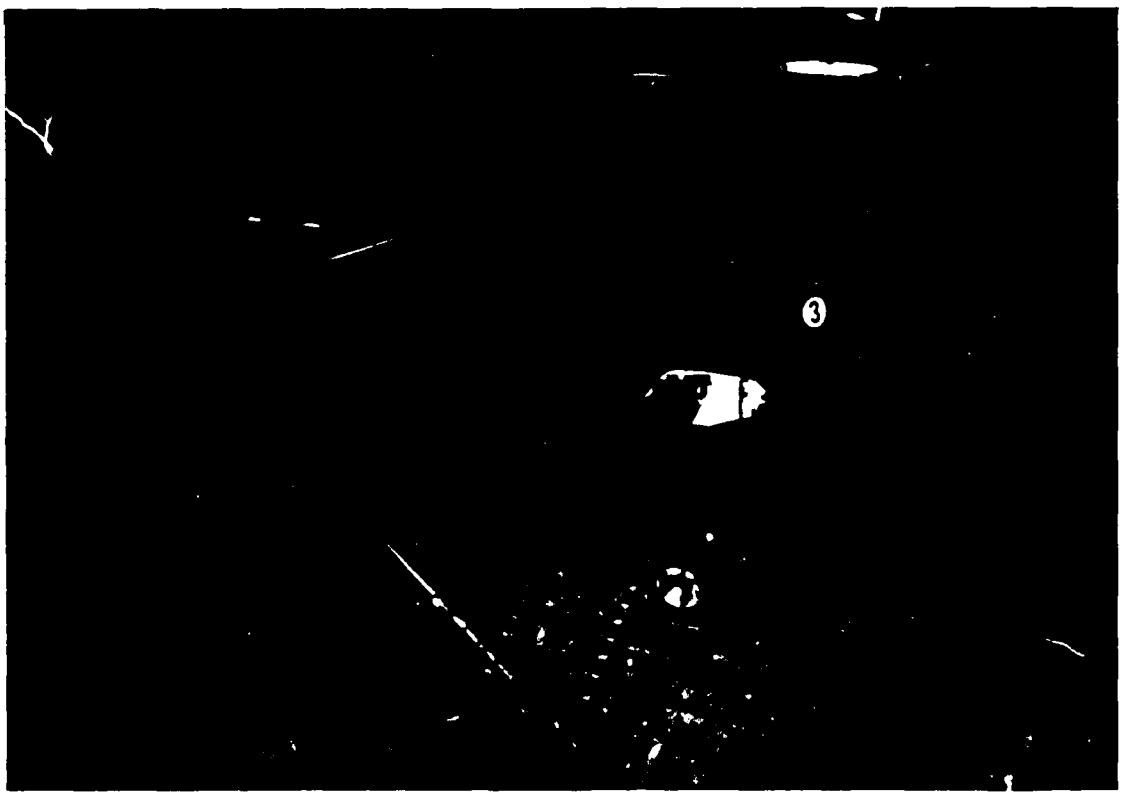

Figure I-3. AMX-13 Turret, Gunner's and Commander's Hatches

The 90 mm autoloader is fed by two 6-round revolving magazines located at the rear of the turret on either side, as shown in Figure I-4. Extra rounds are stowed in the turret and driver's area.

Internal access to the revolver magazines was very difficult. The breech and feed chute however were accessible (although made difficult because of the lack of space). Handwheels are provided at the commander's and gunner's station to assist in clearing jams. Rounds are loaded into the revolver magazines through each magazine hatch shown in Figure I-4. The autoloader allows the gun to fire 1 round per 5 seconds. After each round is fired, shell casings are ejected automatically through a single hatch at the turret rear. Stowage capacity is provided for a total of 34 main gun rounds (21 in the turret, 13 in the hull) and 3600 rounds of coaxial machine gun ammunition.

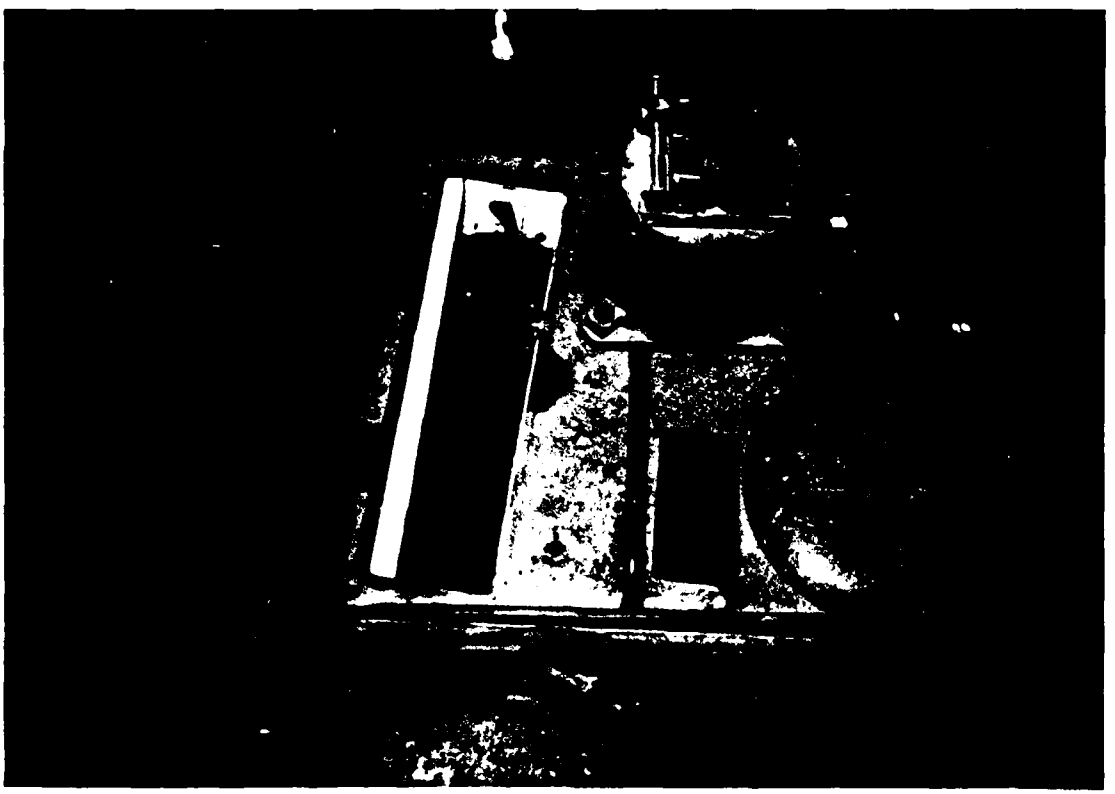

Figure I-4. Six-Round Revolving Magazine, Right, Rear Turret Area

B. HFEA OF THE AMX-13 TANK

1. General Boarding, Movement

Although dedicated handholds are not provided, boarding the AMX-13 was found to be very easy because of the distance from the deck to the ground (44 inches). Mounting the vehicle could be done quickly and easily by grasping any deck item, as Figure I-5 demonstrates. Metal serrated steps are designed onto the rear-most portion of each fender. For these reasons, boarding was rated exceptional.

The extremely limited interior space prevents movement from the commander's to the gunner's station. There is space provided to move from the commander's station to the driver's area. However, the opening provided measured only 14 inches wide by 20 inches deep; this could be accomplished by only the smallest of crewmen. Dead weight drag would be almost impossible to or from the turret using this access opening. The evaluator (95th percentile in stature) found it very difficult accessing much of the tank interior because of the restricted space.

Crew movement from the outside to the inside of the turret was observed as very difficult, especially through the gunner's hatch. Hatches are very narrow. Details of hatch dimensions are discussed in the following paragraphs.

2. Driver's Station

Table I-1 summarizes selected measurements of the driver's station, including seat dimensions. Five out of the nine dimensions failed to meet human engineering design criteria of MIL-STD-1472C. Seat pan and back rest dimensions fall far short of standards, with a very limited seat depth of only 6.5 inches. Figure I-6 shows the driver's seat in the AMX-13 viewed from the hatch opening.

The seat pan is inadequate to support the popliteal understructure of the legs. At the lowest adjustment, the seat sets flush with the floor. However, there appeared to be barely enough static elbow room (22.5 inches). Shoulder clearance was restricted to about 5 inches short of standards and would pose a problem for even the smaller stature crewmen.

Figure I-5. Boarding Made Easy Due to Low Deck, Numerous Grasp Areas

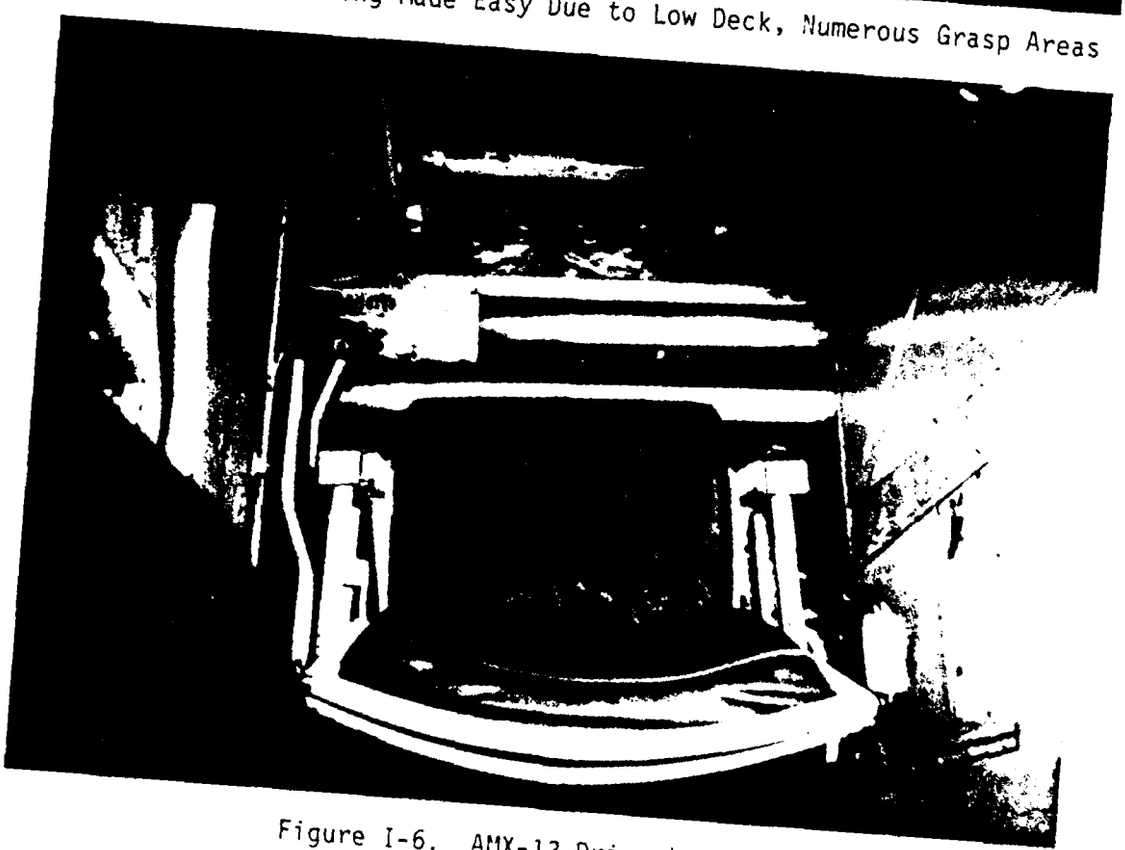

Figure I-6. AMX-13 Driver's Seat

TABLE I-1. SELECTED MEASUREMENTS OF VEHICLE SEATING AND ANTHROPOMETRY

	Seat Pan Dimensions (Length x Width)	Seat Back	Seat Padding Thickness	Seat Depth	Boot Clearance	Head Clearance	Control Distance	Shoulder Clearance	Static Elbow	Popliteal Height
Criteria	(15-17) x 18 in.	(18-20) x 18 in	(1.5 in.)	(16 in.)	(14 in.)	(39.5 in.)	(34 in.)	(19.6 in.)	(21.1 in.)	(19.7 in.)
Centurion										
Driver	*15.75 x 15.5	*14 x 16	1.5 - 3.0	*8.0	16.0	*34.0	24.5	*17.5	23.0	19.25
Cmdr	*10.25 x 14.5	*4.25 x 10	1.25	*5.0	13.5	*36.0	27.0	–	24.0	*18.0
Gunner	*13 x 13	4.25 x 10	2.75	*6.5	*9.5	39.0	21.0	21.0	*19.75	16 - 20.5
Loader	*13.5 x 13.75	*4.25 x 12	2.0	*7.0	*5.25	47.0	17.25	19.25	29.0	*24.0
Chieftain										
Driver	18.25 x 16.25	18.25 x 14.25	3.75	*14.0	14.5	*26.0	26.0	20.0	27.5	*11.0
Cmdr	14.25 x 15.0	*10.0 x 11.0	2.0	*9.5	*11.0	*38.25	28.75	20.0	26.0	12.0 - 22.0
Gunner	*12.0 x 14.5	*5.5 x 11.0	2.5	*8.0	15.5	39.0	16.0	21.0	26.0	18.0 - 22.0
Loader	–	–	–	–	–	–	–	–	–	–
AMX-13										
Driver	*10.5 x 14.0	*11 x 12.75	3.75	*6.25	23.25	*32.25	25.0	*14.75	22.5	*15.25
Cmdr	*9.75 dia.	–	1.0	–	–	–	–	–	–	–
Gunner	*9.5 x 10.75	–	1.5	*5.5	*7.5	*35.0	*15.0	*16.0	21.0	*23.0

*Failed to meet standards

86 0608 TR W 01

Footnotes to Table I-1:

1) .75 in. added for head clearance criteria to account for CVC helmet; .5 in. added for seat compassability
2) Figures for head clearance with seats adjusted fully down.
3) Figures for control distance are measurements from seat back to closest hand control forward.
4) Popliteal height includes ranges of height (vertical adjustability) for seats capable of adjustment.
5) Blank spaces indicate missing part or whole equipment items precluding measurements.
6) Asterisks indicate actual measurements which fail to meet MIL-STD-1472C criteria by > 1.0 inch.

86 0608 TR W 02

References to Table I-1:

Seat Depth – Seat reference point to front edge of seat pan. MIL-STD-1472C, Table 59, Human Eng. Design Data Digest

Boot Clearance – Front of seat pan to heel point of accelerator. MIL-STD-1472C, Table 59

Head Clearance – SRP to roof line, Table 59

Control Distance – Functional Reach, Table 33.

Shoulder Clearance – Bideltoid breadth, Figure 27.

Static Elbow – Forearm-forearm breadth, Figure 27.

Popliteal height – Figure 26.

86 0608 TR W 03

Head clearance with the seat in its full down position was about 7 inches less than minimum standards. The station would accommodate only the 1st percentile U.S. armor crewman without CVC helmet, closed hatch.

Figure I-7 presents a photographic view of the AMX-13 driver's controls from the seated position. The seat lacked lumbar support altogether and would likely introduce fatigue and back pain during extended operations. With the seat fully down, the front of a 95th percentile soldier's knee to the nearest forward object (the right lateral) is only 4.75 inches. The position of the knees could interfere with the control of both right and left laterals.

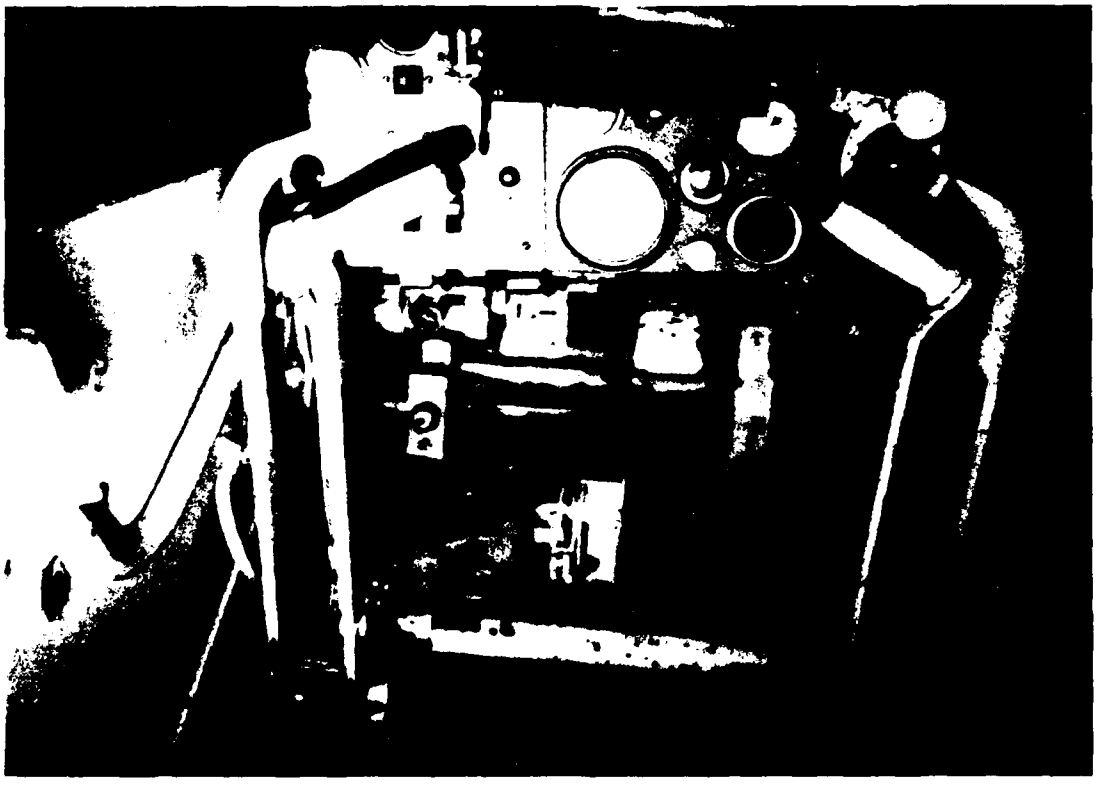

Figure I-7. AMX-13 Driver's Controls

The seat, when adjusted fully up for open hatch driving, measured 15.25 inches, accommodating slightly larger crewmen than closed hatch operations. However, viewing all of the critical controls and displays from both open and closed hatch postures appeared inadequate.

