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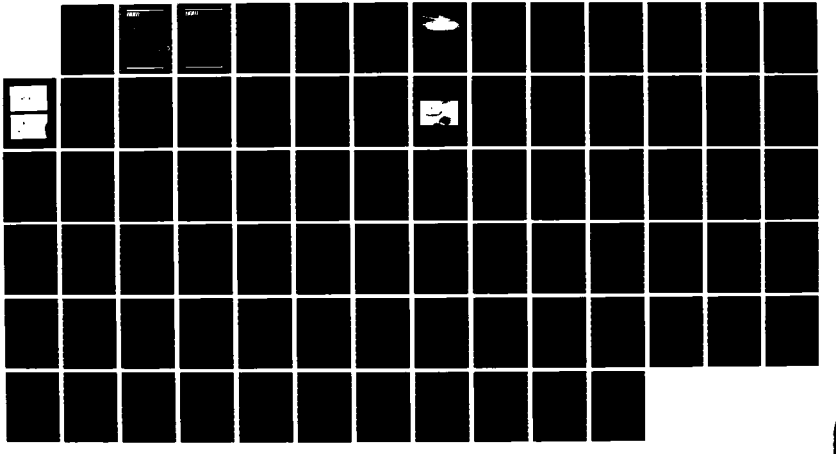

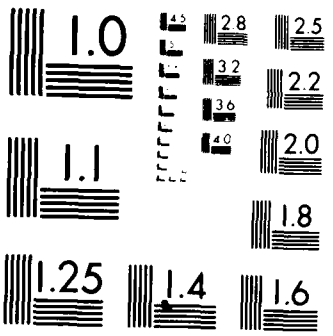

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Human Factors Engineering Data Base Development for Armored Combat Vehicles and Analyses of Three NATO Tank Systems

Volume II - Human Factors Engineering Analysis of the British Centurion Main Battle Tank

July 3, 1986

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VOLUME II
HUMAN FACTORS ENGINEERING ANALYSIS OF THE BRITISH CENTURION MAIN BATTLE TANK

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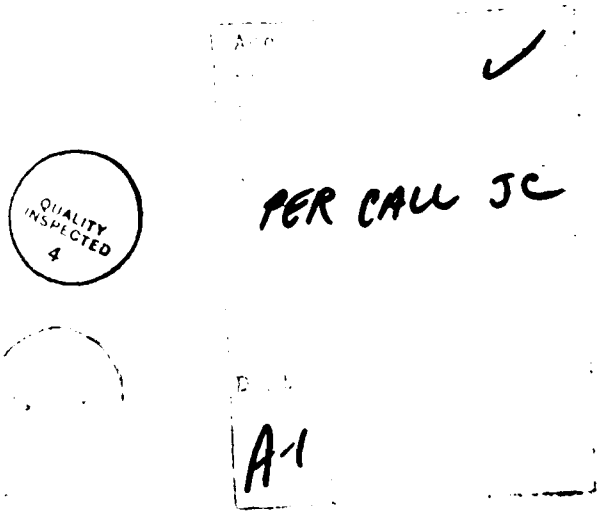

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CHAPTER I

HUMAN FACTORS ENGINEERING ANALYSIS OF THE BRITISH CENTURION MAIN BATTLE TANK

A. BRITISH CENTURION

1. Development

In 1943, the British Directorate of Tank Design identified a requirement for a heavy cruiser tank to consist of good armor protection, 17 pounder gun system, and improved cross-country performance. Later marks accommodated the 105 mm rifled tank gun. The initial mock-up version of the Centurion was completed in 1944, followed by six prototype vehicles completed in 1945. The Centurion entered into service for the British Army in Korea and has since seen combat in the Middle East, with the Australian Army during the Indo-Pakistan war, and in Vietnam with the Australian Army.

Production of the Centurion MBT was accomplished by the Royal Ordnance Factory at Leeds, Vickers at Elswick, and Leyland Motors at Leyland. Final production was completed in 1961 with over 4,000 tanks built of which at least 2,500 have been exported.

2. Description

Figure I-1 shows the Centurion MBT. The Centurion consists of an all-welded hull that is divided into three primary sections: driver's station located at the front, fire control systems located in the center, and the engine/transmission located in the rear section.

The driver's station is located at the front of the hull on the right side with ammunition positioned on the driver's left side. Positioned in the center section of the hull is the turret that consists of cast construction with the roof welded into place. An ammunition resupply hatch is located within the left side of the turret with stowage boxes positioned on either side. The loader's station is located on the left of the turret section, commander positioned on the right, and the gunner located in front of and below the commander's station.

The commander's cupola has the capability to be traversed 360 degrees by hand and is provided with a ballistic pattern periscope sight

Figure I-1. Centurion MBT

system and seven observation periscopes. The gunner has a ballistic pattern graticule periscope sight system that is linked to a range drum. A heat-compensated bar connects the commander's and gunner's sight systems. The loader is provided with only one single observation periscope.

The engine section located at the rear is separated from the fighting compartment by a fireproof bulkhead. Power is transmitted from the engine (Rolls Royce Meteor 12-cylinder liquid-cooled gasoline engine) through the clutch to the Merritt-Brown transmission. Drive from the output epicyclic gears is transmitted through an internally toothed coupling ring and an externally toothed driving shaft to the final drive.

The Centurion's suspension system is of Hortsmann type design and consists of three basic sections located on each side of the vehicle. The first and last road wheel units are provided with specialized shock

absorbers. The drive sprocket is located at the rear, idler at the front, and six track return rollers. The tops of the cast manganese steel tracks are covered by removable armor skirts that provide protection against HEAT projectiles.

The Centurion has no NBC system or amphibious capability although a deep fording kit was developed. Current models have been refitted to provide infrared driving lights, infrared searchlight, and infrared sights for both the commander and gunner.

The main armament system of the Centurion MK V is a 105 mm rifled tank gun that is provided with a fume extractor. Effective range of 1800 meters is possible with APDS, or between 3000 and 4000 meters using HESH. The weapon is aimed using a 12.7 mm (.50 cal) ranging machine gun mounted coaxially with the main armament system. Maximum effective range of this system is 1800 meters. The gunner can select only one operational mode: manual elevation and traverse, non-stabilized power traverse, stabilized powered elevation and traverse, or emergency, single-speed power traverse.

Mounted coaxially to the left of the main armament system is a 7.62 mm machine gun with a similar weapon on the commander's cupola designed for anti-aircraft use. In addition, six electrically operated smoke dischargers are located on either side of the turret.

3. Current Status

Currently, the Centurion is in service with Denmark, Great Britain (artillery observation role), India, Israel, Jordan, the Netherlands, Kuwait, South Africa, Sweden, and Switzerland. There are more variants of the Centurion than any other post-Second World War main battle tank class vehicle.

Attachment 1 provides the data collected at Ft. Knox pertaining to the system's human engineering.

B. HFEA OF THE CENTURION MBT

1. General, Boarding, Movement

The only observable boarding paths to the hull and turret areas of the tank are the tank tracks at the rear of the vehicle on either side. Crew members use existing cables and other deck items to pull themselves on board. There were no handholds designed specifically for boarding. This could cause some problems for the crew when attempting to mount quickly.

With regard to entering the vehicle once onboard, it was found that hatches are of sufficient size and shape to allow quick and free movement into the vehicle. However, the driver's hatch posed an extreme problem when closed, in unlocking and lifting to its full OPEN position. This particular problem is described further in the next section. Non-slip surfaces were not provided in the design of this tank, contributing to unsafe conditions for crew members operating top-side.

