MIL-STD-1472-G Evaluation of an HDT Storm SRTV

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HDT Storm SRTV

The HDT Storm Search and Rescue Tactical Vehicle is a military vehicle with multiple uses in the field but was designed for the United States Air Force (*HDT Storm Search and Rescue Tactical Vehicle*, n.d.). The design choices and tools that make up this vehicle were intended for multi-purpose use and allow the vehicle to take on many challenges on and off the ground. The interesting thing about this vehicle is that it can be deployed by air support to assist military personnel on the ground in tasks like search and rescue or disaster relief (*HDT Storm Search and Rescue Tactical Vehicle*, n.d.).



Figure 1

(Home | HDT global, n.d.)

I chose to do a standard evaluation on this vehicle because the mass number of features built into it must comply with standards involving design, ruggedness, visual displays, etc. The standards I include are on the vehicle as a whole, therefore, are broader in nature. For future evaluations, it would be beneficial to separate evaluations on singular specifications within the vehicle, like, the artillery equipment or the structure of the vehicle. This would allow for more specificity in the choice of standards in the evaluation of compliance. This vehicle was built to take on terrain that

an average four-wheeled vehicle could never attempt to travel on and carry many people at once. The design features are noticeably related to the tasks this vehicle takes on, therefore, I am interested to see which standards the design team did or did not comply with.



Figure 2

(USAF GAARV ~ HDT STORM SRTV, 2021)

MIL-STD-1472-G

I originally was going to conduct this evaluation using MIL-STD-1180-B because it was created specifically for ground vehicles, however, following more research I found that this vehicle was used by the US Air Force and, therefore, falls under a multi-purpose land and air vehicle. By using MIL-STD-1472-G, I am able to assess all human engineering design and development criteria required to comply with this specific MIL standard. The standard encompasses everything from general requirements like safety to detailed requirements like visual displays. Below is a table that includes all standard numbers that will be assessed in this evaluation as well as the name and description of the standard. I will use these to determine whether the vehicle upholds the standard in its current state. Furthermore, being that this vehicle is used in Special Ops, there is little information on the displays and controls used outside of normal vehicle

features; these features include clearances, physical dimensions, speeds, etc. My assessment of the displays and controls will be limited to the information available to the public.

Evaluation

General Requirements

Standard #	Standard Name	Standard Description	Compliance	Notes
3.3.4	Boot (brake operation)	Minimum clearance needed to operate brake pedal without accelerator interfering. (15cm)	-Compliance is negligible -Levers will not interfere with operation of acceleration pedal	-Brakes are operated using levers directly under the steering wheel -Two levers for left and right braking are present -Same goes for accelerator operation
3.3.21	Occlusion	An obstruction that prohibits one from viewing the image that should be displayed	-Compliant with exceptions	-Displays for Commander and left seat occupant do not appear to suffer from potential occlusion -Steering wheel occludes the analog displays on the central dashboard of the vehicle
4.1	Design Objectives	N/A	N/A	N/A
4.1.6	System manpower	Design shall optimize system manpower by identifying the minimum number of personnel required consistent with system performance requirements, human performance, workload and safety requirements, and	-Compliant -This standard may be additionally supported using special ops knowledge	-Tasks are offloaded between minimum of three operators: driver, gunmen, Commander, and left seat occupant -additional operators include “guardian

		reliability, affordability, and risk constraints.		angels" within jump seats
4.2	Standardization	Controls, displays, marking, coding, labeling, and arrangement schemes (equipment and panel layout) shall be uniform for common functions of all equipment and systems.	-Compliant	-All markings in vehicle are in the same color and font. -The displays do not change arrangement from vehicle to vehicle -Driver control arrangements as well as the analog displays are constant
4.4.1	Compliance	Compliance with the design criteria presented in this standard shall be included as part of a program's Human Engineering effort.	N/A	N/A
4.9	Ruggedness	Systems and equipment shall be sufficiently rugged to withstand handling in the field during operation, maintenance, supply, and transport within the environmental limits specified for those conditions in the applicable hardware or system specification.	-compliant	-side hill angle=45° -vehicle can be grounded through midair delivery -water fording= 40"

Standard 3.3

The two standards, boot (brake operation) and occlusion were considered definitions in MIL-STD-1472-G, however, they are important in the evaluation of the HDT Storm SRTV. The brake operation is different from a normal ground vehicle; it uses a total of two levers that

control the left and right-side braking systems individually. Following the 15cm minimum clearance requirement between the acceleration pedal and brake pedal, this standard would be negligent (MIL-STD-1472G, n.d.). The lever distance from the accelerator pedal in addition to the different modalities of use makes this standard difficult to assess which is why I regarded it as negligible. The use of levers decreases the possible error that comes with the wrong choice between pedals.

The standard/definition for occlusion was evaluated using the images I could find of the inside of the vehicle. In terms of the displays for the crew members besides the driver, there is no noticeable occlusion. On the other hand, the wheel that the driver interacts with has the potential to occlude the analog displays located on the dashboard of the vehicle. Movements outside of normal might need to be performed in order to properly assess the analog displays. The driver would not be able to quickly glance down to assess the status of the vehicle.