No seat restraint system was observed. The tight fit, however, would prevent excessive lateral body movement.

Reflective glare on instrument panels was not a problem because of the recessed position of displays and controls in the tank hull. The right-most lateral blocked viewing of the display located to the immediate right of the master panel.

The gear shift lever contacts the ceiling when shifted into first, third, and fourth gears. Operation of the gear shift would be very difficult with bulky handwear.

The most difficult operational feature of the driver's station was free movement of the legs in open and closed hatch modes to operate foot pedals. Only 18 inches was provided, measured between the hull ceiling immediately in front of the driver, and the floor, with the foot pedals and control panel in between. The bottom edge of the clutch pedal is suspended 10.5 inches from the floor, leaving 6.5 inches clearance to the ceiling. These workspace restrictions would probably interfere with the most simple driving tasks for the full range of U.S. armor crewmen. This design would require careful selection of the smaller stature crewmen for efficient, safe, and effective operation. Maintenance within such a restricted area would also be a serious problem for all but the smallest sized crewmen.

Only one indicator light was observed. A large, red light occupied a position to the left of the control panel just beneath the hatch rim, apparently a fire warning indicator. The position of the indicator appeared adequate.

Dimensions of the hatch opening are shown in Table I-2. The oblong design measures 14 inches wide, narrow enough to require even the 1st percentile U.S. armor crewman to turn the shoulders to enter and exit the station. Crewmen clad in arctic or NBC gear would find it even more difficult to ingress/egress the station.

Figure I-8 shows the driver's flat hatch design. The hatch operates by swinging outward and back, as the photograph depicts. One in the full open position, the hatch locks in place by a positive latch mechanism. The hatch must also be locked down by the steel bar

TABLE I-2. HATCH DIMENSIONS

Criteria	13 x 23 in. (light) 16 x 27 in. (bulky)	Evaluator's Ratings
Centurion		
Driver	15.75 x 20.75	4
Cmdr	21.75 dia.	5
Loader	19.25 x 19.25	5
Chieftain		
Driver	15 x 21.25	4 adequate
Cmdr	20.0 dia.	5 very adequate
Loader	20.0 x 17	5
AMX-13		
Driver	14 x 17.5	3 inadequate
Cmdr	18.0 dia.	1 extremely inadequate
Gnr	*17.25 (14.5 in.)	1

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arrangement seen in the photograph. Evaluators surmise that this bar prevents the hatch from vibrating loose when open during cross-country travel. This arrangement demands more time and attention of the driver to lock open and to unlock and close than other, more traditional hatch arrangements. To make the transition from open hatch to closed hatch, especially with the vehicle in motion, would present a safety hazard and would require excessive time.

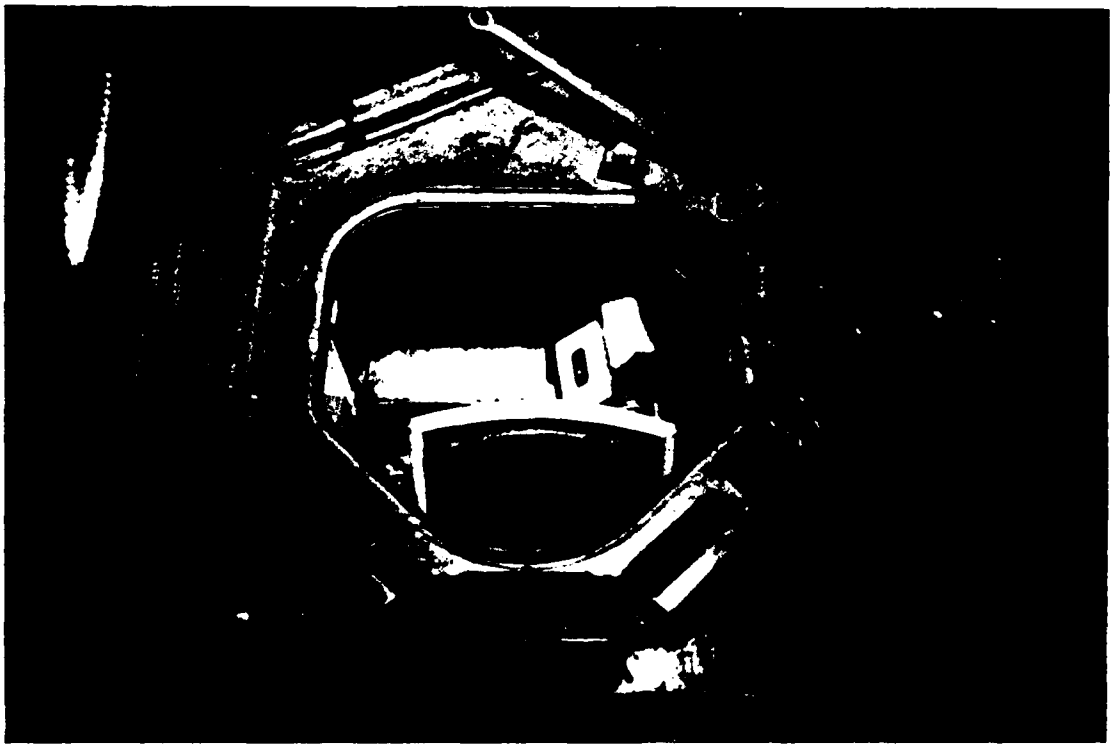

Figure I-8. AMX-13 Flat Hatch Design

The three periscopes located at the driver's station provide about 140 degrees forward unity vision. At least 180 degrees forward visibility is achieved with the hatch open. Padding is provided at each periscope. A rubber or compressed vinyl padding is provided on the inside of the hatch rim and would likely prevent serious contact injuries when getting in and out of the driver's station.

Generally, the driver's station in the French AMX-13 is designed for smaller stature crewmen and cannot be evaluated or judged

against U.S. standards. It demonstrates successfully a lesson in armor design, requiring selection of crews to a limited portion of the soldier population, much like pilot selection was restricted in the past to smaller candidates.

a. Advantages

Advantages of the driver's station in the AMX-13 are few. Any advantages would be restricted to operation and maintenance by smaller stature crews.

One advantage is the periscope arrangement. Although limited in forward visibility, the quality of the optics appeared higher than the British tanks. Also, the tight fit of the driver's station would prevent excessive lateral body movement during violent cross-country maneuvers.

b. Disadvantages

A number of disadvantages are associated with the AMX-13 driver's station. First, the hatch design prevents quick and safe operation. Secondly, inadequate leg, knee, arm, elbow, and foot space is provided to operate the controls efficiently and effectively, even for crewmen of smaller stature. Finally, inadequate space is provided for free and easy movement up and into the turret area.

Overall, the human engineering design of the AMX-3 driver's station, based on static crew station measurements and evaluator observations, is judged inadequate.

3. Commander's Station

The commander's seat in the AMX-13, although present in the vehicle, was not mounted. The seat pan is round and measures 9.5 inches in diameter, roughly half of military standard criteria. The seat back was not present.

The seat is provided with a fixed foot rest measuring 15 inches from the seat pan. The minimum popliteal height for a 1st percentile seated armor crewman is 15.5 inches. This means that for just about the entire U.S. Army armor crew population, adequate support would not be provided for popliteal leg support. The foot rest dimensions measure 10 inches square, meeting human engineering design recommendations of MIL-HDBK 759A.

Entering and exiting the commander's station was made difficult by virtue of the fact that very little room for maneuvering into and out of the station is provided. An overhead view of the hatch is shown in Figure I-9. The photograph shows the rear portion of the commander's station. Foot steps to enter and exit the station are not provided, leaving the crewman to step on the most convenient object available, which appeared to be the binocular case or stowed 90 mm rounds. When moving through the hatch, a 95th percentile male contacts the hatch rim with the shin. This condition could cause serious injury to the commander, especially if his foot slips, because the drop to the turret floor is 65.75 inches (almost 6 feet) without the seat mounted. However, the seat, when properly mounted, would reduce the risk of injury considerably.

The restricted area for free movement at the commander's station would make maintenance tasks extremely difficult for even the smallest of U.S. armor crewman. A 95th percentile male cannot bend and touch the turret floor. Radio equipment located beneath the main gun breech front, would be especially difficult to reach. Figure I-10 shows the forward area of the commander's station. To the right is a handwheel, apparently for clearing jams in the 90 mm autoloader. Only 0.5 inch exists between the outer turning radius of the handwheel and the communications box to the left front, causing knuckle contact with the box. The handwheel linkage runs the length of the gun breech to the breech rear, shown in Figure I-11. A number of universal joints attached to the handwheel and to the breech recoil mechanism are exposed and could pose a safety problem during main gun firing. The only protection from main gun recoil is the metal tube housing the cable attaching the handwheel to the revolver magazines.

The previous photograph also shows 90 mm ammunition stowage racks at the left of the commander's station, the radios located beneath the breech, and backup fire control handle to the left. To the rear of the station are located intercommunications equipment, 7.5 mm ammunition drums under the gun recoil area, hatch handle, and other miscellaneous items.

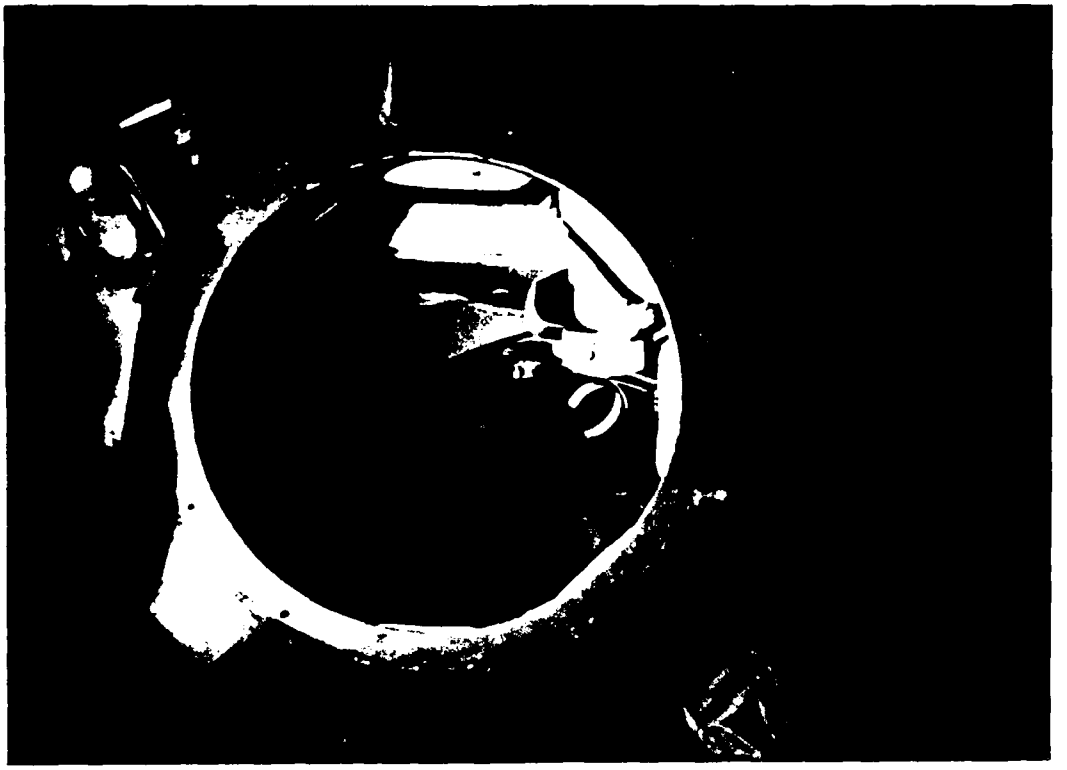

Figure I-9. AMX-13 Commander's Hatch

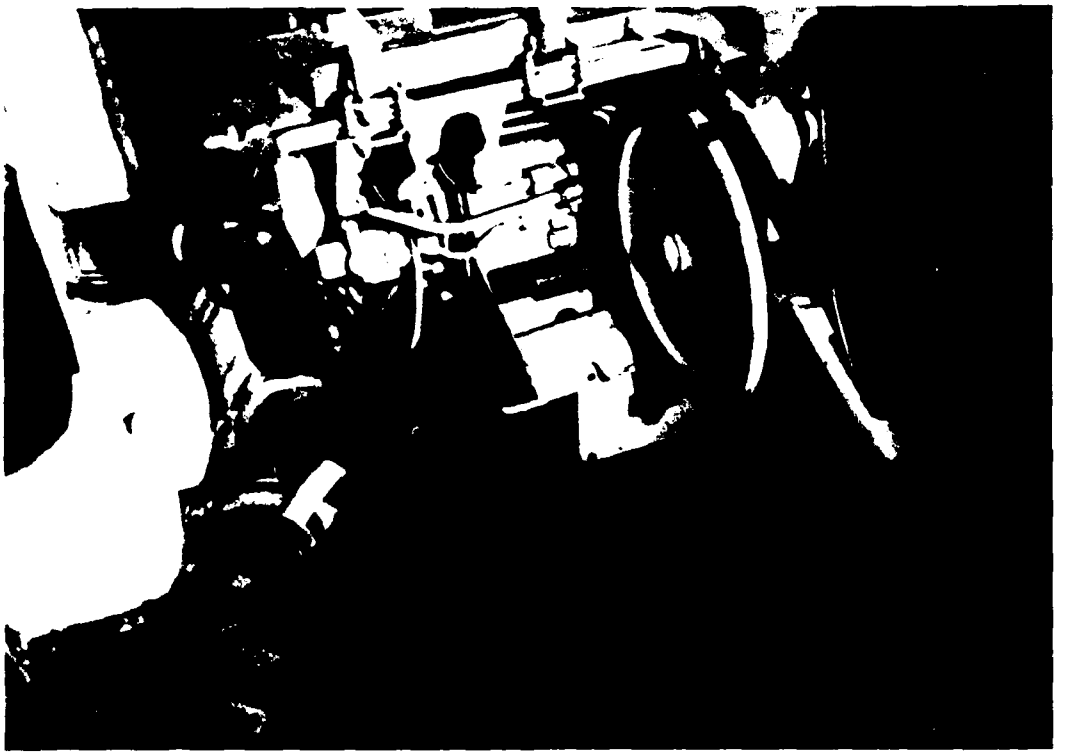

Figure I-10. AMX-13 Commander's Controls/Displays Arrangement

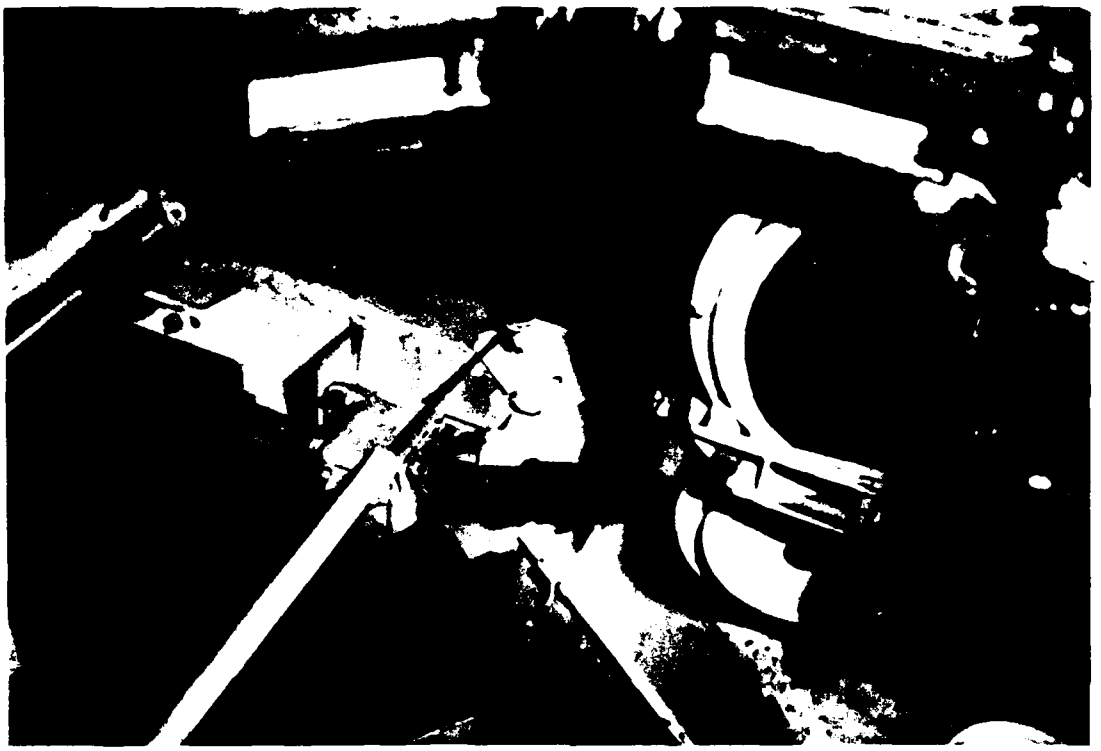

Figure I-11. Linkage for Automatic Feed 90 mm Autoloader

Most items appear to have been mounted without regard to the commander's task requirements. The commander does not have visual access to the gunner or driver. The larger occupants would have difficulty operating the radio and most other equipment requiring bending or stooping. Moreover, accessing the stowed main gun rounds quickly and without damage might prove difficult under most circumstances. Removing wounded or incapacitated crewmen would also be very difficult. The operating dimensions of the commander's station measured only about 31 inches from the main gun breech to the right and to the turret wall to the left, with about the same distance forward and rearward.