Although the turret required rotation to allow for driver egress to the turret area, the space for movement into the turret from the driver's station appeared sufficient even for nuclear, biological, and chemical (NBC) military oriented protective posture (MOPP) or arctic-clad crewmen. However, it would be difficult to remove an incapacitated crewman from the driver's station into the turret area. This is not necessarily seen as a shortcoming since sufficient area for dead weight drag from the hull position of any vehicle into the turret area remains a difficult design objective.

2. Driver's Station

Table I-1 summarizes the Centurion driver's seating dimensions. Although the driver's seat pan is adequate in length by current human engineering standards, the width dimensions fall short by about 2.5 inches. This shortcoming would not likely contribute to driver performance degradation. However, back discomfort and possibly driver performance problems may result because of the inadequate seat back length.

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

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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

Although the seat padding is thick enough to satisfy human engineering criteria, the material covering the seat appeared to be of a vinyl substance and could promote excessive perspiration over extended operations, especially in warm climates. The seat depth, as measured from the seat reference point to the seat pan front is about half of the length called for in MIL-STD-1472C. When operating with the seat adjusted fully up, hatch open, it could restrict the blood flow in the driver's under-leg region for smaller 5-25th percentile drivers.

Head clearance for the 95th percentile male soldier with CVC helmet, seat adjusted fully down, falls about 5.5 inches short of standards. In fact, with only 34 inches head clearance, the station would accommodate only the 10th percentile U.S. Army armor crewman. Coupled with the apparent lack of adequate suspension for a reasonably comfortable cross-country ride, this condition could lead to driver head and neck fatigue or injury. Driving tasks when viewing through periscopes would be very difficult. It should also be noted that the seat, when adjusted down, hatch closed, does not allow for sufficient clearance for a helmeted driver. The head of a 95th percentile driver makes contact with the underside rear of the hatch rim. This condition forces the driver's head down and forward in relation to a normally seated posture.

Although the shoulder clearance in this vehicle measured approximately 2.0 inches short of criteria, minimal driver performance degradation would be expected, if any. However, the narrow area may contribute to other degradations, such as fatigue, during extended operations.

The driver's seat back appeared to be capable of adjusting to an almost full down position to allow egress back and into the turret area. The adequacy of viewing and operating hand and foot controls was rated as extremely adequate by evaluators, considering the allowable area in the crew station. There were only two features of the driver's station that may cause difficulties in visual and manual access. First, the compass, used for land navigation, is located in a visually awkward

position to the front-right of the driver. Secondly, the fire extinguisher, located at the immediate left-rear of the driver, causes driver arm and elbow contact. This would likely interfere with some driving tasks.

Visual access to the rear view mirrors, located on the front left and right sponsons was very difficult. With the hatch closed, the driver is required to lean forward with his face almost contacting the periscopes. Maneuvering the vehicle under these conditions could lead to facial injury.

a. Advantages

With respect to the design of the Centurion's driver station, several human engineering advantages became apparent during the evaluation. First, the two periscopes, one each located on either hatch piece, provides for good forward viewing. However, the viewing angle with the two periscopes is restricted to about 150 degrees (less than U.S. military standards of 180 degrees).

Another advantage in this design is the simplicity of the controls and displays. The driver instrument panel is located to the right-front and is very visually accessible. The hand and foot controls for steering, acceleration, gear shift, and braking are located and arranged in an efficient manner for driving tasks. Finally, with the exception of the movement restrictions mentioned above, ample room for the driver is provided to perform typical driving tasks.

b. Disadvantages

The major shortcoming in the Centurion driver station design is the hatch. The two-piece hatch, seen in Figure I-2, opens out to the left and right. Each piece has a swivel periscope for viewing up to about 150 degrees forward of the tank. The hatch pieces are designed with a spring at the hinge point to assist in opening and closing. The spring in this particular vehicle may have been corroded, rusted, or just weakened from years of operation. In any regard, two problems exist. First, to open (and close) each hatch piece required turning the periscope so that the bottom portion of the periscope underneath the hatch clears the hatch rim. Secondly, extreme effort is demanded of the driver

to push open the hatch from a seated position (and at the same time turn the periscope). Most of the weight of each hatch piece is forward of the seated operator, as seen in Figure I-2, making this task difficult and hazardous. Operation of the hatch can result in the hatch slipping and crushing the driver's hand or fingers against the hatch rim or the half of the hatch, or slipping and hitting the driver's head.

To operate the hatch quickly, especially in combat, would be very difficult without causing delays or injuries, or without interfering with driving tasks.

3. Commander's Station

The seating dimensions for the commander's station are shown in Table I-1. Dimensions fall short of MIL-STD-1472C requirements and could pose discomfort problems for 95th percentile, arctic or NBC MOPP clothed individuals during extended operations. Like the other seat backs in the Centurion, the commander's seat back falls far short of U.S. military design criteria. This type of unimproved seat design could contribute to physical fatigue and eventual task degradation. The commander's seating design in the Centurion's replacement, the Chieftain, corrects some of the seating problems observed in this system.

The commander is provided with back-up sights for engaging targets, manual elevation and traverse, and IR adapters. Although the commander's cupola provides 360 degrees vision through seven observation periscopes, true unity vision is not provided. However, the cupola can be traversed to cover any dead space in viewing.

The commander's footrest measures 8.75 x 10.75 inches and would not accommodate arctic or NBC footwear very efficiently. The footrest appears to have been designed for stand-up open-hatch operations but is located too far forward in relation to the hatch to be of much practical use. The commander would likely stand on the seat.

Seat adjustability is provided. However, access to the adjustment bar is difficult without scraping one's knuckles, as the clearance between the adjustment handle and seat pan measures only 0.5 inch. Operation with arctic or NBC gloves would prove especially difficult.

Figure I-2. Centurion Driver's Hatch

When seated in the full down position, the back of the head (without helmet, 95th percentile male) contacts the hatch rear rim, forcing the head forward and slightly down. The problem would be exacerbated when wearing the CVC helmet and could lead to neck or head injuries.

There is generally a lack of adequate protective padding around the hatch rim and periscopes. The only protective padding observed were browpads for the periscopes. Ingress and egress through the hatch as well as viewing through the periscopes may pose a safety problem.

Viewing all of the commander's displays and controls was judged poor. The commander's back-up periscope/sight was difficult to access and could only be operated by positioning the cupola to expose it between the periscopes.

Although the cupola provided a control handle for manual traverse, its locking and unlocking device was difficult to actuate.

A unique feature with this station is the method for manually elevating the main gun. A manual elevation wheel linked by drive chain, which, in turn, is linked to the gunner's elevation handwheel, is located in front and to the left of the commander. The handwheel handle measures 1.0 inch in length (preferred length IAW MIL-STD-1472C is 1.5 inches). This chain drive arrangement appeared to provide fairly sensitive elevation control response for a manual backup system.

With regard to the commander's manual turret traverse handle, insufficient clearance is provided because of a control box located directly above the handle. Control movement would be restricted when operating with arctic handwear.

The commander's hatch is 21.75 inches in diameter and provides sufficient area for ingress/egress. The underside of the hatch is padded with 0.5 inch compressed material. Means are not provided for clearing periscopes on the outside of mud, dust, snow, etc. without requiring the commander to exit the vehicle.

Head clearance provided for the seated operator would accommodate only a 50th percentile (U.S. Army) male operator with helmet. Although the popliteal height (floor to top of padding, seat front) measured 18 inches, seat fully adjusted down, this would likely cause no severe problems during long or short term operations.

a. Advantages

Three major advantages are presented by the design of the Centurion's commander's station. First, ample room is provided for elbow, torso, leg, and knee movement. The second advantage is an adequately large hatch diameter for free and easy movement into and out of the tank. Finally, the commander is able to communicate if need be, by hand or shouted orders to the other turret crew members because of the relatively free and open space provided.

b. Disadvantages

The only major disadvantage observed at the commander's station, given the restriction of the static evaluation, was the seat design. Seat adjustment was very difficult, seat pan and back dimensions fall short of minimum requirements, and an adequate footrest was not provided.

4. Gunner's Station

The gunner's station in the Centurion MBT is located to the right in the turret, front and below the commander. Table I-1 summarizes the gunner's seating dimensions. The seat pan, back, and seat depth all fall short of U.S. military design criteria. The seat back consisted of a detachable bar with swivel back rest. The seat back could be removed for easier ingress/egress. It appeared to evaluators that the seat would probably cause back pain and fatigue during long term operations, especially cross-country.

As in most armored combat vehicles of this class, the gunner's station is cramped, affording little in the way of free body movement. Areas for elbow movement fell just short of design criteria, but appeared to present only moderate difficulty when accessing controls. Head clearance meets standards to accommodate 95th percentile male operators.

Seat vertical adjustment of 4.5 inches was provided with an easily accessible adjustment handle located at about the center of the seat front, between the operator's legs. Actual adjustment also was fairly easy.

A metal guard provides protection to the gunner from the main gun breech to his left. Most of the controls located at this station

measured within easy reach of a normally seated operator. A retractable chest support, however, was not provided for gunnery tasks requiring interface with primary fire control optics.

Although the workspace designed for manual gun lay was very adequate, to fire the gun the gunner must remove his hand from either the traverse or elevation handle. This would make firing at a moving target very difficult.

Because most of the decals and placards were painted over, an evaluation of symbology and lettering could not be made. However, the location of placards and other symbols originally provided are within ready view of the occupant.

The fire control handle for the coaxial machine gun is located 31 inches forward and to the left of the seated operator. To operate the machine gun, the gunner must reach forward to grip the coax fire control handle. It is difficult for a 95th percentile male to do this while at the same time viewing the target through the fire control optics (ballistic sight/periscope). Crewmen of smaller stature would find the task even more difficult.

A safety hazard exists which could cause injury to the eye or left temple area of the gunner. The depression/elevation knob for manual gun lay is provided only several inches to the immediate left of the seated gunner at eye level.

A demister/wiper is provided for the gunner's ballistic periscope on the outside of the vehicle. Because the vehicle was not operational, an evaluation could not be made as to its effectiveness.

The front of the right knee of a 95th percentile operator contacts the metal housing for the powered traverse/elevation controls. This condition could cause injury to the knee during cross-country operations, and would certainly cause discomfort.

For the few toggle switches and buttons located at this station, all are exposed to accidental activation. Only the communications box is provided with recessed switches.

The devices which provide the gunner with outside viewing appeared ineffective. His field of view was restricted to that provided by one periscope, or about 60 degrees forward vision.

a. Advantages

The major advantage of the Centurion gunner's station, considering this type of evaluation, is the simplicity of design and arrangement of fire control apparatus. With some additional padding at the primary fire control device and protrusions near the head area, the station would represent a simple but well human engineered effort.

b. Disadvantages

Considering the age and original design objectives of the Centurion MBT, the gunner is presented with few real disadvantages relative to the station's human engineering. In addition to the safety hazard posed by protrusions near the gunner's head, the seating is inadequate. The type of archaic seat arrangement built into the Centurion gunner station would meet with dissatisfaction among today's U.S. Army armor personnel. The Spartan appeal this type of primitive seat design may have to some would not reduce the likelihood of back fatigue and injury in combat, especially for modern requirements for 72-hour continuous operation.

5. Loader's Station

Selected measurements of the loader's station are shown in Table I-1. The loader's seat is mounted on the portion of the turret covering the turret gear. Although the seat itself falls short of minimal U.S. military standard dimensions, it appeared adequate for tasks requiring frequent movement to serve the main gun.

The seat mount is fixed with a 90 degree seat pan-to-back angle. The seat reference point to the bottom protective recoil bar of the 105 mm gun measured only 11.5 inches, with the seat facing on a near-obliquity the main gun breech. This arrangement can cause the knees to make contact with the protective recoil bar.

Ample elbow, arm, and head room is provided. The head clearance, as seen in Table I-1, exceeds standards by several inches. The seat is removable for stowage during loading and firing operations. Relative to loading and firing tasks, the effectiveness of the seat design and placement for seated loading and firing operations was rated as very effective. Good access is provided to the breech block lever and ready ammunition stowage racks next to the loader in front.

The location of four main gun ready rounds, to the left and front of the seated loader, provide quick access. However, the additional rounds are located beneath the turret deck panels and appear very difficult to access, especially in combat. No stub base deflector was observed but a stub base box was present. The webbing around the stub base box could interfere with the free foot movement of the loader.

According to the literature, the Centurion turret is designed with an ammunition resupply hatch located within the left turret wall. This hatch, as observed during the evaluation, is operated by pushing outward with an attached steel bar. Evaluators thought that this hatch was designed as a firing port for small arms. The opening measures 8 inches in diameter and is recessed into the turret wall, 10 inches from the loader's seat back. However, it appears that 105 mm ammunition could more easily and quickly be uploaded into the tank through the loader's hatch, even though personnel may be exposed to small arms fire and fragmentation.

The ranging apparatus used with the 105 mm main gun is directly in front of the loader making loading, charging, and maintenance easy. The coaxial machine gun (7.62 mm) is located just to the right of the RMG and also is easy to access.

The loader is provided with one periscope of the same model as that used by the driver. The periscope swivels and provides about the same forward viewing as does each of the driver's periscopes. The periscope was provided with a browpad that appeared adequate to protect the face from injury.

When entering and exiting the vehicle, the loader uses the top of the two metal bars located around the main gun breech which prevents contact of the breech with the loader. This top bar is located 26 inches from the loader's hatch rim.

The few indicator lights provided at this station are not testable. Also, protective guards or covers over control switches were not observed.

Table I-2 shows the dimensions of the loader's hatch. The dimensions of the hatch approximate U.S. military standard criteria for crews

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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garbed in overalls. It would be a tight fit however, if the occupant were wearing bulky arctic or NBC MOPP clothing. Opening and closing the loader's two-piece hatch was far easier than the driver's station. The loader's and commander's hatches are shown in Figure I-3. The loader's hatch rim was void of any kind of padding. The hatch itself was padded on the underside portion with 1.5 inches of material. All hatches were provided with lock open latches and were moderately difficult in releasing from the lock open position.

a. Advantages

The greatest advantage attributable to the human engineering design of the loader's station in the Centurion is the ample room