Referring again to Table I-2, the commander's hatch opening falls well short of the minimum recommended dimensions of MIL-HDBK-759A. The minimum recommended size for circular hatches is 22 inches for light

clothing and 28 inches for crewmen garbed in arctic or NBC clothing. The hatch would not accommodate a 5th percentile U.S. armor crewman with arctic clothing.

The hatch cover swivels rearward and locks into place. Hatch control is provided by a handle located at the rear of the commander's head. The rear-most periscope in the cupola obstructs operation of the handle. Only 0.25 inch is provided for clearance between the handle and the periscope, making operation very difficult, especially with arctic or NBC handwear. Anthropometric accommodation of a seated individual, closed hatch could not be estimated since the seat was not mounted.

Eight periscopes provide near-360 degrees unity vision. Periscopes were not padded and present a safety hazard, especially during cross-country operation. The cupola is fixed to the turret and cannot be rotated independently.

A unique feature of the AMX-13 is the "iron sight" provided in front of the commander's and gunner's foremost periscopes. A cross hair reticle is built into the periscope, occupying the right portion of the viewing area. Using the periscope reticle, the crewmen aligns the front iron sight (which can be folded down when not in use), with the target. This sight arrangement provides the advantage of simplicity. However, target accuracy with the sights could not be evaluated.

The commander's station, like the others in the AMX-13, provides very limited space for all but the smallest crewmen. A number of hazardous protrusions exist and ingress/egress is made extremely difficult because of the tight fit. It appeared to evaluators as though French designers began with a limited area in which to place operational equipment, and did so with little regard for the occupant.

a. Advantages

As mentioned previously, the iron sights provide a very simple means for target engagement. However, the accuracy of this system could not be measured. Another advantage of the human engineering design of the commander's station is the reduced crew of three, making battle management somewhat easier.

b. Disadvantages

Generally, the greatest disadvantage attributable to the design of the AMX-13 commander's station is the limited work space. Anthropometric accommodation of the design restricts crew selection. Even with smaller crewmen, the arrangement of control and display components interferes with fundamental tasks.

4. Gunner's Station

The gunner's station in the AMX-13 is located to the right in the turret. Table I-1 provides selected dimensional measurements for the gunner's seat. The seat back was not available for evaluation.

As Table I-1 indicates, except for seat padding and static elbow space, none of the measurements meet U.S. human engineering standards. The gunner's seat pan represents the worse case of all other seats evaluated in this report.

The seat would accommodate less than the 1st percentile U.S. armor crewman when considering hip breadth. Vertical seat adjustability measured only 2.5 inches. Popliteal height (distance from top of seat pan to floor) measured 23 inches. The maximum allowable height in U.S. standards is 19.8 inches. Without a foot rest, blood circulation in the gunner's legs could be restricted causing pain and discomfort.

Once seated inside, adequate elbow room is provided for 95th percentile individuals. However, free shoulder movement for only the 1st percentile U.S. armor crewmen is provided. Space allowed for leg and knee movement is also inadequate. Head clearance falls about 4 inches short of standards, accommodating only 25th percentile males. Boot clearance, front of the seat to the nearest forward object measured 7.5 inches, leaving very little room for smaller crewmen.

The gunner's seat is generally inadequate and would not lend to effective human performance, especially during long term operations.

Only two periscopes are provided for forward viewing, restricting the gunner's surveillance capabilities to about 120 degrees forward vision. The periscopes are not padded and present a safety hazard. A browpad measuring 1.5 inches square is located just above the primary sight, as shown in Figure I-12. The browpad would provide very little

protection against the effects of main gun acceleration and was very uncomfortable even during the static evaluation.

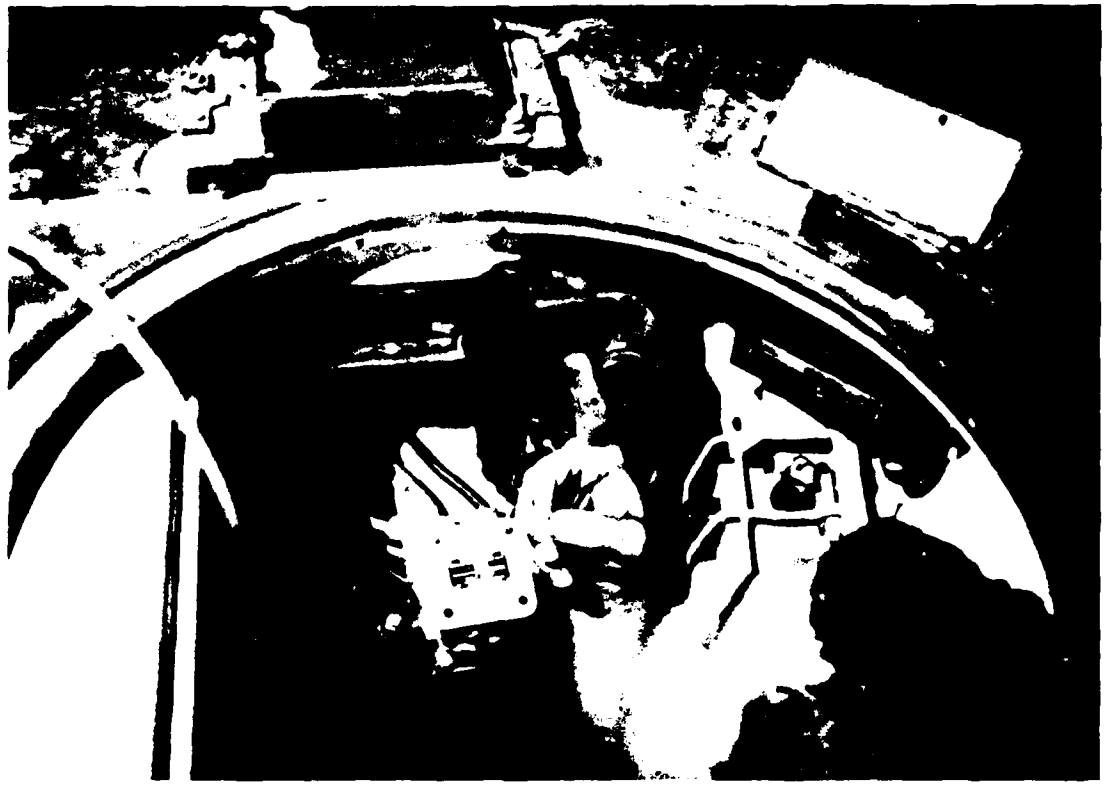

Figure I-12. Gunner's Browpad for Primary Sight

The gunner's station is even more restricted in available workspace than the commander's, as described in the previous section. The gunner's left elbow and arm contacts continuously the main gun breech.

All controls and displays are within easy view except the traverse handle, which is located below the two-handed fire control handle. The manual traverse handle is located 30 inches from the seat back (estimated from the SRP). Manual target acquisition and gun lay would likely be difficult for larger crewmen because of the limited space to operate the manual traverse handle.

Figure I-13 shows a portion of the gunner's station from overhead.

Figure I-13. AMX-13 Gunner's Station

The elevation handle is located to the left against the main gun breech wall. Operation of the handle was easy and, except for the lack of elbow room, posed no problems. The two-handed yoke controller, located conveniently in front of the gunner was easily accessible. The distance from the seat back to the controller measured 15 inches. Based on anthropometric data for the 95th percentile U.S. armor crewman, only 4 inches would remain between the chest and the controller, and even less with arctic and NBC clothing.

The intercommunications box is located only 5 inches from the design eye, just forward and to the right, posing an eye contact hazard. Direct visual contact with the other crewmembers is not possible. Many decals, placards, and other written instructions are located beyond the gunner's seated view.

A rotary handwheel, identical to that provided to the commander for clearing 90 mm main gun jams (or for manually introducing a new round from the revolver magazines, the evaluator could not tell), is located beneath the breech on the the turret rear wall. Manual access is very difficult for larger crewmen.

Figure I-14 shows the flat hatch arrangement. Figure I-15 shows a closer view of the gunner's hatch area toward the rear. Notice the obstruction on the right of the photograph blocking partially the hatch opening. The hatch diameter is 17.25 inches (narrower than the commander's hatch). However, actual hatch entrance size, measured from the obstruction to the hatch right rim area is only 14.5 inches, about 1.5 inches smaller than that required to accommodate the 1st percentile U.S. armor crewman.

Just within the hatch, only 17 inches is provided between the hatch handle, with the hatch open, to the front periscope. Evaluators had to first lower the right shoulder into the turret, then the left. When seated, the shoulders of a 95th percentile, lightly clothed individual fits tightly against the turret right wall and a metal plate to the left protecting the crewman from the gun breech.

The fire control box can serve as a convenient foot rest when entering and exiting the vehicle as it is located only 14.5 inches from the hatch opening. Of course, utilizing the controller as a step would cause severe reliability problems for that item.

a. Advantages

There are two distinct advantages to the human engineering design of the AMX-13 gunner's station. First, the reduced crewspace prevents excessive lateral movement during violent, cross-country rides. Secondly, the extremely close proximity of controls and displays may facilitate efficient and effective operation by smaller individuals.

b. Disadvantages

There are a great many more disadvantages to the AMX-13 human engineering design than advantages. To summarize, the design of the gunner's station, like the commander's and gunner's, allows only a small portion of the soldier population adequate space to conduct gunnery

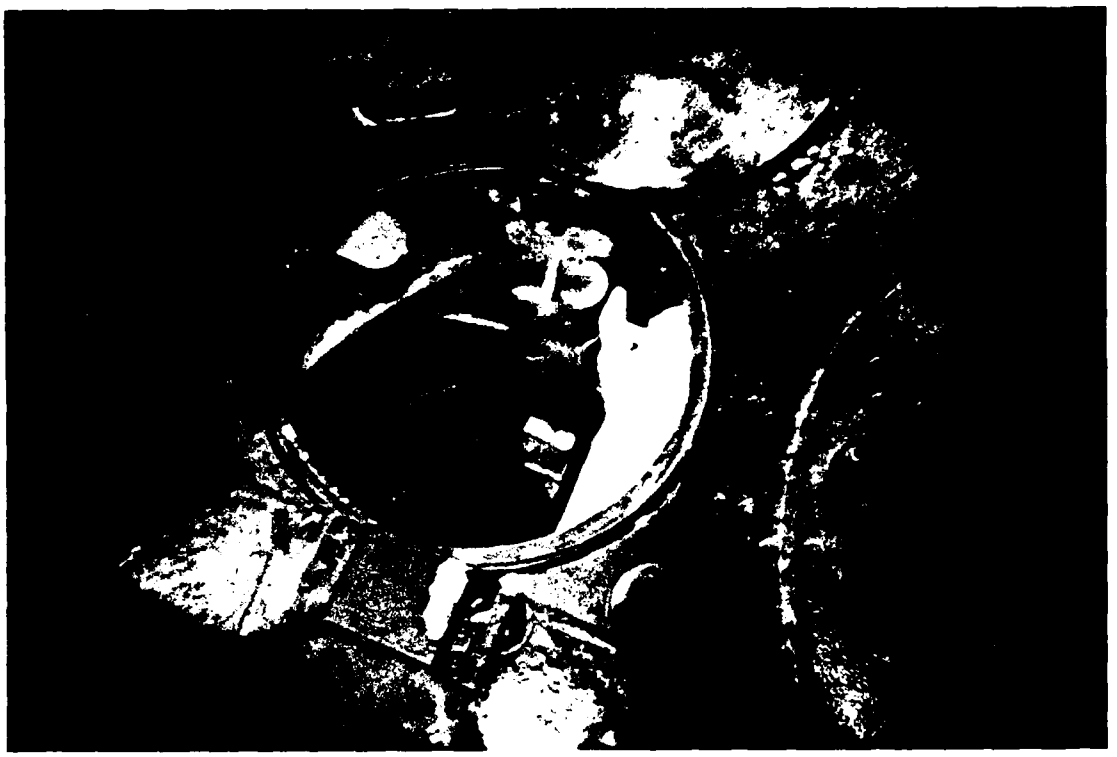

Figure I-14. AMX-13 Gunner's Hatch

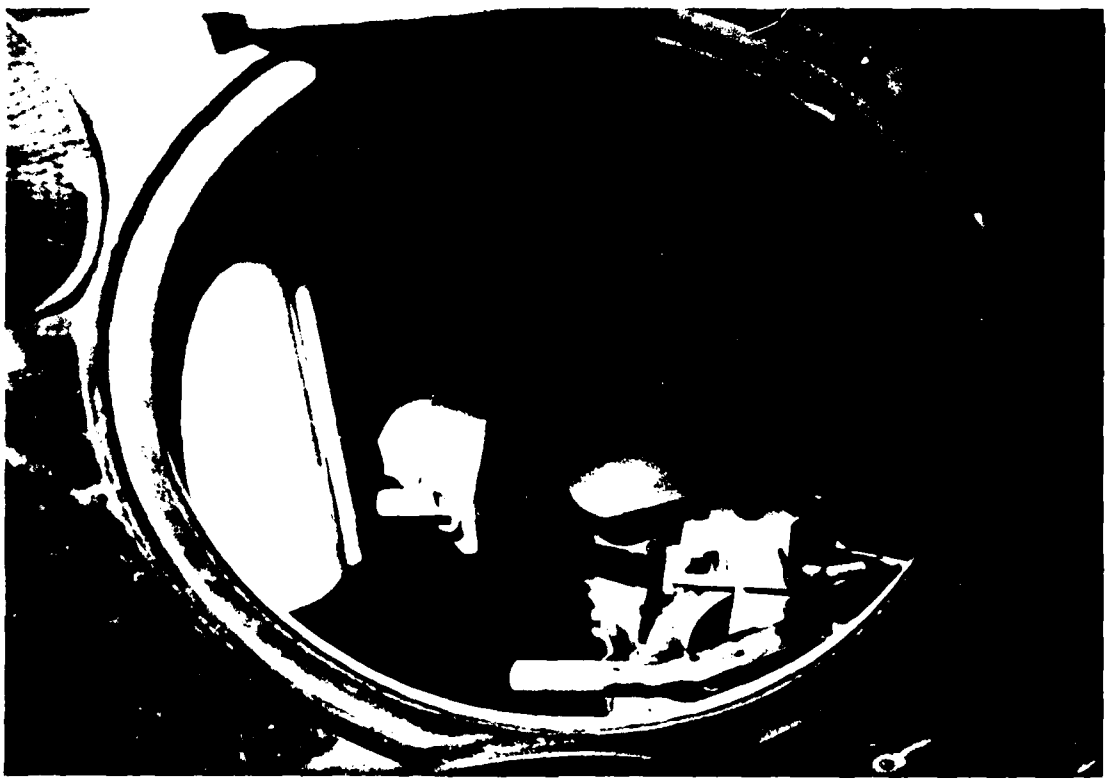

Figure I-15. AMX-13 Obstruction Bloccking Gunner's Hatch

and maintenance tasks. Even the smaller crewmen would find it difficult to operate without incurring injuries from protrusions, lack of padding, and the arrangement of the main gun recoil system. Outside visibility is severely restricted and, in a one-on-one engagement with other tanks, the AMX-13 would be at a great tactical disadvantage. Its greatest defense in combat, however, would remain speed and agility.