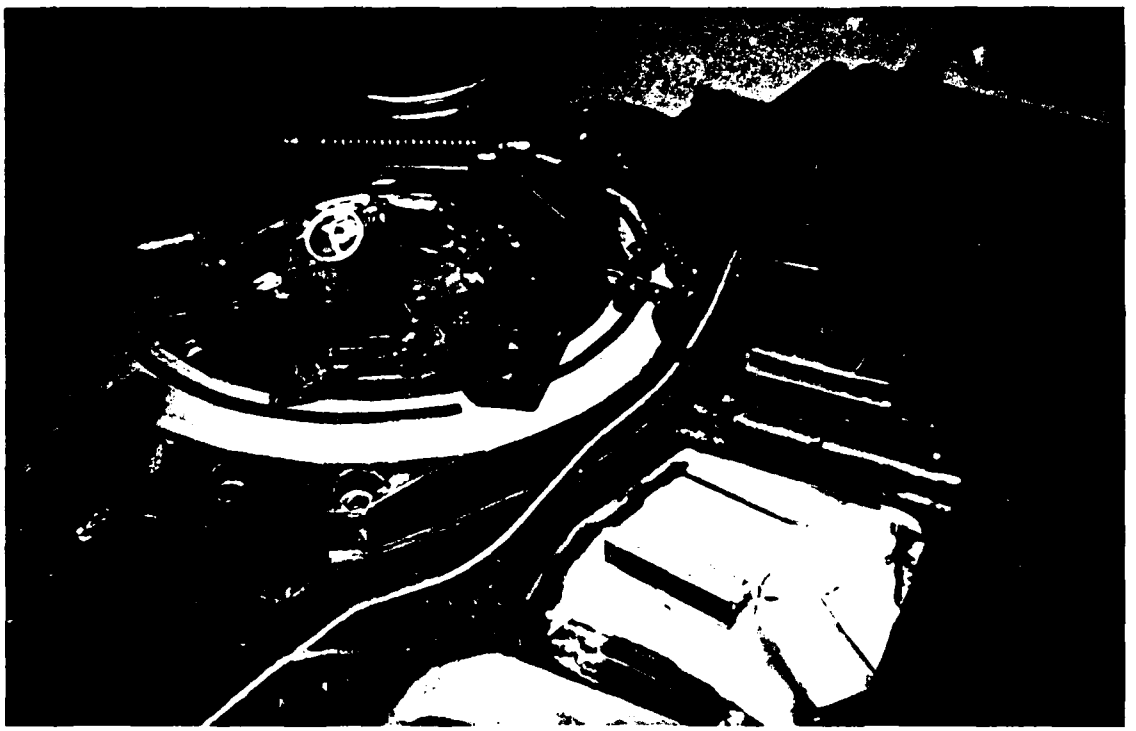

Figure I-3. Loader's and Commander's Hatches

for free movement. This allows quick and easy access to the main gun breech, ready ammunition, coaxial and ranging machine guns, and communications equipment. It also provides visual access to the other crew members, including the driver.

b. Disadvantages

The one salient disadvantage associated with the loader's station is the location of stowed main gun ammunition. Quick access to rounds located beneath the floor panels would be difficult and time consuming under any condition.

6. Crew Integration, Safety and Health

Human engineering evaluators attempted to assess a number of characteristics of each vehicle subject to evaluation pertaining to general crew integration aspects of the system based on static observations.

Given the simplicity of the Centurion's design for each crew station and the related tasks required of the crew members to perform, it appeared entirely feasible to cross-train personnel for all tank positions.

The operation of the tank appeared to be possible under degraded conditions. It is probable that operation of the tank could be accomplished by a reduced crew of three without more than about 30 percent reduction in efficiency. The tank could operate with two crew members but would naturally be limited in performance to slow, defilade type fire.

The design of the Centurion for stowage of personal gear, small arms ammunition, combat rations, water, and other items appeared adequate. Interior space for extended operations also appeared adequate.

Generally, the interior components of the Centurion lacked adequate padding. The gunner's station represented a worst case condition, with several protrusions offering a safety hazard to the gunner's face area.

With regard to maintenance access, interior access appeared very good. Evaluators considered access to main and secondary weapons, hydraulic lines, electrical connectors, and other maintenance items. Engine maintenance was not considered because of the access restrictions to the vehicle at the time of the evaluation.

Stowage of replacement items such as road wheels, firing pins, track blocks, etc. appeared adequate. Main gun rounds stowed beneath the floor panels appeared to pose the only stowage problem.

Finally, the design of the Centurion appeared very adequate to protect against inadvertent ignition/explosion of main gun rounds, coax rounds, and other ammunition.

7. Evaluator's Ratings

Table I-3 summarizes the results of the subjective ratings for the Centurion. Evaluators responded with 75 percent positive ratings. Thirty-seven percent of the ratings reflected very positive impressions of the system's human engineering design. The total number of ratings is 131.

C. DISCUSSION

The Centurion was designed more than 40 years ago when human factors engineering as a recognized profession was just beginning. In evaluating the Centurion against human engineering design criteria established since then, it becomes apparent that some of the simpler, yet more important, crew station design features were considered in the Centurion's design (e.g., available space for free foot, leg, arm, and head movement at the loader's station, etc.) while others were not, such as adequate driver forward vision. This would indicate that either the British were cognizant of the importance of soldier-system factors and included human engineering into tank design purposefully, or, most probably, they simply designed for the soldier as best they could as a lower priority subsystem component.

The evaluation exposed a general deficiency in the British seating design, with dimensions falling well short of U.S. military human engineering design standards. However, when considering that the tank's occupants were a lower priority, and given the period of development, the overall human engineering design of each crewstation in the Centurion appeared remarkably well fitted to combat.

TABLE I-3. STATISTICAL SUMMARY OF EVALUATOR'S RATINGS, BRITISH CENTURION MBT

TARGET SYSTEM RATING VALUES	1 EXTREMELY NEGATIVE	2 VERY NEGATIVE	3 NEGATIVE	4 POSITIVE	5 VERY POSITIVE	6 EXTREMELY POSITIVE
CENTURION						
GENERAL,BOARDING,ETC.	1	2	0	1	2	0
DRIVER STATION	1	1	1	8	13	2
COMMANDER STATION	2	3	3	10	3	1
GUNNER STATION	0	3	1	5	10	0
LOADER STATION	0	0	6	14	10	0
CREW INTEGRATION	1	5	3	12	7	0
TOTAL = 131	5	14	14	50	45	3
POSITIVE RESPONSES = 75%						
NEGATIVE RESPONSES = 25%						

86-0608-TR-G-01

ATTACHMENT 1

HUMAN FACTORS ENGINEERING DATA BASE FOR THE BRITISH CENTURION 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; RMG = Ranging machine gun

0399 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, [CENTURION, MARK V REG. NO 10BA38111-450]

0002 Vehicle class; tracked, wheeled; tank, light armored vehicle; etc., [TRACKED; MEDUIM; CENTURION, MARK V REG. NO 10BA38111-450]

0004 Vehicle identification, country of origin, [UNITED KINGDOM]

0006 Vehicle identification, manufacture date, [1952]

0008 Vehicle operability, overall condition of vehicle, rating scale 3 [4, STATIC DISPLAY IN PATTON MUSEUM]

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

0012 Vehicle operability, weapon condition, main gun, (text)

0014 Vehicle operability, weapon condition, coax machine gun, (text)

0018 Vehicle operability, weapon condition, commander's weapon, (text)

0020 Crew number, total, [4]

0021 Crew location, driver, [FRONT, RIGHT-CENTER]

0022 Crew location, gunner, [TURRET, RIGHT, BELOW COMMANDER]

0023 Crew location, commander, [TURRET, RIGHT, ABOVE GUNNER]

0024 Crew location, loader, [TURRET, LEFT]

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

0026 Cannon, stabilization [YES]

0028 Turret, traverse limits [360 DEGREES]

0030 Cannon, rate-of-fire, cannon, (rnds/min)

0040 Cannon, turret traverse rate, [360 DEGREES IN 25 SECONDS]

0044 Mobility, fording prep time, (min)

0046 Cannon, rate of fire, stationary, (min/sec)

0047 Cannon, rate of fire, moving, (min/sec)

0048 Cannon, autoloader, description, [MANUAL LOAD]

0050 Cannon, autoloader, manual assist, description, (text)

0052 Cannon, ammo, storage, location, [105MM, 4 ROUNDS READY RACK LOCATED NEXT TO LOADER'S LEFT KNEE. STD ROUNDS LOCATED BELOW FLOOR PLATE]