5. Crew Integration, Safety, Health Hazards

Identical fire control system displays/controls were not observed at the commander's station. Operations with a disabled gunner in a degraded mode may restrict battle capabilities to maneuver and possibly command and control.

Considering the design of the crewstations, arctic and NBC apparel would restrict more severely the abilities of the crew to perform. Emergency ingress and egress likewise poses a problem, even for the smaller stature crews. Donning and doffing arctic and NBC clothing without exiting the vehicle would be extremely difficult, if not impossible, under any circumstance. Accessibility to items stowed in the interior of the AMX-13 is extremely difficult, including the fire suppression system.

Decontaminating the interior of the vehicle would also present a severe problem since a great many areas cannot be accessed by any but the smallest stature soldiers. Even they would find the tasks difficult.

Regarding stowage, some stowage space is available on the outside of the turret by use of racks. Very little area is provided within the turret and hull for stowage of personal arms and ammunition, NBC gear, rations, water, and other essential items. Moreover, access to items stowed inside would be very difficult. Extended operations could tax crew members beyond reasonable human limits.

Access to the engine for repair and maintenance is possible from the front right deck and from a removable panel at the driver's immediate right. Access to the main gun and coax machine gun is made extremely difficult because of the lack of interior workspace for free elbow, arm, body, and hand movement. The general adequacy of interior workspace for performing checks and maintenance services was rated as extremely poor.

The quality of protection afforded to cables, indicators, etc, against inadvertent activation and damage during repairs is poor. Labels and placards identifying items that may need repair or replacement were difficult to see.

Refueling operations would likely be very easy because of the location of the fuel inlet at the rear of the vehicle. Ample space is provided for manipulating the fuel cap with arctic and NBC handwear.

Accessing the main gun ammunition, except for five rounds located at the commander's left foot area and several at the gunner's right, against the turret wall, is difficult. The rounds stowed at the commander's station could suffer damage from the occupant (e.g., stepping on them) or from other items dropped from above. To upload the 90 mm rounds into the revolver magazines would require the occupants to exit the vehicle, open the hatch on either side of the turret rear bustle, and reload each in turn, exposing the individual to hostile fire.

6. Evaluator's Ratings

As shown in Table I-3, evaluators rated the AMX-13 human engineering design the lowest of the three systems subject to evaluation. 76-percent of the responses were negative. Only 24-percent indicated some positive aspects of the vehicle. 51-percent of the ratings, based on a total of 102 responses, indicated very negative to extremely negative human engineering system characteristics.

C. DISCUSSION

It may not be entirely fair to compare the French AMX-13 Light Tank with the British main battle tanks. The operational requirements of the AMX-13 are significantly different from the Centurion and Chieftain vehicles.

First, the AMX-13 was designed to provide a high speed, low silouette reconnaissance vehicle that could also defeat heavy armor. However, the role of the AMX-13 apparently was not to engage heavy armor in sustained combat.

Secondly, the tank was designed specifically to accommodate personnel five feet, eight inches (5'8") in stature. The French, it seems, are willing to live with restrictions in crew selection to smaller individuals. The United States is not willing to do this. Therefore, it may be unfair to compare crewstation design with U.S. military human engineering standards. Of course, as an export item, other countries purchasing the tank are also placed under the same crew selection requirements. If other using countries assign crews who exceed the 5'8" stature limit, then some (possibly much) degradation in crew performance can be expected.

TABLE I-3. STATISTICAL SUMMARY OF EVALUATOR'S RATINGS, FRENCH AMX-13

TARGET SYSTEM RATING VALUES	1 EXTREMELY NEGATIVE	2 VERY NEGATIVE	3 NEGATIVE	4 POSITIVE	5 VERY POSITIVE	6 EXTREMELY POSITIVE
AMX-13						
GENERAL,BOARDING,ETC.	1	4	0	0	0	1
DRIVER STATION	4	4	3	7	0	1
COMMANDER STATION	3	7	3	4	2	
GUNNER STATION	2	4	13	6	0	1
CREW INTEGRATION	14	9	7	1	1	0
TOTAL = 102	24	28	26	18	3	3
POSITIVE RESPONSES = 24%						
NEGATIVE RESPONSES = 76%						

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ATTACHMENT 3

HUMAN FACTORS ENGINEERING DATA BASE FOR THE FRENCH AMX-13 MBT

Human Factors Engineering Data Base
File Name: AMR7
Evaluator's Rating Scales

0300 Evaluator's Rating Scale 1
6 = Extremely adequate
5 = Very adequate
4 = Adequate
3 = Inadequate
2 = Very Inadequate
1 = Extremely inadequate

0304 Evaluator's Rating Scale 2
6 = Extremely easy
5 = Very easy
4 = Easy
3 = Difficult
2 = Very difficult
1 = Extremely difficult

0306 Evaluator's Rating Scale 3
6 = Extremely good
5 = Very good
4 = Good
3 = Poor
2 = Very poor
1 = Extremely poor

0308 Evaluator's Rating Scale 4
6 = Extremely accessible
5 = Very accessible
4 = Accessible
3 = Inaccessible
2 = Very inaccessible
1 = Extremely inaccessible

0310 Evaluator's Rating Scale 5
6 = Definitely not dangerous/hazardous
5 = Probably not dangerous/hazardous
4 = Maybe not dangerous/hazardous
3 = Maybe dangerous/hazardous
2 = Probably dangerous/hazardous
1 = Definitely dangerous/hazardous

0312 Evaluator's Rating Scale 6
6 = Extremely effective
5 = Very effective
4 = Effective

3 = Ineffective
2 = Very ineffective
1 = Extremely ineffective

0314 Evaluator's Rating Scale 7
6 = Extremely improbable
5 = Very improbable
4 = Probably not
3 = Probably
2 = Highly likely
1 = Extremely likely

0316 Color coding IAW MIL-STD-1472C
Red = Critical; stop; emergency
Yellow = Caution; slow down
Green = Safe; go
White = ON; general status; operating

0318 Control movement IAW MIL-STD-1472C
ON = Up, right, clockwise, pull
OFF = Down, left, counter-clockwise, push
Increase = Forward, up, right, clockwise
Decrease = Rearward, down, left, counter-clockwise

0342 Abbrev; Cmdr = Commander

0344 Abbrev; Com = Communications

0348 Abbrev; CVC = Combat vehicle crewman

0352 Abbrev; DAY-CHV = Day-Closed hatch viewing

0354 Abbrev; dB(A) = decibels, A-weighted

0358 Abbrev; Dvr = Driver

0360 Abbrev; FLIR = Forward looking infra red

0364 Abbrev; ft-C = Foot-candles

0368 Abbrev; FOV = Field of view

0370 Abbrev; Gnr = Gunner

0372 Abbrev; Hz = Hertz

0374 Abbrev; IAW = In accordance with

0378 Abbrev; Ldr = Loader

0380 Abbrev; lx = Lux

0382 Abbrev; m = meters

0383 Abbrev; MG = machine gun

0384 Abbrev; mm = millimeters

0386 Abbrev; MIL-STD = Military standard

0388 Abbrev; MOPP-4 = Military oriented protective posture, level 4

0390 Abbrev; MRT = Modified rhyme test

0392 Abbrev; N = Newtons

0394 Abbrev; NBC = Nuclear, biological, chemical

0396 Abbrev; NET = New Equipment Training

0397 Abbrev; Rh = Relative humidity

0398 Abbrev; RMS = Root mean square

0402 Abbrev; SRP = Seat reference point

0406 Abbrev; Sta = Station

0408 Abbrev; SWAT = Subjective Workload Assessment Technique

0408 Abbrev; TECOM = Test and Evaluation Command

0410 Abbrev; TOP = Test Operation Procedures

Human Factors Engineering Data Base
File Name: AMR1
System Profile

0001 Vehicle name, generic and military [AMX-13 M51/W]

0002 Vehicle class; tracked, wheeled; tank, light armored vehicle; etc., [light tank; tracked; 14.8 tons, 40 mph]

0004 Vehicle identification, country of origin, [FRANCE]

0006 Vehicle identification, manufacture date, [1955]

0008 Vehicle operability, overall condition of vehicle, rating scale 3 [4]

0010 Vehicle operability, automotive condition, engine/drive train, [DRIVEABLE]

0012 Vehicle operability, weapon condition, main gun, [OPERABLE]

0014 Vehicle operability, weapon condition, coax machine gun, [NOT PRESENT]

0018 Vehicle operability, weapon condition, commander's weapon, [INOPERABLE]

0020 Crew number, total, [3]

0021 Crew location, driver, [FRONT, LEFT HULL]

0022 Crew location, gunner, [TURRET, RIGHT]

0023 Crew location, commander, [TURRET, LEFT]

0024 Crew location, loader, [N/A, AUTOLOADER]

0025 Crew location, infantry passengers, [N/A]

0026 Cannon, stabilization, [MANUAL]

0028 Turret, traverse limits, [360 DEGREES]

0030 Cannon, rate-of-fire, cannon, [UNKNOWN]

0040 Cannon, turret traverse rate, [360 DEGREES IN 12 SECONDS]

0044 Mobility, fording prep time, [UNKNOWN]

0046 Cannon, rate of fire, stationary, [UNKNOWN]

0047 Cannon, rate of fire, moving, [UNKNOWN]

0048 Cannon, autoloader, description, [90MM AUTO, TWO MAGAZINES,

ROUNDS REVOLVING]

0050 Cannon, autoloader, manual assist, description, [ACCESS BY EITHER COMMANDER/GUNNER BY USE OF HANDWHEEL. COMMANDER'S LOCATED ON THE BREECH BLOCK; GUNNER'S BEHIND BREECH LOCATED AGAINST TURRET WALL.]

0052 Cannon, ammo, storage, location, [TURRET BUSTLE, 2 6-ROUND MAGAZ

0054 Coax MG, type (text)

0056 Coax MG, caliber, [7.62MM]

0058 Coax MG, fire control (text)

0060 Cmdr's weapon, cupola, description, [ROOF MOUNTED, OVERLAPPING VISUAL SYSTEM]

0062 Cmdr's weapon, elevation limits, (degrees)

0064 Cmdr's weapon, traverse limits, (milirads/min)

0080 Main weapon, fire control, system type, (text)

0082 Main weapon, fire control, range finder, type, (text)

0084 Main weapon, fire control, ballistic computer, description, (text)

0086 Main weapon, fire control, ammo selector, description, [FRENCH]

0088 Searchlight, model, [NOT PRESENT]

0090 Searchlight, field of view, [NOT PRESENT]

0092 Searchlight, effective range, [NOT PRESENT]

0094 Main weapon, fire control, telescope, model, [FRENCH]

0096 Main weapon, fire control, telescope, MAG, (power)

0098 Main weapon, fire control, telescope, FOV, (degrees)

0120 Main weapon, fire control, location, [GUNNER'S POSITION, NO TRIGGER PROVIDED ON HANDLE. TWO HANDED YOKE CONTROLLER.]

0124 Main weapon, fire control, FLIR, model (text)

0126 Main weapon, fire control, FLIR, MAG, [UNKNOWN]

0128 Main weapon, fire control, FLIR, FOV, [UNKNOWN]

0130 Main weapon, fire control, FLIR, location, [UNKNOWN]

0140 Main weapon, fire control, range finder, MAG, [UNKNOWN]

0144 Main weapon, fire control, range finder, FOV, [UNKNOWN]

0146 Main weapon, fire control, range finder, location, [UNKNOWN]

0148 Main weapon, fire control, range finder, accuracy, [UNKNOWN]

0150 Azimuth indicator, description, [FRENCH]

0156 Ident Friend-Foe, [N/A]

0160 NBC protection, type, collective protection; individual, [NONE]

0166 NBC filter, type, [N/A]

0168 NBC collective protection, type, overpressure/etc., [N/A]

0174 NBC individual protection, type, (text)

0176 NBC individual protection, filter type (text)

0178 NBC agent detector, type (text)

0180 NBC agent detector, location (text)

0190 Engine, location, [FRONT, RIGHT HULL]

0196 Engine, maintenance access, interior, [RIGHT WALL, DRIVER'S]

0200 Resupply, POL, time, [N/A]

0220 Cannon, ammo, type 1, descrip; weight, [HEAT, 8.9KG]

0222 Cannon, ammo, type 2, descrip; weight, [HE, 10.4KG]

0226 Cannon, ammo, type 3, descrip; weight, [SMOKE, 10.6KG]

0228 Cannon, ammo, type 4, descrip; weight (Kg; lbs/oz.)

0260 Main gun dead space, distance from front glacis (meters)

0266 Fire control system, elevation quadrant indicator provided? (Yes/No; Comments)

0270 Fire control system, traverse indicator type (text)

Human Factors Engineering Data Base
File Name: ARMR1
General, Boarding, Movement

2004 Handholds/footholds, adequacy of boarding using, rating scale 1 [6]

2005 Boarding handholds, grasp space, [none provided]

2006 Boarding footholds, dimensions, L x W, [3 in. serrated steps on each rear fender]

2008 Non-skid surfaces, adequacy of, rating scale 2, [2]

2009 Obstructions boarding vehicle? [NO]

2010 Alternate boarding paths? [YES, STEPS PROVIDED ON REAR FENDER]

2011 Alternate emergency hatch provided? [NO]

2100 Inter-crew station passage, difficulty moving from primary entrance hatch to loader's station, rating scale 2, [1]

2101 Inter-crew station passage, average time to move from primary entrance to loader's station, [N/A]

2102 Inter-crew station passage, difficulty moving from primary entrance hatch to cmdr's station, rating scale 2, [2]

2103 Inter-crew station passage, average time to move from primary entrance to cmdr's station, [N/A]

2104 Inter-crew station passage, difficulty moving from primary entrance hatch to gunner's station, rating scale 2, [2]

2105 Inter-crew station passage, average time to move from primary entrance to gunner's station, [N/A]

2106 Gunner's seat back, must be removed to enter station? [NO]

2108 Driver's ingress from turret to station, must turret be rotated? [YES, 14 INCHES X 20 INCHES OPENING]

2109 Driver's ingress from turret to station, average time, non-NBC garbed, [N/A]

2111 Driver's ingress from turret to station, average time, NBC garbed, [N/A]

2113 Driver ingress from turret to station, effort required, NBC garbed, rating scale 2 [N/A]

2115 Emergency egress, adequacy of moving from driver sta to turret, rating scale 2 [2]

2117 Dead weight drag, ease of dead weight drag from driver station into turret, rating scale 2 [N/A]

2118 Dead weight drag, from driver station into turret, average time, NBC garbed, [N/A]

2119 Dead weight drag, from driver station into turret, average time, non-NBC garbed, [N/A]

2120 Dead weight drag, from gunner station to outside vehicle, ease of, rating scale 2 [N/A]

2121 Dead weight drag, from gunner station to outside vehicle, average time, NBC garbed, [N/A]

2122 Dead weight drag, from gunner station to outside vehicle, time, non-NBC garbed, [N/A]

2124 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, ease of, rating scale 2 [N/A]

2125 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, average time, non-NBC garbed, [N/A]

2126 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, average time, NBC garbed, [N/A]

Human Factors Engineering Data Base
File Name: AMR2
Driver's Station

3005 Dvr sta, seat back dimensions, [11 INCHES X 12.75 INCHES]

3010 Dvr sta, seat pan dimensions, IAW MIL-STD-1472C, Fig 50, [10.5 INCHES X 14 INCHES]

3012 Dvr sta, seat padding, thickness, IAW MIL-STD-1472C, Fig 50, [3.75 INCHES]

3014 Dvr sta, seat back rest-to-seat angle, IAW MIL-STD-1472C, Fig 50, [N/A]

3016 Dvr sta, seat slope, IAW MIL-STD-1472C, Fig 50, [N/A]

3018 Dvr sta, distance from seat front, top of padding, to floor, IAW MIL-STD-1472C, Fig 50, [15.25 INCHES]

3020 Dvr sta, seat vertical adjustability, IAW MIL-STD-1472C, Fig 50, [15 INCHES]

3022 Dvr sta, seat forward-rearward adjustability, IAW MIL-STD-1472C, Fig 50, [NOT PROVIDED]

3024 Dvr sta, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, [24 INCHES]

3026 Dvr sta, MIL-STD-1472C, Table 28 dimension B, Elbow, static, [22.5 INCHES]

3028 Dvr sta, MIL-STD-1472C, Table 28 dimension C, Shoulder, [14.75 INCHES]

3030 Dvr sta, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, [14 INCHES]

3032 Dvr sta, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, [25 INCHES]

3034 Dvr sta, MIL-STD-1472C, Table 28 dimension F, Boot clearance from pedal, [NO PEDALS PROVIDED]

3036 Dvr sta, MIL-STD-1472C, Table 28 dimension G, Distance between pedals, [2.75 INCHES]

3038 Dvr sta, MIL-STD-1472C, Table 28 dimension H, Boot clearance from brake pedal, [8.25 INCHES]

3040 Dvr sta, MIL-STD-1472C, Table 28 measurement 1, head clearance, closed hatch, SRP to underside of hatch, [32.25 INCHES, SEAT DOWN]