0054 Coax MG, type, [ORDNANCE QUICK FIRING, 20-POUNDER MARK 1]

0056 Coax MG, caliber, [3.3IN, 83.4MM]

0058 Coax MG, fire control, [FINGER-OPERATED ELECTRIC FIRING FOR 20-POUNDER]

0060 Cmdr's weapon, cupola, description, (text)

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, (text)

0088 Searchlight, model (text)

0090 Searchlight, field of view (degrees)

0092 Searchlight, effective range (meters)

0094 Main weapon, fire control, telescope, model (text)

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

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

0120 Main weapon, fire control, location, (text)

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

0126 Main weapon, fire control, FLIR, MAG (power)

0128 Main weapon, fire control, FLIR, FOV (degrees)

0130 Main weapon, fire control, FLIR, location (text)

0140 Main weapon, fire control, range finder, MAG (power)

0144 Main weapon, fire control, range finder, FOV (degrees)

0146 Main weapon, fire control, range finder, location (text)

0148 Main weapon, fire control, range finder, accuracy (text)

0150 Azimuth indicator, description (text)

0156 Ident Friend-Foe, (text)

0160 NBC protection, type, collective protection; individual, (text)

0166 NBC filter, type (text)

0168 NBC collective protection, type, overpressure/etc.,(text)

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 (text)

0196 Engine, maintenance access, interior (text)

0200 Resupply, POL, time (min)

0220 Cannon, ammo, type 1, descrip; weight (Kg; lbs/oz.)

0222 Cannon, ammo, type 2, descrip; weight (Kg; lbs/oz.)

0226 Cannon, ammo, type 3, descrip; weight (Kg; lbs/oz.)

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 [2]

2005 Boarding handholds, grasp space (mm; in)

2006 Boarding footholds, dimensions, L x W, (mm; in)

2008 Non-skid surfaces, adequacy of, rating scale 2 [1]

2009 Obstructions boarding vehicle? [YES, CABLES AND MUFFLER MOUNTED IN THE REAR]

2010 Alternate boarding paths? [NO]

2011 Alternate emergency hatch provided? [NO]

2100 Inter-crew station passage, difficulty moving from primary entrance hatch to loader's station, rating scale 2 [5]

2101 Inter-crew station passage, average time to move from primary entrance to loader's station (no. trials; seconds)

2102 Inter-crew station passage, difficulty moving from primary entrance hatch to cmdr's station, rating scale 2 [5]

2103 Inter-crew station passage, average time to move from primary entrance to cmdr's station (no. trials; seconds)

2104 Inter-crew station passage, difficulty moving from primary entrance hatch to gunner's station, rating scale 2 [4]

2105 Inter-crew station passage, average time to move from primary entrance to gunner's station (no. trials; seconds)

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]

2109 Driver's ingress from turret to station, average time, non-NBC garbed, (no. trials; seconds)

2111 Driver's ingress from turret to station, average time, NBC garbed, (no. trials; seconds)

2113 Driver ingress from turret to station, effort required, NBC garbed, rating scale 2 (1-6)

2115 Emergency egress, adequacy of moving from driver sta to turret, rating scale 2 (1-6)

2117 Dead weight drag, ease of dead weight drag from driver station into turret, rating scale 2 (1-6)

2118 Dead weight drag, from driver station into turret, average time, NBC garbed (no. trials; seconds)

2119 Dead weight drag, from driver station into turret, average time, non-NBC garbed (no. trials; seconds)

2120 Dead weight drag, from gunner station to outside vehicle, ease of, rating scale 2 (1-6)

2121 Dead weight drag, from gunner station to outside vehicle, average time, NBC garbed (no. trials; seconds)

2122 Dead weight drag, from gunner station to outside vehicle, time, non-NBC garbed (no.; seconds)

2124 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, ease of, rating scale 2 (1-6)

2125 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, average time, non-NBC garbed, (no. trials; seconds)

2126 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, average time, NBC garbed (no. trials; seconds)

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

3005 Dvr sta, seat back dimensions, [14 INCHES X 16 INCHES]

3010 Dvr sta, seat pan dimensions, IAW MIL-STD-1472C, Fig 50, [15.75 INCHES X 15.50 INCHES]

3012 Dvr sta, seat padding, thickness, IAW MIL-STD-1472C, Fig 50, [1.5 INCHES BACK; 3 INCHES FRONT]

3014 Dvr sta, seat back rest-to-seat angle, IAW MIL-STD-1472C, Fig 50, (degrees)

3016 Dvr sta, seat slope, IAW MIL-STD-1472C, Fig 50, (degrees)

3018 Dvr sta, distance from seat front, top of padding, to floor, IAW MIL-STD-1472C, Fig 50, [19.25 INCHES]

3020 Dvr sta, seat vertical adjustability, IAW MIL-STD-1472C, Fig 50, [8.50 INCHES]

3022 Dvr sta, seat forward-rearward adjustability, IAW MIL-STD-1472C, Fig 50, [NONE PROVIDED]

3024 Dvr sta, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, [23.50 INCHES]

3026 Dvr sta, MIL-STD-1472C, Table 28 dimension B, Elbow, static, [23 INCHES]

3028 Dvr sta, MIL-STD-1472C, Table 28 dimension C, Shoulder, [17.50 INCHES]

3030 Dvr sta, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, [15.50 INCHES]

3032 Dvr sta, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, [21.75 INCHES]

3034 Dvr sta, MIL-STD-1472C, Table 28 dimension F, Boot clearance from pedal, [5 INCHES]

3036 Dvr sta, MIL-STD-1472C, Table 28 dimension G, Distance between pedals, [5 INCHES]

3038 Dvr sta, MIL-STD-1472C, Table 28 dimension H, Boot clearance from brake pedal, [7.75 INCHES]

3040 Dvr sta, MIL-STD-1472C, Table 28 measurement 1, head clearance, closed hatch, SRP to underside of hatch, [34 INCHES]

3042 Dvr sta, MIL-STD-1472C, Table 28 measurement 2, abdominal, seat back to steering device, [24.25 INCHES]

3044 Dvr sta, MIL-STD-1472C, Table 28 measurement 3, front of knee, seat back to closest forward object, [42 INCHES]

3046 Dvr sta, MIL-STD-1472C, Table 28 measurement 4, seat depth, SRP to front edge of seat pan, [8 INCHES]

3050 Dvr sta, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to heel point of accelerator, [16 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 [6]

3054 Dvr sta, seat, adequcy of lumbar support, rating scale 1 [5]

3056 Dvr sta, seat provided with restraint,seat belts? [NO]

3058 Dvr sta, seat, adequacy of seat restraint/seat belt system, rating scale 1 (1-6)

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 (1-6)

3070 Dvr sta, adequacy of emergency braking, rating scale 1 (1-6)

3072 Dvr sta, closed hatch, non-NBC, adequacy of ventilation (use of fresh outside air), rating scale 1 (1-6)

3074 Dvr sta, daylight driving, open hatch, reflective glare on instruments? [NO, WHITE ON BLACK BACKGROUND]

3076 Dvr sta, open hatch, adequacy of rear view mirror, rating scale 1 [2]

3078 Dvr sta, seat back material, [VINYL]

3080 Dvr sta, head rest material, (text)

3082 Dvr sta, distance closest hand control from SRP, [17.75 INCHES]

3084 Dvr sta, adequacy of access and operation of hand/foot controls, rating scale 1 [5]

3086 Dvr sta, visibility, quality of visibility of controls/displays, day and night operations, rating scale 3 [5]

3088 Dvr sta, visibility; viewing distance to most distant display, [17.75 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 [5]

3094 Dvr sta, display functions grouped together? [YES, FEW DISPLAYS; RIGHT SIDE, EYE LEVEL]

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

3097 Dvr sta, master caution light provided? [YES]

3098 Dvr sta, master caution light, distance, angle from design eye postion, [16 INCHES]

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

3100 Dvr sta, master caution light, color, [RED]

3101 Dvr sta, displays illuminated? [MASTER PANEL BACK LIGHTING]

3102 Dvr sta, primary display color, [WHITE 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? [NO, WHITE LIGHT USED]

3107 Dvr sta, luminance controls provided with full OFF? [YES]

3108 Dvr sta, indicator lights, grouped together, close to driver's line of sight? [YES, ONLY ONE PROVIDED]

3110 Dvr sta, indicator lights, colored correctly, IAW MIL-STD-1472C? [NO, RED USED AS MASTER OPERATING INDICATOR]

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, irstrument panel nomenclature used of appropriate size, contrast with panel, and readable? [YES]

3120 Dvr sta, decals/placards readable, properly placed? [YES]

3122 Dvr sta, controls provided best choice for critical driving tasks? [YES, LATERALS PROVIDED]

3124 Dvr sta, size, shape, spacing between controls appropriate for effective intended usage? [YES]

3126 Dvr sta, controls located and arranged to facilitate sequential usage? [YES]

3128 Dvr sta, adequacy of access to driver's controls, rating scale 4 [5]

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 [5]

3138 Dvr sta, adequacy of driver control/display arrangement, rating scale 1 [5]

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

3140 Dvr sta, excessive force required to operate hand controls? (Yes/No; comments)

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? [SEPARATE GUARDS BETWEEN ELECTRICAL SWITCHES]

3156 Dvr sta, protective covers/guards, adequately positioned to permit observation of displays, nomenclature, indicators, etc., rating scale 1 [5]

3158 Dvr sta, steering device, adequacy of size to permit complete control of vehicle, rating scale 1 [5]

3160 Dvr sta, NBC collective protection provided? [NO]

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 (1-6)

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? [NO]

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 [5]

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 [4]

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

3192 Dvr sta, ease of transitioning from open to closed hatch mode with vehicle in motion, rating scale 2 (1-6)

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; PERISCOPES PROVIDED]

3198 Dvr sta, closed hatch viewing, viewing distance to closest point in front of vehicle, using DAY-CHV, [13.5 INCHES]

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 [4]

3210 Dvr sta, closed hatch, adequacy of upward viewing through periscope, rating scale 1 [4]

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, IR]

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 [4]

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, [102 INCHES]

3234 Dvr sta, driver vision, open hatch, forward FOV, (degrees)

3236 Dvr sta, driver vision, open hatch, quality of forward, lateral visibility, rating scale 3 [4]

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, [LOCATED ON LEFT WALL

3346 Dvr sta, ease of access to com hookup from normal seated position, rating scale 2 [6]

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 [5]

3358 Dvr sta, effectiveness of communicating to other crew members using hand signals or other methods, rating scale 6 [4]

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 [4]

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 [5]

3386 Dvr sta, safeguard provided against inadvertent activation of interior lights? [YES]

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, [STICK, CABLE ACTUATED]

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

3506 Dvr sta, general anthropometric fit, [percentile male]

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

4000 Cmdr sta, seat back dimensions, l x w, (mm; in.)

4001 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, dimensions seat pan, [10.25 INCHES X 14.50 INCHES]

4002 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, [.75 INCH BACK; 1.25 INCHES PAN]

4004 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, [90 DEGREES FIXED]

4006 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, [90 DEGREES FIXED]

4008 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, [18 INCHES TO FOOT REST]

4010 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, [INOPER]

4012 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, forward adjustability, [NOT PROVIDED]

4014 Cmdr sta, seat pan material, [VINYL]

4016 Cmdr sta, seat back material, [VINYL/CANVAS]

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, [19 INCHES]

4024 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, [12 INCHES]

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, [21 INCHES]

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, [36 INCHES]

4034 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 2, Abdominal, seat back to nearest forward object, [27 INCHES]

4036 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 4, Seat depth SRP to front edge of seat pan, [5 INCHES]

4040 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 7, Boot, front seat pan to nearest object forward, [13.5 INCHES]

4042 Cmdr Sta, seat, effectiveness of cmdr's seat, considering adjustability, cushioning, size, and back angle, rating scale 6 [4]

4044 Cmdr sta, seat adjustable vertically? [YES, INOPER]

4046 Cmdr sta, quality of viewing cmdr's instruments with seat adjusted fully up, open hatch, for 95th percentile male, rating scale 3 [4]

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 [2]

4052 Cmdr sta, seat material promote excessive perspiration during extended operations? [NO]

4054 Cmdr sta, foot rest provided for arctic boot-sized foot? [NO]

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

4058 Cmdr sta, foot rest dimensions, [8.75 INCHES X 10.75 INCHES]

4060 Cmdr sta, vertically-adjustable standing platform provided for stand-up, open hatch operations? [YES, BUT MAY BE DIFFICULT]

4062 Cmdr sta, adequacy of standing platform considering use with arctic boots, rating scale 1 [2]

4064 Cmdr sta, can cmdr's seat be adjusted to permit sitting with head and shoulders exposed? [YES, BUT INOPER]

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 [4]

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? [NO]

4078 Cmdr sta, ease of folding seat back for stand-up operations, rating scale 2 [5]

4080 Cmdr sta, ease of access to adjustment controls for seat operation, rating scale 2 [4]

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 [3]

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

4088 Cmdr sta, effectiveness of cupola periscopes for outside viewing during closed hatch operations, rating scale 6 [4]

4090 Cmdr sta, cupola provided with controls for manual traverse (of cupola)? [YES, DIAMETER 4.50 INCHES]

4091 Cmdr sta, ease of locking/unlocking cupola manual traverse locking device, rating scale 2 [2]

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 [5]

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 [4]

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, [LOCATED RIGHT OF KNEE, CHEST LEVEL]

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, [2.50 INCHES]

4147 Cmdr sta, effectiveness of communicating with other crew members using hand signals or other non-electronic methods, rating scale 6 [5]

4148 Cmdr sta, overall adequacy of controls/displays for tasks cmdr must perform, rating scale 1 [4]

4149 Cmdr sta, accessibility for operation of controls, rating scale 4 [6]

4150 Cmdr sta, quality of visibility of controls/displays, day and nighttime operations, rating scale 3 [4]

4152 Cmdr sta, distance from design eye, to nearest display, [12 INCHES, LEFT PERISCOPE]

4154 Cmdr sta, distance from design eye, to most distant display, [21.75 INCHES, BACKUP SIGHT]

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? [ONE RED LIGHT EMERG FIRE CONTROL BOX]

4163 Cmdr sta, primary display; color, [RED]

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)

4168 Cmdr sta, displays color-coded efficiently IAW MIL-STD-1472C? [YES]

4170 Cmdr sta, indicator lights grouped together, close to cmdr's line of sight? [YES]

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

4176 Cmdr sta, indicator lights testable? [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? (Yes/No; comments)

4186 Cmdr sta, decals/placards readable, understandable, properly placed? (Yes/No; comments)

4188 Cmdr sta, general, ease of control actuation for all cmdr's controls, rating scale 2 [4]

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? [YES]

4194 Cmdr sta, NBC collective protection provided? [NO]

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 (1-6)

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 [5]

4240 Cmdr sta, hatch dimensions, [21.75 INCHES DIAMETER]

4242 Cmdr sta, hatch, combat lock provided? [NO]

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 (1-6)

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? (Yes/No; comments)

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, [360 DEGREES UNITY]

4258 Cmdr sta, outside viewing, closed hatch, blind spots? [YES]

4260 Cmdr sta, outside viewing, closed hatch, upward viewing angle through periscopes/vision blocks, (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 [4]