3042 Dvr sta, MIL-STD-1472C, Table 28 measurement 2, abdominal, seat back to steering device, [25 INCHES]

3044 Dvr sta, MIL-STD-1472C, Table 28 measurement 3, front of knee, seat back to closest forward object, [4.75 INCHES]

3046 Dvr sta, MIL-STD-1472C, Table 28 measurement 4, seat depth, SRP to front edge of seat pan, [6.25 INCHES]

3050 Dvr sta, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to heel point of accelerator, [23.25 INCHES]

3052 Dvr sta, adequacy of viewing and operating hand and foot controls, viewing displays in all vertically adjusted seat positions, open/closed hatch, rating scale 1 [2]

3054 Dvr sta, seat, adequcy of lumbar support, rating scale 1 [2]

3056 Dvr sta, seat provided with restraint,seat belts? [NOT PROVIDED]

3058 Dvr sta, seat, adequacy of seat restraint/seat belt system, rating scale 1 [N/A]

3060 Dvr sta, seat designed to prevent bloodflow to popliteal area? [NO]

3062 Dvr sta, seat provided with adjustable headrest? [NO]

3064 Dvr sta, seat material, promote excessive perspiration during estended operations? [YES]

3066 Dvr sta, seat material, become excessively hot during operations in hot conditions? [YES]

3068 Dvr sta, adequacy of emergency steering or evasive maneuvers, rating scale 1 [INOPERABLE]

3070 Dvr sta, adequacy of emergency braking, rating scale 1 [INOPERABLE]

3072 Dvr sta, closed hatch, non-NBC, adequacy of ventilation (use of fresh outside air), rating scale 1 [N/A]

3074 Dvr sta, daylight driving, open hatch, reflective glare on instruments? [NO, RECESSED]

3076 Dvr sta, open hatch, adequacy of rear view mirror, rating scale 1 [N/A]

3078 Dvr sta, seat back material, [VINYL]

3080 Dvr sta, head rest material, [N/A]

3082 Dvr sta, distance closest hand control from SRP [18 INCHES]

3084 Dvr sta, adequacy of access and operation of hand/foot controls, rating scale 1 [4]

3086 Dvr sta, visibility, quality of visibility of controls/displays, day and night operations, rating scale 3 [4]

3088 Dvr sta, visibility; viewing distance to most distant display [27 INCHES]

3090 Dvr sta, visibility; viewing angle from design eye position to worse condition primary display (degrees)

3092 Dvr sta, adequacy of displays for critical driving tasks, rating scale 1 [4]

3094 Dvr sta, display functions grouped together? [YES]

3096 Dvr sta, closed hatch, displays readable? (Yes/No; comments)

3097 Dvr sta, master caution light provided? [NO]

3098 Dvr sta, master caution light, distance, ngle from design eye postion, (mm; in./degrees)

3099 Dvr sta, master caution light, range of luminance, (range in lx; ft-C)

3100 Dvr sta, master caution light, color (text)

3101 Dvr sta, displays illuminated? [NO]

3102 Dvr sta, primary display color, [WHITE AND TAN ON BLACK]

3103 Dvr sta, display luminance range, (lx; ft-C)

3104 Dvr sta, display luminance variable control? (Yes/No; comments)

3105 Dvr sta, spot brightness values, primary displays, (display type; location; ft-L)

3106 Dvr sta, primary displays, color-coded efficiently? (Yes/No, comments)

3107 Dvr sta, luminance controls provided with full OFF? (Yes; No; comments)

3108 Dvr sta, indicator lights, grouped together, close to driver's line of sight? (Yes/No; comments)

3110 Dvr sta, indicator lights, colored correctly, IAW MIL-STD-1472C? (Yes/No; comments)

3112 Dvr sta, indicator lights testable? (Yes/No; comments)

3114 Dvr sta, indicator lights dimmable? (Yes/No; comments)

3116 Dvr sta, indicator lights, luminance range, (lx; ft-C)

3118 Dvr sta, instrument panel nomenclature used of appropriate size, contrast with panel, and readable? (Yes/No; comments)

3120 Dvr sta, decals/placards readable, properly placed? (Yes/No; comments)

3122 Dvr sta, controls provided best choice for critical driving tasks? (Yes/No; comments)

3124 Dvr sta, size, shape, spacing between controls appropriate for effective intended usage? [NO]

3126 Dvr sta, controls located and arranged to facilitate sequential usage? (Yes/No, comments)

3128 Dvr sta, adequacy of access to driver's controls, rating scale 4 [3]

3130 Dvr sta, primary controls illuminated? (Yes/No; comments)

3132 Dvr sta, primary control area illumination level (lx; ft-C)

3134 Dvr sta, direction of control movement correct? (Yes/No; comments)

3136 Dvr sta, controls located adequately near associated displays? Rating scale 1 (1-6)

3138 Dvr sta, adequacy of driver control/display arrangement, rating scale 1 [4]

3139 Dvr sta, methods provided to reduce glare? [NO]

3140 Dvr sta, excessive force required to operate hand controls? [YES]

3142 Dvr sta, force measurement of primary hand control (N; lbs)

3144 Dvr sta, force measurement of secondary hand control (N; lbs)

3146 Dvr sta, force measurement of tertiary hand control (N; lbs)

3148 Dvr sta, excessive force required to operate foot controls? [NO]

3150 Dvr sta, force measurement of excelerator (N; lbs)

3152 Dvr sta, force measurement of foot brake (N; lbs)

3154 Dvr sta, control switch guards, protective covers or guards provided? (Yes/No; comments)

3156 Dvr sta, protective covers/guards, adequately positioned to permit observation of displays, nomenclature, indicators, etc., rating scale 1 (1-6)

3158 Dvr sta, steering device, adequacy of size to permit complete control of vehicle, rating scale 1 [4]

3160 Dvr sta, NBC collective protection provided? [YES]

3162 Dvr sta, NBC collective protection, hose located to provide ready access by driver, closed hatch operations, rating scale 3 (1-6)

3164 Dvr sta, NBC collective protection, air temp/humidity at mask (degrees, C; degrees, F; Rh)

3166 Dvr sta, NBC collective protection, access to collective protection filter cannister, rating scale 2 [5]

3168 Dvr sta, NBC collective protection, location of collective protection filter (text)

3170 Dvr sta, type of NBC mask (text)

3172 Dvr sta, NBC, access to heater with collective protection, rating scale 2 (1-6)

3174 Dvr sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

3176 Dvr sta, NBC collective protection, effectiveness of overpressure on driver tasks, rating scale 6 (1-6)

3177 Dvr sta, NBC collective protection, bulk air dump provided? (Yes/No; location)

3178 Dvr sta, NBC collective protection, bulk air dump rate/volume, (ft/min; cu ft/min)

3179 Dvr sta, NBC collective protection, effectiveness of NBC filter to strain dust, other non-NBC particulates, rating scale 6 (1-6)

3180 Dvr sta, adequacy of hatch entry padding, rating scale 2 [1]

3182 Dvr sta, ease of opening/closing hatch, rating scale 2 [1]

3183 Dvr sta, hatch dimensions, l x w x d, (mm; in.)

3184 Dvr sta, time to egress, from closed hatch position to outside of vehicle, non-NBC-clad, (seconds)

3186 Dvr sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4 clad, (seconds)

3188 Dvr sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 [3]

3190 Dvr sta, open hatch mode, probability of injury from traversing turret, rating scale 5 [1]

3192 Dvr sta, ease of transitioning from open to closed hatch mode with vehicle in motion, rating scale 2 [2]

3194 Dvr sta, time to transition from open to closed hatch mode with vehicle in motion, (seconds)

3196 Dvr sta, driver provided with daylight, closed hatch viewing system (DAY-CHV)? (Yes/No; comments)

3198 Dvr sta, closed hatch viewing, viewing distance to closest point in front of vehicle, using DAY-CHV, (m; ft)

3200 Dvr sta, general adequacy of closed hatch viewing to outside of vehicle, rating scale 1 [5]

3202 Dvr sta, closed hatch viewing, adequacy of interface with DAY-CHV device and NBC mask, rating scale 1 (1-6)

3204 Dvr sta, closed hatch, forward viewing angle through periscope from left to right, (degrees)

3206 Dvr sta, closed hatch, forward viewing angle using DAY-CHV, from left to right, (degrees)

3208 Dvr sta, closed hatch, adequacy of upward viewing through DAY-CHV device, rating scale 1 (1-6)

3210 Dvr sta, closed hatch, adequacy of upward viewing through periscope, rating scale 1 (1-6)

3212 Dvr sta, closed hatch, upward viewing angle through DAY-CHV device, (degrees)

3214 Dvr sta, closed hatch, upward viewing angle through periscope, (degrees)

3216 Dvr sta, DAY-CHV system, adequacy of defroster system, operation in cold weather, rating scale 1 (1-6)

3218 Dvr sta, DAY-CHV system, time to defrost, cold weather operations, from cold start (min, sec)

3220 Dvr sta, cold weather operations, frosting or misting of windshield/periscope? (Yes/No; comments)

3222 Dvr sta, adequacy of wipers to remove rain, snow, dust, etc. from DAY-CHV, rating scale 1 (1-6)

3224 Dvr sta, night vision device provided? (Yes/No; comments)

3226 Dvr sta, adequacy of night vision device, rating scale 1 (1-6)

3228 Dvr sta, time to install driver night vision device from stowed position, (seconds)

3230 Dvr sta, visibility, adequacy of viewing ground, open hatch, seat adjusted fully up, 5th percentile male, rating scale 1 [5]

3232 Dvr sta, driver vision, open hatch, viewing distance to point on ground closed to vehicle, normally seated, 5th percentile male, seat adjusted fully up, (m; ft)

3234 Dvr sta, driver vision, open hatch, forward FOV, [180 DEGREES]

3236 Dvr sta, driver vision, open hatch, quality of forward, lateral visibility, rating scale 3 [6]

3238 Dvr sta, escape hatch provided other than primary hatch? [NO]

3240 Dvr sta, escape hatch dimensions, l x w, (mm, in.)

3242 Dvr sta, quality of accessibility to escape hatch, rating scale 3 (1-6)

3344 Dvr sta, location of communication (com) hookup, [LEFT WALL, NEXT TO HEAD, APPROX 6 INCHES]

3346 Dvr sta, ease of access to com hookup from normal seated position, rating scale 2 [5]

3348 Dvr sta, com equip, ease of operation of com box w/arctic handwear, rating scale 2 (1-6)

3350 Dvr sta, com equip, space between connector and bulkhead, or connector and closest object, [1 INCH]

3352 Dvr sta, speech intelligibility, dvr's com equip, CVC helmet, MRT, non-NBC, (percent correct)

3354 Dvr sta, speech intelligibility, dvr's com equip, CVC helmet, MRT, w/NBC mask, (percent correct)

3356 Dvr sta, com equip, probability of intercom cord interfering with dvr mobility, rating scale 7 [2]

3358 Dvr sta, effectiveness of communicating to other crew members using hand signals or other methods, rating scale 6 [1]

3360 Dvr sta, quality of speech intelligibility, dvr's com equip, CVC helmet, non-NBC, rating scale 2 (1-6)

3364 Dvr sta, quality of speech intelligibility, dvr's com equip, CVC helmet, w/NBC mask, rating scale 2 (1-6)

3370 Dvr sta, chance of handedness or eye glasses interfering with driving operations, rating scale 2 [4]

3372 Dvr sta, ease of training new operator quickly, rating scale 2 (1-6)

3376 Dvr's exterior lights, adjustable to illuminate desired field of view? (Yes/No; comments)

3378 Dvr's exterior lights, illumination level, 25m, full ON, front of vehicle, (lx; ft-C)

3380 Dvr's exterior lights, level of difficulty to replace bulbs, etc., rating scale 2 (1-6)

3382 Dvr sta, general adequacy of interior lighting, rating scale 1 (1-6)

3384 Dvr sta, accessibility of control for interior lighting, rating scale 4 (1-6)

3386 Dvr sta, safeguard provided against inadvertent activation of interior lights? (Yes/No; comments)

3390 Dvr sta, heater, temperature at dvr's feet, full ON,

(degrees C; degrees F)

3392 Dvr sta, heater, variable heat control provided? (Yes/No; comments)

3394 Dvr sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

3396 Dvr sta, ease of operation considering practicality of heater, reliability, accessibility, etc., rating scale 2 (1-6)

3398 Dvr sta, heater, accessibility of heater control, rating scale 4 (1-6)

3400 Dvr sta, heater, adequacy of safeguards to prevent heat injury to personnel, rating scale 1 (1-6)

3408 Dvr sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

3410 Dvr sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

3412 Dvr sta, ventilation, non-NBC; variable control provided for ventilation system? (Yes/No; comments)

3414 Dvr sta, ventilation, non-NBC; accessibility to ventilation control, rating scale 4 (1-6)

3416 Dvr sta, ventilation, non-NBC; effectiveness of ventilation system at station, 6 (1-6)

3456 Dvr sta, steady-state noise hazards, any frequency/condition, rating scale 5 (1-6)

3460 Dvr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

3464 Dvr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

3468 Dvr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ, (dBA)

3470 Dvr sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

3472 Dvr sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration: peak pressure-dBA)

3480 Dvr sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

3482 Dvr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; 50 HZ; 80)

3484 Dvr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; 50 HZ; 80 HZ)

3486 Dvr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS 30 HZ; 50 HZ; 80 HZ)

3488 Dvr sta, probability of ride vibrations causing visual difficulties, rating scale 7 (1-6)

3490 Dvr sta, vibration amplitude, dvr's instrument panel, (RMS)

3494 Dvr sta, vehicle lurch, start-stop? (Yes/No; comments)

3500 Dvr sta, emergency brake, location (text)

3502 Dvr sta, emergency brake, type of actuation (text)

3504 Dvr sta, emergency brake, force required, operation, (N; lbs)

Human Factors Engineering Data Base
File Name: AMR3
Commander's Station

4000 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, dimensions seat pan, l x w, [9.75 INCHES]

4002 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, [1 INCH]

4004 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, (degrees)

4006 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, (degrees)

4008 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, (mm; in.)

4010 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, (range in mm; in.)

4012 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, forward adjustability, (range in mm; in.)

4014 Cmdr sta, seat pan material, [VINYL]

4016 Cmdr sta, seat back material, (text)

4018 Cmdr sta, seat, head rest material, [NOT PROVIDED]

4020 Cmdr sta, seat, restraint system provided? [NO]

4021 Cmdr sta, adequacy of restraint system, rating scale 1 (1-6)

4022 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, (mm; in.)

4024 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, (mm; in.)

4026 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, (mm; in.)

4028 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, (mm; in.)

4030 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, (mm; in.)

4032 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 1, closed hatch, SRP to underside of hatch, (mm; in.)

4034 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 2, Abdominal, seat back to nearest forward object, (mm; in.)

4036 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 4, Seat depth SRP to front edge of seat pan, (mm; in.)

4038 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 6, Seat pan height, (mm; in.)

4040 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 7, Boot, front seat pan to nearest object forward, (mm; in.)

4042 Cmdr Sta, seat, effectiveness of cmdr's seat, considering adjustability, cushioning, size, and back angle, rating scale 6 (1-6)

4044 Cmdr sta, seat adjustable vertically? (Yes/No; comments)

4046 Cmdr sta, quality of viewing cmdr's instruments with seat adjusted fully up, open hatch, for 95th percentile male, rating scale 3 (1-6)

4048 Cmdr sta, quality of viewing cmdr's instruments during closed hatch operations, rating scale 3 (1-6)

4050 Cmdr sta, adequacy of lumbar (back) support during extended operations, rating scale 1 (1-6)

4052 Cmdr sta, seat material promote excessive perspiration during extended operations? [YES]

4054 Cmdr sta, foot rest provided for arctic boot-sized foot? [PLATFORM FOR FOOT REST]

4056 Cmdr sta, adequacy of foot rest for operations in closed hatch seated condition, rating scale 1 [3]

4058 Cmdr sta, foot rest dimensions, [10 INCHES X 10 INCHES]

4060 Cmdr sta, vertically-adjustable standing platform provided for stand-up, open hatch operations? [NO]

4062 Cmdr sta, adequacy of standing platform considering use with arctic boots, rating scale 1 (1-6)

4064 Cmdr sta, can cmdr's seat be adjusted to permit sitting with head and shoulders exposed? (Yes/No, comments)

4066 Cmdr sta, approx distance 95th percentile seated male exposed above hatch line, seat adjusted fully up, (mm; in.)

4068 Cmdr sta, ease of emergency egress, open hatch, non-NBC

clad 95th percentile male, rating scale 2 (1-6)

4070 Cmdr sta, ease of emergency egress, open hatch, NBC MOPP-4 clad 95th percentile male, rating scale 2 (1-6)

4072 Cmdr sta, average time to emergency egress from cmdr sta, open hatch, non-NBC clad 95th percentile male, (no. trials; seconds)

4074 Cmdr sta, average time to emergency egress from cmdr sta, open hatch, NBC MOPP-4 clad 95th percentile male, (seconds)

4076 Cmdr sta, seat, capability to fold seat back for stand-up operations? (Yes/No; comments)

4078 Cmdr sta, ease of folding seat back for stand-up operations, rating scale 2 (1-6)

4080 Cmdr sta, ease of access to adjustment controls for seat operation, rating scale 2 (1-6)

4082 Cmdr sta, force required to operate seat adjustment controls, (N; lbs)

4084 Cmdr sta, probability of injury during the performance of dynamic tasks (transitioning from open to closed hatch, etc.), due to contact with station equipment, rating scale 5 [6]

4086 Cmdr sta, quality of viewing all controls and displays during day/night closed/open hatch operations, rating scale 3 [4, FEW CONTROLS/DISPLAYS]

4088 Cmdr sta, effectiveness of cupola periscopes for outside viewing during closed hatch operations, rating scale 6 [5, 360 DEGREES UNITY]

4090 Cmdr sta, cupola provided with controls for manual traverse (of cupola)? [NO, NO TRAVERSE CAPABILITY]

4091 Cmdr sta, ease of locking/unlocking cupola manual traverse locking device, rating scale 2 (1-6)

4092 Cmdr sta, force required to unlock cupola traverse lock, (N; lbs)

4093 Cmdr sta, force required to actuate manual cupola traverse control, (N; lbs)

4094 Cmdr sta, level of difficulty to rotate cupola using manual controls, rating scale 2 (1-6)

4096 Cmdr sta, weapons servicing, ease of sighting and firing cmdr's weapon, closed hatch, considering rotation of

cupola, location of periscopes, and fire controls, rating scale 2 (1-6)

4098 Cmdr sta, ease of sighting and firing cmdr's weapon, open hatch mode, rating scale 2 (1-6)

4100 Cmdr sta, average time to charge and sight cmdr's weapon from seated position, open hatch, (no. trials; seconds)

4102 Cmdr sta, ease of access to ammunition for cmdr's weapon, rating scale 2 (1-6)

4104 Cmdr sta, average time to upload (from ammo stowage), reload cmdr's weapon, (no. trials; seconds)

4106 Cmdr sta, ease of uploading/reloading tasks, cmdr's weapon, rating scale 2 (1-6)

4108 Cmdr sta, ease of performing simple maintenance or repairs on cmdr's weapon, rating scale 2 (1-6)

4110 Cmdr sta, average time to acquire target using cmdr's GPS extension, open hatch mode, non-NBC, daytime, (no. trials; range in meters; seconds)

4120 Cmdr sta, average time to acquire target using cmdr's GPS extension, open hatch mode, NBC MOPP-4, daytime, (no. trials; range in meters; seconds)

4122 Cmdr sta, average time to acquire target using cmdr's GPS extension, closed hatch, non-NBC, (no. trials; range in meters; seconds)

4124 Cmdr sta, average time to acquire target using cmdr's GPS extension, closed hatch, NBC MOPP-4, (no. trials; range in meters; seconds)

4126 Cmdr sta, ease of performing target acquisition and main gun firing tasks using cmdr's GPS extension, open hatch, rating scale 2 (1-6)

4128 Cmdr sta, ease of performing target acquisition and main gun firing tasks using cmdr's GPS extension, closed hatch, rating scale 2 (1-6)

4138 Cmdr sta, com equip, location of com hookup, [31 INCHES FROM BACK TURRET WALL; RADIO EQUIPMENT, KNEE LEVEL FORWARD OF COMMANDER BENEATH BREECH]

4140 Cmdr sta, ease of operation of com box w/arctic handwear, rating scale 2 [4]

4142 Cmdr sta, quality of speech intelligibility, cmdr's com equip, CVC helmet, non-NBC, rating scale 2 (1-6)

4143 Cmdr sta, quality of speech intelligibility, cmdr's com equip, CVC helmet, w/NBC mask, rating scale 2 (1-6)

4144 Cmdr sta, speech intelligibility, cmdr's com equip, CVC helmet, non-NBC, MRT, (percent correct)

4145 Cmdr sta, speech intelligibility, cmdr's com equip, CVC helmet, w/NBC mask, MRT, (percent correct)

4146 Cmdr sta, com equip, space between connector and bulkhead or nearest object, [.25 INCH]

4147 Cmdr sta, effectiveness of communicating with other crew members using hand signals or other non-electronic methods, rating scale 6 [2]

4148 Cmdr sta, overall adequacy of controls/displays for tasks cmdr must perform, rating scale 1 [3]

4149 Cmdr sta, accessibility for operation of controls, rating scale 4 [4]

4150 Cmdr sta, quality of visibility of controls/displays, day and nighttime operations, rating scale 3 [3]

4152 Cmdr sta, distance from design eye, to nearest display, [6 INCHES]

4154 Cmdr sta, distance from design eye, to most distant display, [40 INCHES]

4156 Cmdr sta, viewing angle from design eye position to worse case primary display, (degrees)

4158 Cmdr sta, display functions grouped together? [YES]

4160 Cmdr sta, closed hatch, displays readable? (Yes/No; comments)

4162 Cmdr sta, displays illuminated? [NO]

4163 Cmdr sta, primary display; color (red, blue green, white, green, etc.)

4164 Cmdr sta, secondary display; (color)

4165 Cmdr sta, controls provided with display for variable lumination? [NO]

4166 Cmdr sta, master power control provided? (Yes/No; comments)

4167 Cmdr sta, range of display luminance, (display description; range in lx; ft-L)

4163 Cmdr sta, displays color-coded efficiently IAW MIL-STD-1472C? (Yes/No; comments)

4170 Cmdr sta, indicator lights grouped together, close to cmdr's line of sight? [NO]

4174 Cmdr sta, indicator lights color-coded IAW MIL-STD-1472C? [YES, RED]

4176 Cmdr sta, indicator lights testable? [ONE YES; ONE NO]

4178 Cmdr sta, indicator lights dimmable? [NO]

4180 Cmdr sta, range of luminance for indicator lights, (indicator light description; range in lx; ft-L)

4182 Cmdr sta, direction of control movement for all controls IAW MIL-STD-1472C? [YES]

4184 Cmdr sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? [NO, LETTERING TO SMALL]

4186 Cmdr sta, decals/placards readable, understandable, properly placed? [NO, PLACARDS OBSTRUCTED]

4188 Cmdr sta, general, ease of control actuation for all cmdr's controls, rating scale 2 [2]

4190 Cmdr sta, force required, worse case, control actuation, (N; lbs)

4192 Cmdr sta, protective covers or guards placed over controls or switches where appropriate? [NO, TOGGLE SWITCHES NOT PROTECTE

4194 Cmdr sta, NBC collective protection provided? (Yes/No; description; comments)

4196 Cmdr sta, NBC collective protection, location of hose to provide ready access by cmdr, closed hatch operations, rating scale 1 (1-6)

4197 Cmdr sta, location of interface point w/which to hook hose of individual NBC suit into collective protection system, (text)

4198 Cmdr sta, NBC collective protection, air temp/humidity at mask, full cooling (ambient outside temp/humidity; temp/humid measured at mask, degrees, C; degrees, F: Rh)

4200 Cmdr sta, type of NBC mask (text)

4202 Cmdr sta, NBC collective protection, air flow rate/volume

at mask (ft/min; cu ft/min)

4204 Cmdr sta, general adequacy of NBC collective protective system, rating scale 1 (1-6)

4208 Cmdr sta, NBC collective protection, effectiveness of overpressure at cmdr's station, rating scale 6 (1-6)

4210 Cmdr sta, NBC collective protection, effectiveness of filtration system to strain dust, other non-NBC particulates from outside, rating scale 6 (1-6)

4230 Cmdr sta, hatch, adequacy of hatch entry padding, rating scale 1 [1]

4232 Cmdr sta, hatch, ease of opening/closing hatch from inside vehicle, rating scale 2 [2, REAR PERISCOPE OBSTRUCTS HANDLE]

4234 Cmdr sta, time to egress, from closed hatch position to outside of vehicle, non-NBC clad, (seconds)

4236 Cmdr sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4 clad, (seconds)

4238 Cmdr sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 [1]

4240 Cmdr sta, hatch dimensions, [18 INCHES DIAMETER]

4242 Cmdr sta, hatch, combat lock provided? (Yes/No; comments)

4244 Cmdr sta, force required to unlock combat lock, (N; lbs)

4246 Cmdr sta, ease of transitioning from open to closed hatch, rating scale 2 [2]

4248 Cmdr sta, time to transition from open to closed hatch mode (seconds)

4250 Cmdr sta, hatch provide a partially open ("pop-up") mode to allow unrestricted observation while maintaining overhead cover? [NO]

4252 Cmdr sta, space provided between top of turret and bottom of hatch lip in 'pop-up' mode, (mm; in.)

4254 Cmdr sta, hatch make contact with any other equipment of vehicle when open or partially open? (e.g., strike loader's hatch, antenna mount, etc), [NO]

4256 Cmdr sta, outside viewing, closed hatch using periscopes/vision blocks, [CLOSE TO 360 DEGREES UNITY]

4258 Cmdr sta, outside viewing, closed hatch, blind spots?

[NO]

4260 Cmdr sta, outside viewing, closed hatch, upward viewing angle through periscopes/vision blocks, [APPROX 40 DEGREES]

4262 Cmdr sta, adequacy of outside viewing, closed hatch, through periscopes/vision blocks for target acquisition and surveillance, rating scale 1 [4]

4264 Cmdr sta, cmdr's weapon periscope, adequacy of viewing to effectively engage targets using cmdr's weapon, rating scale 1 (1-6)

4266 Cmdr sta, means provided to clear closed hatch vision systems of frost, dust, mud, etc. without exiting vehicle? (Yes/No; comments)

4268 Cmdr sta, adequacy of means provided to clear vision systems of frost, etc. without exiting vehicle, rating scale 1 (1-6)

4270 Cmdr sta, night vision device available for viewing through periscopes/vision blocks? [YES, IR]

4274 Cmdr sta, effectiveness of night vision device for target acquisition, surveillance, engagement, rating scale 6 (1-6)

4280 Cmdr sta, illumination levels, open hatch, measured at communications device and instrument panels, (lx; ft-C)

4282 Cmdr sta, illumination levels, closed hatch, measured at communications device and instrument panels, (lx; ft-C)

4284 Cmdr sta, luminance levels of displays, (type of display; location; lx; ft-L)

4286 Cmdr sta, chance of handedness or eye glasses interfering with operations, rating scale 3 [2]

4288 Cmdr sta, general adequacy of interior lighting, rating scale 1 (1-6)

4290 Cmdr sta, accessibility of controls for internal lighting, rating scale 4 [5]

4292 Cmdr sta, safeguard provided against inadvertent activation of interior lights? [NO]

4294 Cmdr sta, heater, temperature at cmdr's station, (degrees C; degrees F)

4296 Cmdr sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

4300 Cmdr sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

4304 Cmdr sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

4306 Cmdr sta, ventilation, non-NBC; variable control provided for ventilation system? (Yes/No; comments)

4308 Cmdr sta, ventilation, non-NBC; variable control for ventilation provided for all stations at cmdr's sta? Yes/No; comments)

4310 Cmdr sta, ventilation, non-NBC; accessibility to ventilation control, rating scale 4 (1-6)

4312 Cmdr sta, ventilation, non-NBC; effectiveness of ventilation system at station, rating scale 6 (1-6)

4318 Cmdr sta, steady-state noise hazards, any frequency/conditions, rating scale 5 (1-6)

4320 Cmdr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

4324 Cmdr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

4328 Cmdr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ (dBA)

4330 Cmdr sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

4332 Cmdr sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration; peak pressure-dBA)

4340 Cmdr sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

4342 Cmdr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

4344 Cmdr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

4346 Cmdr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

4348 Cmdr sta, probability of ride vibrations causing visual difficulties for cmdr, rating scale 7 (1-6)

4350 Cmdr sta, vibration amplitude, cmdr's console, (RMS)

Human Factors Engineering Data Base
File Name: AMR4
Gunner's Station

5000 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat pan dimensions, [9.5 INCHES X 10.75 INCHES]

5004 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, [1.5 INCHES]

5006 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, (degrees)

5008 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, (degrees)

5010 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, [23 INCHES]

5012 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, [2.5 INCHES]

5014 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, forward-rearward adjustability, (range in mm; in.)

5016 Gun sta, seat, seat pan material, [VINYL]

5018 Gun sta, seat, seat back material, (text)

5020 Gun sta, seat, head rest material, (text)

5022 Gun sta, seat, restraint system provided? (Yes/No; comments)

5023 Gun sta, adequacy of restraint system, rating scale 1 (1-6)

5024 Gun sta, seat, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, [25 INCHES]

5026 Gun sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, [21 INCHES]

5028 Gun sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, [20 INCHES/16 INCHES]

5030 Gun sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, [12 INCHES]

5032 Gun sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, [14 INCHES]

5034 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 1, SRP to closest object overhead, [35 INCHES]

5036 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 2, Abdominal, seat back to nearest forward object, [15 INCHES]

5038 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 4, seat depth SRP to front edge of seat pan, [5.5 INCHES]

5040 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 6, seat pan height, [23 INCHES]

5042 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to nearest object forward, [7.5 INCHES]

5044 Gun sta, seat, effectiveness of gunner's seat, considering adjustability, cushioning, size, and back angle, rating scale 4 [2]

5046 Gun sta, seat, adjustable vertically? [YES]

5048 Gun sta, instruments, overall quality of viewing during closed hatch operations, rating scale 3 [3, TWO FORWARD OPTICAL SCOPES]

5050 Gun sta, adequacy of lumbar (back) support during cross country maneuvers, rating scale 1 [1]

5052 Gun sta, seat material promote excessive perspiration during extended operations? (Yes/No; comments)

5054 Gun sta, protective guard provided between leg and gun breech? [YES]

5056 Gun sta, ease of emergency egress, non-NBC, 95th percentile male, rating scale 2 [2]

5058 Gun sta, ease of emergency egress, NBC MOPP-4, 95th percentile male, rating scale 2 [2]

5060 Gun sta, average time to emergency egress from sta, non-NBC, 95th percentile male, (no. trials; seconds)

5062 Gun sta, average time to emergency egress from sta, NBC MOPP-4, 95th percentile male, (no. trials; seconds)

5064 Gun sta, ease of access to adjustment controls for seat operation, rating scale 2 [2]

5066 Gun sta, force required to operate seat adjustment controls, (N; lbs)

5068 Gun sta, quality of viewing all controls and displays, rating scale 3 [3, TRAVERSE HANDLE NOT IN VIEW]

5070 Gun sta, seat designed to laterally restrain gunner during

violent maneuvers? [NO]

5072 Gun sta, seat designed so forward edge prevents restricted blood flow in popliteal (underside) of leg? [NO]

5074 Gun sta, retractable chest support provided? [NO]

5076 Gun sta, adequacy of retractable chest support to steady gunner during gunnery operations, rating scale 1 (1-6)

5078 Gun sta, dimensions of chest support, l x w x d, (mm; in.)

5100 Gun sta, adequacy of workspace to perform powered target acquisition and tracking, rating scale 1 [4]

5104 Gun sta, adequacy of workspace to perform powered gun lay, rating scale 1 [4]

5106 Gun sta, average time to acquire targets using GPS, powered mode, (no. trials; range of target in meters; seconds)

5110 Gun sta, adequacy of workspace to perform manual target acquisition and tracking, rating scale 1 [3]

5112 Gun sta, adequacy of workspace to perform manual gun lay, rating scale 1 [3]

5116 Gun sta, average time to acquire target, manual mode, (no. trials; range of target; seconds)

5118 Gun sta, average time to lay on target, manual mode, (no. trials; range of target; seconds)

5120 Gun sta, ease of selecting designated ammunition type during main gun firing, rating scale 2 [3]

5122 Gun sta, effectiveness of range finder during firing procedures, rating scale 6 (1-6)

5126 Gun sta, ease of selection of coax or main weapon as desired, rating scale 2 (1-6)

5127 Gun sta, accessibility of main gun/coax selector, rating scale 4 (1-6)

5128 Gun sta, controls, distance from SRP to nearest control, [10 INCHES FROM DESIGN EYE]

5130 Gun sta, controls, distance from SRP to most distant control, [38 INCHES]

5134 Gun sta, accessibility for operation of all controls, rating scale 4 [3]

5136 Gun sta, quality of visual access to all controls and displays, day and night operations, rating scale 3 [3]

5150 Gun sta, location of communications equipment, [5 INCHES FROM DESIGN EYE, RIGHT AND FRONT, MOUNTED ON RIGHT WALL]

5152 Gun sta, ease of operation of com box w/arctic handwear, rating scale 2 [4]

5153 Gun sta, com equip, space between connector and bulkhead or nearest object, [.75 INCH]

5154 Gun sta, speech intelligibility, gnr's com equip, CVC helmet, MRT, non-NBC, (percent correct)

5155 Gun sta, speech intellibibility, gnr's com equip, CVC helmet, MRT, w/NBC mask, (percent correct)

5156 Gun sta, quality of speech intelligibility, gnr's com equip, CVC helmet, non-NBC, rating scale 2 (1-6)

5157 Gun sta, quality of speech intelligibility, gnr's com equip, CVC helmet, w/NBC mask, rating scale 2 (1-6)

5158 Gun sta, effectiveness of communicating with other crew members using hand signals or other non-electronic methods, rating scale 6 [3]