4266 Cmdr sta, means provided to clear closed hatch vision systems of frost, dust, mud, etc. without exiting vehicle? [NO]

4268 Cmdr sta, adequacy of means provided to clear vision systems of frost, etc. without exiting vehicle, rating scale 1 [1]

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

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 [3]

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 (1-6)

4292 Cmdr sta, safeguard provided against inadvertent activation of interior lights? (Yes/No; comments)

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 [4]

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

4352 Cmdr sta, general anthropometric fit, [percentile male]

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

5000 Gun sta, seat back dimensions, [10 INCHES X 4 INCHES]

5001 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat pan dimensions, [13 INCHES X 13 INCHES]

5004 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, [2.75 INCHES PAN; 1 INCH BACK]

5006 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, [90 DEGREES]

5008 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, [90 DEGREES]

5010 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, [16 INCHES DOWN; 20.50 INCHES UP]

5012 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, [4.50 INCHES]

5014 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, forward-rearward adjustability, [12.50 INCHES]

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

5018 Gun sta, seat, seat back material, [VINYL]

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

5022 Gun sta, seat, restraint system provided? [NO]

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, [27.75 INCHES]

5026 Gun sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, [19.75 INCHES]

5028 Gun sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, [21 INCHES]

5030 Gun sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, [13 INCHES]

5032 Gun sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, [19 INCHES]

5034 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 1, SRP

to closest object overhead, [34.5 INCHES UP; 39 INCHES DOWN]

5036 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 2, Abdominal, seat back to nearest forward object, [21 INCHES]

5038 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 4, seat depth SRP to front edge of seat pan, [6.50 INCHES]

5042 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to nearest object forward, [9.50 INCHES]

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

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

5048 Gun sta, instruments, overall quality of viewing during closed hatch operations, rating scale 3 [5]

5050 Gun sta, adequacy of lumbar (back) support during cross country maneuvers, rating scale 1 [2]

5052 Gun sta, seat material promote excessive perspiration during extended operations? [SEAT YES; BACK NO]

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 [4]

5058 Gun sta, ease of emergency egress, NBC MOPP-4, 95th percentile male, rating scale 2 (1-6)

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 [5]

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 [5]

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? [YES]

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 (1-6)

5104 Gun sta, adequacy of workspace to perform powered gun lay, rating scale 1 [5]

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 (1-6)

5112 Gun sta, adequacy of workspace to perform manual gun lay, rating scale 1 [5]

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 (1-6)

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)

5126 Gun sta, accessibility of main gun/coax selector, rating scale 4 (1-6)

5128 Gun sta, controls, distance from SRP to nearest control, [11 INCHES TO FIRE CONTROL OPTIC]

5130 Gun sta, controls, distance from SRP to most distant control, [33 INCHES TO COAX CONTOL HANDLE]

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

5136 Gun sta, quality of visual access to all controls and

displays, day and night operations, rating scale 3 [5]

5150 Gun sta, location of communications equipment, [6 INCHES FROM RIGHT ELBOW]

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, [2 INCHES]

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 [5]

5159 Gun sta, overall adequacy of controls/displays for critical gunnery tasks, 1 [5]

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

5162 Gun sta, controls/displays; size, shape, spacing appropriate for intended usage? [YES]

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, (red, blue-green, white, etc.)

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? [NO]

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)

5202 Gun sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? [NO, PAINTED OVER]

5204 Gun sta, decals/placards readable, readily understood, and properly placed? [NO, PAINTED OVER]

5206 Gun sta, ease of control actuation for all gunner's

controls, rating scale 2 [4]

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

5214 Gun sta, protective covers/guards placed over controls or switches where appropriate, [NO]

5216 Gun sta, NBC collective protection provided? [NO]

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? [NO]

5242 Gun sta, hatch, ease of opening/closing from inside vehicle, rating scale 2 (1-6)

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 (1-6)

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

5456 Gun sta, hatch, combat lock provided? (Yes/No; comments)

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 (1-6)

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, stationary 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 [2]

5492 Gun sta, ease of training new operator quickly, rating scale 2 [5]

5494 Gun sta, general adequacy of interor lighing, rating scale 1 (1-6)

5496 Gun sta, accessibility of controls for internal lighting, rating scale 4 (1-6)

5498 Gun sta, safeguard provided against inadvertent activation of interior lights? (Yes/No; comments)

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

5502 Gun sta, heater, station designed for equal distr bution 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 [DIRECTLY IN FRONT OF GUNNER]

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

5586 Gun sta, target acquisition, periscope, magnification [X 6]

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)

5598 Gun sta, general anthropometric fit, [percentile male]

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

6000 Ldr sta, seat back dimensions, [4.25 INCHES X 12 INCHES]

6001 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat pan dimensions, [13.50 INCHES X 13.75 INCHES]

6004 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, [2 INCHES]

6006 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, [90 DEGREES FIXED]

6008 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, [90 DEGREES FIXED]

6010 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, [24 INCHES]

6012 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, [FIXED]

6014 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, forward-rearward adjustability, [FIXED]

6016 Ldr sta, seat, seat pan material, [VINYL]

6018 Ldr sta, seat, seat back material, [VINYL]

6020 Ldr sta, seat, restraint system provided, [NO]

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, [34.5 INCHES]

6034 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, [29 INCHES]

6036 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, [19.25 INCHES]

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, [47 INCHES]

6044 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 2, abdominal, seat back to nearest forward object, [17.25 INCHES]

6046 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 4, seat depth, SRP to front edge of seat pan, [7 INCHES]

6048 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 6, seat pan height, [24 INCHES]

6054 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to nearest object forward, [5.25 INCHES]

6056 Ldr sta, seat, effectiveness of ldr's seat, considering adjustability, cushioning, size, and back angle, rating scale 6 [4]

6058 Ldr sta, seat, adjustable vertically? [NO]

6060 Ldr sta, seat, stowable to facilitate standing during loading operations? [YES]

6062 Ldr sta, seat adjustable to provide platform for standing and outside viewing/firing ldr's weapon? [YES]

6064 Ldr sta, adequacy of seat configured to provide standing platform for open hatch viewing/weapons operation, rating scale 1 [5]

6066 Ldr sta, seat, material covering seat promote excessive sweating? [YES]

6068 Ldr sta, seat, material covering seat become excessively hot during operation in warm/hot climates? [YES]

6072 Ldr sta, seat, effectiveness of seat design/placement for seated loading/firing operations, rating scale 6 [5]

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, [8.50 INCHES]

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 [4]

6090 Ldr sta, objects present preventing free interface with main gun/access to main gun ammo? [NO]

6092 Ldr sta, main gun provided with stub case deflector?

[YES]

6094 Ldr sta, main gun provided with stub case box? [YES]

6096 Ldr sta, distance from SRP to stub case box, [11.50 INCHES]

6099 Ldr sta, main gun provided with stub/casing retractor tool/device? [YES]

6102 Ldr sta, probability of injury during loading/firing operations due to design of workstation, rating scale 5 [3]

6104 Ldr sta, probability of striking inadvertently the main gun round nose against bulkhead or objects within turret during loading process, rating scale 3 [3]

6110 Ldr sta, adequacy of workspace to perform rapid loading operations, rating scale 1 [4]

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 [5]

6116 Ldr sta, ease of access to main gun ammo and operation of mechanisms to stow or release ammo, rating scale 2 [4]

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 [3]

6126 Ldr sta, ease of main gun ammunition resupply through cmdr's hatch, rating scale 2 [4]

6128 Ldr sta, ease of main gun ammunition resupply through ldr's hatch, rating scale 2 [4]

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 [3]

6138 Ldr sta, coax, ease of access to load, charge, clear jams

as required, non-NBC clad, rating scale 2 [4]