5159 Gun sta, overall adequacy of controls/displays for critical gunnery tasks, 1 [3]

5160 Gun sta, controls/displays arranged for optimum usage? [YES]

5162 Gun sta, controls/displays; size, shape, spacing appropriate for intended usage? [NO, 5 PART SWITCH BOX, FLOOR MOUNTED, BENEATH BREECH AND UNREADABLE]

5164 Gun sta, similar controls/displays grouped for sequential usage? [YES]

5165 Gun sta, direction of control movement for all controls correct IAW MIL-STD-1472C? [YES]

5166 Gun sta, viewing angle from design eye position to worse case primary display, (degrees)

5167 Gun sta, adequacy of control/display illumination, rating scale 1 (1-6)

5168 Gun sta, illumination level, open hatch, measured at primary display/control position, (lx; ft-C)

5169 Gun sta, illumination level, closed hatch, measured at primary display/control position, (lx; ft-C)

5171 Gun sta, adequacy of control/display luminance, rating scale 1 (1-6)

5172 Gun sta, displays color-coded efficiently, IAW MIL-STD-1472C? [YES]

5174 Gun sta, display color coding, primary display, [WHITE ON BLACK, RED, AND AMBER]

5176 Gun sta, display color coding, secondary display, (red, blue-green, white, etc.)

5178 Gun sta, variable luminance control provided with primary display? (Yes/No; comments)

5179 Gun sta, variable luminance control provided with secondary display? (Yes/No; comments)

5182 Gun sta, range of display luminance, primary display, (display description; range in lx; ft-L)

5184 Gun sta, indicator lights grouped together, close to gunner's line of sight? [YES]

5186 Gun sta, indicator lights correctly color-coded IAW MIL-STD-1472C? [YES]

5190 Gun sta, indicator lights testable? (Yes/No; comments)

5192 Gun sta, indicator lights dimmable? (Yes/No; comments)

5194 Gun sta, range of luminance for indicator lights, primary warning light, (warning light description; range in lx; ft-L)

5196 Gun sta, range of luminance for indicator lights, secondary warning or caution light, (indicator light description; range in lx; ft-L)

5198 Gun sta, adequacy of luminance for primary, warning indicator light, rating scale 1 (1-6)

5200 Gun sta, adequacy of luminance for secondary, warning or caution indicator light, rating scale 1 (1-6)

5204 Gun sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? [PRIMARY,YES; SECONDARY,

5205 Gun sta, decals/placards readable, readily understood, and properly placed? [NO]

5206 Gun sta, ease of control actuation for all gunner's controls, rating scale 2 [3]

5208 Gun sta, force required, worse case, control actuation, (N; lbs)

5214 Gun sta, protective covers/guards placed over controls or switches where appropriate [YES]

5216 Gun sta, NBC collective protection provided? (Yes/No; comments)

5218 Gun sta, if NBC collective protection not provided, describe system, (text)

5220 Gun sta, NBC collective protection, location of interface point with which to hook into hose of individual vest/NBC suit, (text)

5222 Gun sta, NBC collective protection, air temp/humidity at mask, full cooling (ambient outside temp/humidity; temp/humid measured at mask, degrees, C; degrees, F; Rh)

5224 Gun sta, NBC, type of mask, (text)

5226 Gun sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

5228 Gun sta, general adequacy of NBC collective protection, (mask and vest, bulk dump, etc.), rating scale 1 (1-6)

5230 Gun sta, NBC collective protection, effectiveness of overpressure, rating scale 6 (1-6)

5232 Gun sta, NBC, effectiveness of NBC system to strain dust, other non-NBC particulates from outside, rating scale 6 (1-6)

5240 Gun sta, hatch provided? [YES]

5242 Gun sta, hatch, ease of opening/closing from inside vehicle, rating scale 2 [4]

5246 Gun sta, time to egress, from closed hatch position to outside of vehicle, non-NBC clad, (seconds)

5248 Gun sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4 clad, (seconds)

5252 Gun sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 [1]

5254 Gun sta, hatch dimensions, l x w x d, (mm; in.)

5456 Gun sta, hatch, combat lock provided? [NO]

5458 Gun sta, force required to unlock combat lock, (N; lbs)

5460 Gun sta, effectiveness of gunner's unity periscope/vision block for surveillance/initial target acquisition, without NBC mask, rating scale 6 [3]

5462 Gun sta, effectiveness of gunner's unity periscope/vision block for surveillance/initial target acquisition, with NBC mask, rating scale 6 (1-6)

5466 Gun sta, quality of vision through GPS, day mode, rating scale 3 [4]

5468 Gun sta, quality of vision through GPS, night mode, rating scale 3 (1-6)

5470 Gun sta, quality of vision through auxiliary sight, day mode, rating scale 3 (1-6)

5472 Gun sta, quality of vision through auxiliary sight, night mode, rating scale 3 (1-6)

5476 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), moving target, static ıry tank, non-NBC, (no. trials; target range, target speed; seconds)

5478 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), moving target, stationary tank, NBC MOPP-4, (no. trials; target range, target speed; seconds)

5480 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, stationary tank, non-NBC, (no. trials; target range; seconds)

5482 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, stationary tank, NBC MOPP-4, (no. trials; target range; seconds)

5484 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, moving tank, non-NBC, (no. trials; target range; seconds)

5486 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, moving tank, NBC MOPP-4, (no. trials; target range; seconds)

5490 Gun sta chance of handedness or eye glasses interfering with operations, rating scale 3 [3]

5492 Gun sta, ease of training new operator quickly, rating scale 2 [4]

5494 Gun sta, general adequacy of interor lighing, rating scale 1 [3]

5496 Gun sta, accessibility of controls for internal lighting, rating scale 4 [6]

5498 Gun sta, safeguard provided against inadvertent activation of interior lights? [NO]

5500 Gun sta, heater, temperature at gnr's sta, (degrees C; degrees F)

5502 Gun sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

5510 Gun sta, ventilation, non-NBC; effectiveness of fresh air ventilation system, rating scale 6 (1-6)

5512 Gun sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

5514 Gun sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

5516 Gun sta, ventilation, non-NBC; variable control provided for ventilation system? (Yes/No; comments)

5518 Gun sta, ventilation, non-NBC; accessibility to ventilation control, rating scale 4 (1-6)

5528 Gun sta, steady-state noise hazards, any frequency/condition, rating scale 5 (1-6)

5530 Gun sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

5534 Gun sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

5538 Gun sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ, (dBA)

5540 Gun sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

5542 Gun sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration; peak pressure-dBA)

5550 Gun sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

5552 Gun sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

5554 Gun sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

5556 Gun sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

5558 Gun sta, probability of ride vibration causing visual difficulties for gunner, rating scale 7 (1-6)

5560 Gun sta, acceleration, gunner's primary sight optic, (G-acceleration)

5562 Gun sta, acceleration, gunner's brow pad, (G-acceleration)

5564 Gun sta, accelaration, gunner's chest pad, (G-acceleration)

5566 Gun sta, effectiveness of manual data entry into ballistic fire control system under combat; consider ammunition selection, range data, etc., rating scale 6 (1-6)

5580 Gun sta, target acquisition, periscope, location (text)

5584 Gun sta, target acquisition, periscope, model (text)

5586 Gun sta, target acquisition, periscope, magnification (power)

5588 Gun sta, target acquisition, periscope, horizontel field of view, (degrees)

5592 Gun sta, target acquisition, periscope, vertical field of view, (degrees)

5594 Gun sta, target acquisition, periscope, range (meters)

5596 Gun sta, target acquisition, periscope, limitations (text)

Human Factors Engineering Data Base
File Name: AMR5
Loader's Station

6000 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat pan dimensions, l x w, (mm; in.)

6004 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, (mm; in.)

6006 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, (degrees)

6008 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, (degrees)

6010 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, (mm; in.)

6012 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, (range in mm: in.)

6014 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, forward-rearward adjustability, (range in mm; in.)

6016 Ldr sta, seat, seat pan material, (text)

6018 Ldr sta, seat, seat back material, (text)

6020 Ldr sta, seat, restraint system provided (Yes/No/ comments)

6022 Ldr sta, seat, adequacy of restraint system with vehicle in motion, rating scale 1 (1-6)

6030 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, (mm; in.)

6034 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, (mm; in.)

6036 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, (mm; in.)

6038 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, (mm; in.)

6040 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, (mm; in.)

6042 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 1, closed hatch, SRP to underside of hatch, seat adjusted fully down, (mm; in.)

6044 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 2, abdominal, seat back to nearest forward object, (mm; in.)

6046 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 4, seat depth, SRP to front edge of seat pan, (mm; in.)

6048 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 6, seat pan height, (mm; in.)

6054 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to nearest object forward, (mm; in.)

6056 Ldr sta, seat, effectiveness of ldr's seat, considering adjustability, cushioning, size, and back angle, rating scale 6 (1-6)

6058 Ldr sta, seat, adjustable vertically? (Yes/No; comments)

6060 Ldr sta, seat, stowable to facilitate standing during loading operations? (Yes/No; comments)

6062 Ldr sta, seat adjustable to provide platform for standing and outside viewing/firing ldr's weapon? (Yes/No; comments)

6064 Ldr sta, adequacy of seat configured to provide standing platform for open hatch viewing/weapons operation, rating scale 1 (1-6)

6066 Ldr sta, seat, material covering seat promote excessive sweating? (Yes/No; comments)

6068 Ldr sta, seat, material covering seat become excessively hot during operation in warm/hot climates? (Yes/No; comments)

6072 Ldr sta, seat, effectiveness of seat design/placement for seated loading/firing operations, rating scale 6 (1-6)

6074 Ldr sta, seat, distance from SRP to nearest main gun round stowed in ready rack, (mm; in.)

6076 Ldr sta, seat, distance from SRP to most distant main gun round stowed in ready rack, (mm; in.)

6077 Ldr sta, main gun ammo, projectile separate from propellent? (Yes/No; comments)

6078 Ldr sta, ease of access and loading of main gun ammo, rating scale 2 (1-6)

6079 Ldr sta, main gun ammo, type 1, (type/weight, lbs;kg/length, mm; in.)

6080 Ldr sta, main gun ammo, type 2, (type/weight,

lbs;kg/length, mm; in.)

6082 Ldr sta, main gun ammo, type 3, (type/weight, lbs;kg/length, mm; in.)

6090 Ldr sta, objects present preventing free interface with main gun/access to main gun ammo?(Yes/No; comments)

6092 Ldr sta, main gun provided with stub case deflector? (Yes/No; comments)

6094 Ldr sta, main gun provided with stub case box? (Yes/No; comments)

6096 Ldr sta, distance from SRP to stub case box, (mm; in.)

6099 Ldr sta, main gun provided with stub/casing retractor tool/device? (Yes/No; comments)

6102 Ldr sta, probability of injury during loading/firing operations due to design of workstation, rating scale 5 (1-6)

6104 Ldr sta, probability of striking inadvertently the main gun round nose against bulkhead or objects within turret during loading process, rating scale 3 (1-6)

6110 Ldr sta, adequacy of workspace to perform rapid loading operations, rating scale 1 (1-6)

6112 Ldr sta, danger posed by sliding doors of main gun ammo bustle when accessing ammo, rating scale 5 (1-6)

6114 Ldr sta, adequacy of workspace to allow a "safe area" to stand or sit to avoid injury from gun recoil, spent brass, etc, rating scale 1 (1-6)

6116 Ldr sta, ease of access to main gun ammo and operation of mechanisms to stow or release ammo, rating scale 2 (1-6)

6120 Ldr sta, average time to access main gun ammo, load, lock into breech, (no. trials; type ammo; seconds)

6122 Ldr sta, ease of uploading main gun ammunition from semi-ready rack to ready rack, rating scale 2 (1-6)

6126 Ldr sta, ease of main gun ammunition resupply through cmdr's hatch, rating scale 2 (1-6)

6128 Ldr sta, ease of main gun ammunition resupply through ldr's hatch, rating scale 2 (1-6)

6130 Ldr sta, average time to resupply main gun ammunition through cmdr's hatch, full stowage, non-NBC clad, (no.

trials; no. rds; min./seconds)

6132 Ldr sta, average time to resupply main gun ammunition through ldr's hatch, full stowage, NBC MOPP-4, (no. trials; no. rds; min./seconds)

6136 Ldr sta, ease of access to stowed main gun ammunition, rating scale 2 (1-6)

6138 Ldr sta, coax, ease of access to load, charge, clear jams as required, non-NBC clad, rating scale 2 (1-6)

6140 Ldr sta, coax, ease of access to load, charge, clear jams as required, NBC MOPP-4, rating scale 2 (1-6)

6142 Ldr sta, coax, average time to load, non-NBC clad, (no. trials; seconds)

6144 Ldr sta, coax, average time to load, NBC MOPP-4, (no. trials; seconds)

6450 Ldr sta, coax, ease of dismounting coax for maintenance, rating scale 2 (1-6)

6452 Ldr sta, coax, ease of installing coax, rating scale 2 (1-6)

6454 Ldr sta, ease of access and operation of all ldr's controls without being subjected to main gun recoil, rating scale 2 (1-6)

6460 Ldr sta, ease of loading secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 (1-6)

6462 Ldr sta, ease of installing secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 (1-6)

6464 Ldr sta, ease of dismounting secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 (1-6)

6468 Ldr sta, ease of mounting, loading, dismounting secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.) with arctic mittens/NBC gloves, rating scale 2 (1-6)

6470 Ldr sta, average time to mount secondary weapon from stowed position, (no. trials; seconds)

6472 Ldr sta, average time to load secondary weapon, (no. trials; seconds)

6474 Ldr sta, accuracy, secondary weapon, average scores, (no.trials; no. rds per trial; percent rds on target)

6478 Ldr sta, effectiveness of ldr's periscopic vision, rating

scale 6 (1-6)

6480 Ldr sta, outside horizontal visibility, ldr's periscopic/vision block system, (degrees, 0-360)

6482 Ldr sta, outside visibility, blind spots (text)

6484 Ldr sta, outside visibility, vertical viewing, (degrees from horizen)

6486 Ldr sta, means provided to clear periscopes/vision blocks of frost, dust, etc. without exiting vehicle? (Yes/No; comments)

6488 Ldr sta, step (other than seat) provided for ingress to and egress from station? (Yes/No; comments)

6490 Ldr sta, location of step for ingress/egress, (text)

6492 Ldr sta, dimensions of step for ingress/egress, l x w, (mm; in.)

6494 Ldr sta, adequacy of controls/displays for critical tasks, rating scale 1 (1-6)

6496 Ldr sta, accessibility of controls, rating scale 4 (1-6)

6498 Ldr sta, ease of operation of controls, rating scale 2 (1-6)

6510 Ldr sta, quality of visibility of controls/displays for day/night operations, rating scale 3 (1-6)

6512 Ldr sta, viewing distance from design eye to nearest display, (mm; in.)

6514 Ldr sta, viewing distance from design eye position to most distant display, (mm; in.)

6516 Ldr sta, viewing angle from design eye position to worse case primary display, (degrees)

6518 Ldr sta, display functions grouped together? (Yes/No; comments)

6520 Ldr sta, displays readable, closed hatch? (Yes/No; comments)

6522 Ldr sta, displays illuminated? (Yes/No; comments)

6524 Ldr sta, displays color-coded efficiently IAW MIL-STD-1472C? (Yes/No; comments)

6526 Ldr sta, display color, primary display, (red, blue-gree,

etc.)

6528 Ldr sta, display color, secondary display, (red, blue-green, etc.)

6534 Ldr sta, control provided with primary display for variable luminance? (Yes/No; comments)

6536 Ldr sta, range of luminance for primary display, (display description; range in lx; ft-L)

6538 Ldr sta, control provided with secondary display for variable luminance? (Yes/No; comments)

6540 Ldr sta, range of luminance for secondary display, (display description; range in lx; ft-L)

6544 Ldr sta, indicator lights grouped together, close to ldr's line of sight? (Yes/No; comments)

6566 Ldr sta, indicator lights correctly color-coded IAW MIL-STD-1472C? (Yes/No; comments)

6568 Ldr sta, indicator lights testable? (Yes/No; comments)

6570 Ldr sta, indicator lights dimmable? (Yes/No; comments)

6574 Ldr sta, range of luminance for indicator lights, (indicator light discription; range in lx; ft-L)

6576 Ldr sta, direction of control movement for all controls IAW MIL-STD-1472C? (Yes/No; comments)

6578 Ldr sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? (Yes/No; comments)

6580 Ldr sta, decals/placards readable, understandable, properly located? (Yes/No; comments)

6584 Ldr sta, overall ease of control actuation for all ldr's controls, rating scale 2 (1-6)

6586 Ldr sta, force required, worse case, ldr control actuation, (N; lbs)

6588 Ldr sta, protective covers/guards placed over controls or switches where appropriate? (Yes/No; comments)

6590 Ldr sta, NBC collective protection provided? (Yes/No; description; comments)

6592 Ldr sta, if NBC collective protection not provided, describe system, (text)

6594 Ldr sta, NBC collective protection, location of interface point with which to hook into hose of individual vest/NBC suit (text)

6596 Ldr sta, NBC collective protection, air temp/humidity at mask, full cooling (ambient outside temp/humidity; temp/humid measured at mask, degrees C, degrees, F; Rh)

6598 Ldr sta, NBC, type of mask, (text)

6600 Ldr sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

6640 Ldr sta, general adequacy of NBC collective protection, (mask and vest, bulk dump, etc.), rating scale 1 (1-6)

6642 Ldr sta, NBC collective protection, effectiveness of overpressure, rating scale 6 (1-6)

6644 Ldr sta, NBC effectiveness of NBC system to strain dust, other non-NBC particulates from outside, rating scale 6 (1-6)

6646 Ldr sta, hatch provided? (Yes/No; comments)

6648 Ldr sta, hatch, ease of opening/closing from inside vehicle, rating scale 2 (1-6)

6649 Ldr sta, hatch, ease of unlocking/opening from outside, rating scale 2 (1-6)

6650 Ldr sta, time to egress, from closed hatch position to outside of vehicle, non-NBC clad, (seconds)

6651 Ldr sta, hatch, locking mechanism vulnerable to damage by enemy fire? (Yes/No; comments)

6654 Ldr sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4, (seconds)

6656 Ldr sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 (1-6)

6658 Ldr sta, hatch dimensions, l x w x d, (mm; in.)

6660 Ldr sta, hatch, combat lock provided? (Yes/No; comments)

6662 Ldr sta, force required to unlock combat lock, (N; lbs)

6664 Ldr sta, adequacy of hatch entry padding, rating scale 1 (1-6)

6666 Ldr sta, ease of releasing hatch from secured, open hatch

position, to closed hatch position, rating scale 2 (1-6)

6668 Ldr sta, force required to release lock-back latch mechanism, (N; lbs)

6670 Ldr sta, average time to emergency egress ldr sta, from closed hatch position, non-NBC, (no. trials; seconds)

6672 Ldr sta, average time to emergency egress ldr sta, from closed hatch position, NBC MOP-4, (no. trials; seconds)

6674 Ldr sta, effectiveness of ldr's unity periscope/vision blocks for surveillance, w/o NBC mask, rating scale 6 (1-6)

6676 Ldr sta, effectiveness of ldr's unity periscope/vision blocks for surveillance, w/NBC mask, rating scale 6 (1-6)

6680 Ldr sta, location of communications equipment, (text)

6682 Ldr sta, ease of operation of com box w/arctic handwear, rating scale 2 (1-6)

6684 Ldr sta, speech intelligibility, ldr com equip, CVC helmet, non-NBC, MRT, (percent correct)

6686 Ldr sta, speech intelligibility, ldr com equip, CVC helmet, w/NBC mask, MRT, (percent correct)

6688 Ldr sta, com equip, space between connector and bulkhead or nearest object, (mm; in.)

6690 Ldr sta, quality of speech intelligibility, CVC helmet, non-NBC, rating scale 2 (1-6)

6692 Ldr sta, quality of speech intelligibility, CVC helmet, w/NBC mask, rating scale 2 (1-6)

6700 Ldr sta, chance of handedness or eye glasses interfering with operations, rating scale 3 (1-6)

6702 Ldr sta, general adequacy of interior lighting, rating scale 1 (1-6)

6704 Ldr sta, accessibility of controls for interior lighting, rating scale 4 (1-6)

6706 Ldr sta, safeguard provided against inadvertent activation of interior lights? (Yes/No; comments)

6708 Ldr sta, heater, temperature at ldr's station, (degrees C: degrees, F)

6710 Ldr sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

6714 Ldr sta, ventilation, non-NBC; effectiveness of fresh outside air ventilation system, rating scale 6 (1-6)

6716 Ldr sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

6718 Ldr sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

6720 Ldr sta, ventilation, non-NBC; variable control provided for ventilation? (Yes/No; comments)

6722 Ldr sta, ventilation, non-NBC; accessibility to ventilation control, 4 (1-6)

6728 Ldr sta, steady-state noise hazards, any frequency/condition, rating scale 5 (1-6)

6730 Ldr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

6734 Ldr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

6738 Ldr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ, (dBA)

6740 Ldr sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

6742 Ldr sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration; peak pressure-dBA)

6750 Ldr sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

6752 Ldr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

6754 Ldr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

6756 Ldr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

Human Factors Engineering Data Base
File Name: AMR6
Crew Integration, Safety, Health Hazards

7000 CVC helmet, effectiveness to protect against injury, rating scale 6 (1-6)

7002 CVC helmet, effectiveness of helmet communications device, rating scale 6 (1-6)

7006 Crew, feasible to cross-train crewmembers in all functions of the vehicle? [YES]

7008 Crew, description of cross-training, (text)

7010 Crew, effectiveness of operation of vehicle in degraded mode, 3 man crew, rating scale 6 (1-6)

7012 Crew, effectiveness of operation of vehicle in degraded mode, 2 man crew, rating scale 6 [3]

7014 Crew, approximate overall degradation with reduced, 3 man crew, [2 MAN CREW = 50 PERCENT]

7016 Crew, approximate overall degradation with reduced, 2 man crew, [80]

7020 Crew, workload, probability of workload breakdown during combat operations, rating scale 7 [4]

7022 Crew, driver workload, simulated combat, (numerical score on SWAT)

7024 Crew, cmdr workload, simulated combat, battle management, (numerical score on SWAT)

7026 Crew, gnr workload, simulated combat, (numerical score on SWAT)

7028 Crew, ldr workload, simulated combat, (numerical score on SWAT)

7040 NBC/Arctic gear, considering design of vehicle, probability of NBC/arctic gear degrading crew performance of critical tasks, rating scale 7 [1]

7042 NBC/Arctic gear, probability of NBC/arctic gear interfering with emergency egress from vehicle, rating scale 7 [1]

7044 NBC/Arctic gear, probability of NBC/arctic gear interfering with emergency egress, rating scale 7 [1]

7046 NBC/Arctic gear, adequacy of workspace to permit efficient

donning/doffing of NBC/arctic garb, rating scale 1 [1]

7048 NBC decontamination, effectiveness of procedures, rating scale 6 (1-6)

7050 NBC decontamination, type of decontamination agent in use, (text)

7052 NBC decontamination, probability of damaging exposed, sensitive instruments/equipment w/decon agent, rating scale 7 (1-6)

7056 Water stowage, capacity, (liters; gals)

7058 Water stowage, accessibility to stowed water, rating scale 4 (1-6)

7064 Water stowage, effectiveness of stowage to avoid interference with crew activities, rating scale 6 [1]

7066 Water stowage, accessibility to each crewmember, rating scale 4 [1]

7068 Water stowage, ease of refilling water stowage container, rating scale 2 (1-6)

7070 Water stowage, time to refill water stowage container, (seconds)

7072 Water stowage, probability of damage to stowage container from vehicle motion, crew handling, etc., rating scale 7 (1-6)

7074 Water stowage, adequacy of insulation of water supply against extreme heat/cold, rating scale 1 (1-6)

7076 Ventilation, location of fresh air intake, distance from engine/other exhausts, (text; mm; in.)

7078 General, adequacy of interior space for extended ops; crew work/rest cycles, rating scale 1 [1]

7080 General, probability of crew injury from turret traversal, elevation/depression of main weapon, rating scale 7 [5]

7082 General, adequacy of padding of protruding objects to protect crew from injury, rating scale 1 [1]

7090 Toxic fumes, probability of task degradation because of CO, NH3, NO2, or SO2 concentrations, rating scale 7 (1-6)

7092 Toxic fumes, health hazards imposed on crew, rating scale 5 (1-6)

7094 Toxic fumes, level of CO, turret, automotive, closed hatch, (PPM; COhB)

7096 Toxic fumes, level of CO, turret, main gun firing, closed hatch, 6 rnds, (PPM: COhB)

7098 Toxic fumes, level of CO, turret, main gun firing, closed hatch 10 rnds, (PPM; COhB)

7100 Toxic fumes, level of SO2, turret, main gun firing, closed hatch, 6 rnds, (PPM)

7102 Toxic fumes, level of SO2, turret, main gun firing, closed hatch, 10 rnds, (PPM)

7104 Toxic fumes, level of NO2, turret, main gun firing, closed hatch, 6 rnds, (PPM)

7106 Toxic fumes, level of NO2, turret, main gun firing, closed hatch, 10 rnds, (PPM)

7108 Toxic fumes, level of NH3, turret, main gun firing, closed hatch, 6 rnds, (PPM)

7110 Toxic fumes, level of NH3, turret, main gun firing, closed hatch, 10 rnds, (PPM)

7112 Ventilation, bore evacuator provided? [YES]

7114 Ventilation, ventilator fan in turret provided? (Yes/No; comments)

7116 Ventilation, emergency ventilation system provided? (Yes/No; description/comments)

7120 Fire suppression, automatic fire suppression system provided? (Yes/No; description)

7122 Fire suppression, overall adequacy of system, rating scale 1 (1-6)

7124 Fire suppression system, automatic activation time (miliseconds)

7126 Fire suppression, accessibility to system for repair, manual activation, rating scale 4 [1]

7128 Fire suppression, probability of inadvertent activation, rating scale 7 (1-6)

7130 Fire suppression, portable fire extinguisher provided? [NONE OBSERVED]

7132 Fire suppression, quick accessibility to fire

extinguishers, rating scale 4 [3]

7140 Maintenance, automotive, accessibility to drain valves, rating scale 4 (1-6)

7142 Maintenance, automotive, accessibility to oil filters, rating scale 4 (1-6)

7144 Maintenance, automotive, accessibility to air filters, rating scale 4 (1-6)

7146 Maintenance, automotive, accessibility to engine adjustments, rating scale 4 (1-6)

7148 Maintenance, automotive, accessibility to batteries/terminals, rating scale 4 (1-6)

7150 Maintenance, interior, accessibility to weapons, rating scale 4 [2]

7152 Maintenance, interior, accessibility to hydraulics, rating scale 4 [2]

7154 Maintenance, interior, accessibility to electrical systems, rating scale 4 [2]

7156 Maintenance, ease of identifying PMCS checkpoints, rating scale 2 (1-6)

7158 Maintenance, general adequacy of workspace for performing checks, maintenance services, rating scale 1 [2]

7160 Maintenance, ease of reading dipsticks, gauge levels, etc, rating scale 2 (1-6)

7166 Maintenance, automotive, average time to perform routine maintenance checks, (no. trials; min/sec)

7168 Maintenance, automotive, average time to replace oil filter, (no. trials; min/sec)

7170 Maintenance, automotive, average time to replace air filter, (no. trials; min/sec)

7172 Maintenance, effectiveness of caution/warning labels/placards for PMCS considering size, location, color-coding, etc., rating scale 6 (1-6)

7174 Maintenance, special tools required (Yes/No; comments)

7178 Maintenance, special tools stowed on-board vehicle? (Yes/No; comments)

7180 Maintenance, adequacy of maintenance procedures in terms of

complexity, training requirements, etc., rating scale 1 (1-6)

7182 Maintenance, specialized diagnostics required? (Yes/No; comments)

7184 Maintenance, built-in test/diagnostic equipment provided? (Yes/No; comments)

7186 Maintenance, average time to diagnose faults, (no. trials; seconds)

7188 Repairs, interior, accessibility to electrical cables/hydraulic lines, rating scale 4 [1]

7190 Repairs, quality of protection afforded to cables, indicators, etc. against inadvertent damage during repairs, rating scale 3 [3]

7192 Repairs, cables/indicators, etc., adequacy of labels, color-coding, etc. for easy identification, rating scale 1 [3]

7194 Repairs, emergency; is system designed to "short track" in event of emergency?(Yes/No; comments)

7196 Stowage, adequacy of design for stowage of replacement items (i.e., road wheels, track blocks, firing pins, etc.) for transport into combat, rating scale 1 [3]

7198 Battle damage assessment/repair, capability/probability of crew being able to assess/repair damage during combat, rating scale 7 (1-6)

7206 Maintenance, ease of removing/replacing power pack, rating scale 2 (1-6)

7208 Maintenance, ease of breaking track (consider workspace and linkage assemblies), rating scale 2 (1-6)

7210 Maintenance, average time to break track, replace new linkage, (no. trials; min/sec)

7214 Refueling, ease of accessing fuel inlet, manipulating with arctic handwear, rating scale 2 [5]

7218 Stowage, adequacy of space for personnel equipment, NBC garments, individual weapons/ammunition, inside vehicle, rating scale 1 [1]

7220 Stowage, personnel gear/weapons stowed outside vehicle? (Yes/No; comments)

7222 Stowage, adequacy of stowage of combat rations, rating

scale 1 (1-6)

7224 Stowage, amount of personnel combat rations stowed on-board, (days)

7226 Stowage, quick access of personnel weapons/ammunition/ grenades, rating scale 4 [2]

7228 Stowage, accessibility of main gun ammumition, uploading, rating scale 4 [?]

7230 Stowage, accessibility of coax/cmdr's weapon ammunition, rating scale 4 [3]

7232 Stowage, adequacy of design to protect against inadvertent ignition/explosion of main gun rnds, rating scale 1 [2]

7234 Stowage, adequacy of design to protect against inadvertent ignition/explosion of coax/other ammunition, rating scale 1 [2]

7236 Stowage, method of uploading vehicle, through turret, other means, [UPLOAD 90MM ROUNDS THROUGH TWO PANELS LOCATED ON REAR BUSTLE. OTHER ROUNDS THROUGH COMMANDER'S HATCH]

7238 Stowage, ease of uploading/downloading, main gun ammunition, consider hatches, hull obstructions, etc., rating scale 2 [2]

7240 Stowage, average time to upload, main gun rnds, (no. trials; min/sec)

7242 Stowage, average time to upload, coax, other ammunition, water, rations, (no. trials; min/sec)

7244 Stowage, relative difficulty uploading main gun rnds, NBC MOPP-4/collective protection system, rating scale 2 [1]

7246 NBC, type of individual ensembles (text)

7250 Combat operations, pre-combat systems checks required?(Yes/No; comments)

7252 Combat operations, average time to conduct pre-combat systems checks, (no. trials; min;sec)

7254 Combat operations, ease of boresighting/zeoring main gun, rating scale 2 (1-6)

7256 Combat operations, average time to boresight/zero main gun, (no. trials; min;sec)

7258 Combat operations, effectiveness of procedures for rapid, logical sequence of firing commands, rating scale 6 (1-6)

7566 Combat operations, multiple concurrent tasks required during target acquisition, tracking, firing, reloading main weapon? (Yes/No; comments)

7568 Combat operations, probability of system exceeding physical and/or mental capabilities of crew during combat, rating scale 7 (1-6)

7570 Combat operations, probability of vibrations/accelerations causing adverse effects on vehicle, rating scale 7 (1-6)

7576 Combat operations, effectiveness of battle management operating within platoons, rating scale 6 (1-6)

7578 Training, system design accommodating to training aids, instructional devices, NET?(Yes/No; comments)

7586 Extended operations, method provided for waste elimination? (Yes/No; comments)

7590 NBC System, method provided for intake of water/food without removing NBC mask? (Yes/No; comments)

7594 Smoke grenades, ease of reloading, rating scale 2 (1-6)

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Report identifies data elements of a generic nature for an armored vehicle (main battle tank), which voer critical human factors engineering interests and parameters regarding the tank. Report also sets out a methodology for collecting or obtaining the identified data elements. In Volume II, III, and IV are respectively reported collected human factors data elements for three tanks, as follows: British Centurion, British Chieftain, and French AMX 13.

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