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 [4]

6452 Ldr sta, coax, ease of installing coax, rating scale 2 [4]

6454 Ldr sta, ease of access and operation of all ldr's controls without being subjected to main gun recoil, rating scale 2 [5]

6460 Ldr sta, ease of loading secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 [4]

6462 Ldr sta, ease of installing secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 [4]

6464 Ldr sta, ease of dismounting secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 [4]

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 [5]

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

6482 Ldr sta, outside visibility, blind spots, [ONLY 60 DEGREES FORWARD VISION]

6484 Ldr sta, outside visibility, vertical viewing, (degrees from horizen) [SAME AS DRIVER'S]

6486 Ldr sta, means provided to clear periscopes/vision blocks of frost, dust, etc. without exiting vehicle? [NO]

6488 Ldr sta, step (other than seat) provided for ingress to and egress from station? [YES]

6490 Ldr sta, location of step for ingress/egress, [BREECH RECOIL BAR LOCATED 26 INCHES FROM TOP OF HATCH LIP]

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 [4]

6496 Ldr sta, accessibility of controls, rating scale 4 [5]

6498 Ldr sta, ease of operation of controls, rating scale 2 [5]

6510 Ldr sta, quality of visibility of controls/displays for day/night operations, rating scale 3 [5]

6512 Ldr sta, viewing distance from design eye to nearest display, [18 INCHES TO COMM BOX]

6514 Ldr sta, viewing distance from design eye position to most distant display, [26 INCHES]

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

6518 Ldr sta, display functions grouped together? [YES]

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? [NO; NO COLOR DISPLAYS]

6526 Ldr sta, display color, primary display, [BLACK/WHITE]

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

6534 Ldr sta, control provided with primary display for variable luminance? [NO]

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? [NO]

6568 Ldr sta, indicator lights testable? [NO]

6570 Ldr sta, indicator lights dimmable? [NO]

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]

6578 Ldr sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? [YES]

6580 Ldr sta, decals/placards readable, understandable, properly located? [YES]

6584 Ldr sta, overall ease of control actuation for all ldr's controls, rating scale 2 [5]

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? [NO]

6590 Ldr sta, NBC collective protection provided? [NO]

6592 Ldr sta, if NBC collective protection not provided, describe system, [INDIVIDUAL]

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]

6648 Ldr sta, hatch, ease of opening/closing from inside vehicle, rating scale 2 [4]

6649 Ldr sta, hatch, ease of unlocking/opening from outside, rating scale 2 [4]

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? [NO]

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 [5]

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

6660 Ldr sta, hatch, combat lock provided? [YES]

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

6664 Ldr sta, adequacy of hatch entry padding, rating scale 1 [1]

6666 Ldr sta, ease of releasing hatch from secured, open hatch position, to closed hatch position, rating scale 2 [4]

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 [3]

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, [BEHIND AND TO THE RIGHT OF SEATED LOADER]

6682 Ldr sta, ease of operation of com box w/arctic handwear, rating scale 2 [4]

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, [1 INCH]

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 [3]

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)

6758 Ldr sta, general anthropometric fit, [percentile male]

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 [4]

7012 Crew, effectiveness of operation of vehicle in degraded mode, 2 man crew, rating scale 6 [2]

7014 Crew, approximate overall degradation with reduced, 3 man crew, [30 PERCENT]

7016 Crew, approximate overall degradation with reduced, 2 man crew, [40 PERCENT]

7020 Crew, workload, probability of workload breakdown during combat operations, rating scale 7 [3]

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 [3]

7042 NBC/Arctic gear, probability of NBC/arctic gear interfering with emergency egress from vehicle, rating scale 7 [2]

7044 NBC/Arctic gear, probability of NBC/arctic gear interfering with emergency egress, rating scale 7 [2]

7046 NBC/Arctic gear, adequacy of workspace to permit efficient

donning/doffing of NBC/arctic garb, rating scale 1 [DRIVER=2; DRIVER=5; GUNNER=2; COMMANDER=3]

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 (1-6)

7066 Water stowage, accessibility to each crewmember, rating scale 4 (1-6)

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, [NONE PROVIDED]

7078 General, adequacy of interior space for extended ops; crew work/rest cycles, rating scale 1 [4]

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? [NO]

7114 Ventilation, ventilator fan in turret provided? (Yes/No; comments)

7116 Ventilation, emergency ventilation system provided? [NO]

7120 Fire suppression, automatic fire suppression system provided? [NO, FIRE BOTTLES PROVIDED]

7122 Fire suppression, overall adequacy of system, rating scale 1 [3]

7124 Fire suppression system, automatic activation time (miliseconds)

7126 Fire suppression, accessibility to system for repair, manual activation, rating scale 4 [4]

7128 Fire suppression, probability of inadvertent activation, rating scale 7 [5]

7130 Fire suppression, portable fire extinguisher provided? [YES]

7132 Fire suppression, quick accessibility to fire extinguishers, rating scale 4 [4]

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 [5]

7152 Maintenance, interior, accessibility to hydraulics, rating scale 4 [4]

7154 Maintenance, interior, accessibility to electrical systems, rating scale 4 [4]

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 [4]

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? [NO]

7186 Maintenance, average time to diagnose faults, (no. trials; seconds)

7188 Repairs, interior, accessibility to electrical cables/hydraulic lines, rating scale 4 [4]

7190 Repairs, quality of protection afforded to cables, indicators, etc. against inadvertent damage during repairs, rating scale 3 [4]

7192 Repairs, cables/indicators, etc., adequacy of labels, color-coding, etc. for easy identification, rating scale 1 [4]

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 [5]

7198 Battle damage assessment/repair, capability/probability of crew being able to assess/repair damage during combat, rating scale 7 [2]

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 [4]

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 (1-6)

7228 Stowage, accessibility of main gun ammumition, uploading, rating scale 4 [5]

7230 Stowage, accessibility of coax/cmdr's weapon ammunition, rating scale 4 (1-6)

7232 Stowage, adequacy of design to protect against inadvertent ignition/explosion of main gun rnds, rating scale 1 [5]

7234 Stowage, adequacy of design to protect against inadvertent ignition/explosion of coax/other ammunition, rating scale 1 [5]

7236 Stowage, method of uploading vehicle, through turret, other means, (text)

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 (1-6)

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 DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: HEL-FI 2-86	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Human Factors Engineering Database Development for Armored Combat Vehicles and Analyses of Three NATO Tank Systems, Volume II: Human Factors Engineering Analysis of the British Centurion Main Battle Tank	5. TYPE OF REPORT & PERIOD COVERED: Final: 1 Oct 1985-7 Jul1986
	6. PERFORMING ORG. REPORT NUMBER: BDM/ABQ-86-0608-TR
7. AUTHOR(s): T. O'Brien, R. Smith, L. Wascher	8. CONTRACT OR GRANT NUMBER(s): DAAH01-85-D-A024, Delivery Order 0005
9. PERFORMING ORGANIZATION NAME AND ADDRESS: BDM Corporation, 1801 Randolph Rd, Albuquerque, New Mexico, 87106	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 62716A
11. CONTROLLING OFFICE NAME AND ADDRESS: HEL Field Office, 220 Seventh St, Charlottesville, VA 22901-5396	12. REPORT DATE: 3 Jul 1986
	13. NUMBER OF PAGES: 54
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

ANTHROPOMETRY
HUMAN FACTORS ENGINEERING
DATABASE
ARMORED VEHICLE
MAIN BATTLE TANK
CENTURION
CHIEFTAIN
AMX 13

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Report identifies data elements of a generic nature for an armored vehicle (main battle tank), which cover 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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