Design Objectives

Design objectives were difficult to evaluate for the HDT Storm SRTV because the vehicle is used in special ops; therefore, only select information is given to the public. Standard 4.1.6 falls under design objectives and is titled system manpower. Due to the lack of information, I could find regarding the users of the vehicle, I assessed this standard # using the positions of the operators. When operating the vehicle, there is the driver who performs the actions of maneuvering the vehicle. They only have to maintain the vehicle's status by keeping up with their analog displays and controls. The rest of the tasks are offloaded to the Commander, occupant of the left seat, gunner, and "Guardian Angels."



*Figure SEQ Figure * ARABIC 3*

(Home | HDT global, n.d.)

The Commander has control over a set of controls and displays while also having access to an ammo can on the side of the vehicle for supply. The gunner is meant to be the primary source of artillery support. The rest of the crew, disregarding the driver, will be additional artillery support. Furthermore, there is the potential for two additional crew members that are considered "Guardian Angels" because they act as emergency support for search and rescue purposes. The offloading of tasks to a minimum of four people is beneficial for each crew member and lowers their mental workload; as their workload decreases by adding up to six crew members, the crew members' performance will also increase. If more information was known about the special operations tasks, this standard can be evaluated even further.

Standardization

Standardization is important for a vehicle like this; the crew members should be able to operate and perform the same tasks no matter which HDT Storm they are in. After evaluating the standardization of the HDT Storm, it is apparent that it complies with standard 4.2; all fonts and colors are the same, the arrangement of the displays is the same from vehicle to vehicle, the arrangements of the driver controls stay constant, and the analog displays on the dash are positioned the same as well. It would be interesting to assess whether most military vehicles that fall in the same category as the HDT Storm are standardized in a similar way.

Ruggedness

The last standard in general requirements that was necessary to evaluate was ruggedness. For a vehicle that is meant for search and rescue missions, can be grounded from a plane, and can travel on terrain that a



Figure SEQ Figure * ARABIC 4

(YouTube, 2013)

normal vehicle could never, it needs to be rugged. I evaluated the HDT Storm to be compliant with standard 4.9. The side hill angle is equal to 45º; this means that the vehicle can be at a 45º angle on its side and not tip over (Home | HDT global, n.d.). Furthermore, the vehicle can be grounded through midair delivery systems. This can be by plane, or helicopter as seen in the photo. The vehicle must withstand weather events while in flight as well as the ground delivery itself. Finally, the water fording is equal to 40”; this means that the HDT Storm can pass through 40 inches of water without taking on water potentially drowning the engine (Home | HDT global, n.d.). As stated in the same PDF, the vehicle is exceptionally maneuverable in rugged settings. Now that the general requirements have been evaluated, the more detailed requirements can be addressed.

Detailed Requirements

Standard #	Standard Name	Standard Description	Compliance	Notes
5.2.3.7.9	Field of view	The field of view shall provide acceptable visual search performance, object recognition, and spatial orientation. Acceptable field of view size is dependent on specific mission requirements	-Compliant w/ exceptions -Occlusion may occur for driver due to front bars of roll cage	-Driver position is central, therefore provides wide field of view within normal range of 170-180º -Gunner field of view is available in 360º because gun mount is mobile
5.6.2.2	Vertical adjustment	Vertical adjustment of a seat to a higher position shall also increase leg room and footrest angle.	-Does not comply	-seat cannot be adjusted vertically -seat is immobile
5.6.5.1	Lateral visual field	The operator shall have forward visibility through a lateral visual field of at least 180 degrees and pr eferably 220 degrees.	-Compliant	-Lateral visibility is available at a minimum of 180º

5.10.3.2.4	Seating	Seating shall allow the user population to perform their mission functions without degradation of their performance capability in alertness, cognition, strength, or dexterity and without significant or lasting pain or injury	-Does not comply	-Driver seat requires the separation of both legs to different compartments which could lead to entrapment in the event of a crash/rollover -Driver seat does not allow the upper leg to be positioned at 90º with the lower leg
5.12.3.3.2	Display	A centralized display shall be provided to each user to convey vehicle system status and alerts.	-Compliant	-Driver, Commander, and left seat occupant each have their own display -Driver display is analog and conveys system status -Commander and left seat occupant display conveys system status and alerts digitally

Field of View

Standard 5.2.3.7.9 and 5.6.5.1 were evaluated based on the images found of the HDT Storm. The first one is titled field of view and is concerned with visual search. The vehicle is compliant, however, there is one exception; the roll cage surrounds the entire vehicle including the front where the driver sits. This blocks a part of the driver's field of view. Although there is a block, the driver's field of view is still noticeably large and falls in the normal range of 170º-180º. The



*Figure SEQ Figure * ARABIC 5*

(Administrator, 2013)

gunner's position is different in that it allows for 360º of rotation with no occlusion, therefore, their position complies with the standard as well.

The second standard is concerned with the lateral visual field. The same situation applies from the first field of view standard. The occlusion due to the roll cage bars has little effect on the lateral visual field since they are more central. The HDT Storm is compliant with this standard because the lateral visual field is at a minimum of 180º depending on the position of the crew member.

Seating

Seating was an interesting piece of this vehicle to evaluate mainly because they are not average seats you would find in a vehicle. First off, the crew members must strap in with buckles over the chest area in case of a rollover. Furthermore, the seats are thin padding placed on metal structures. The vehicle is not in compliance with standard 5.6.2.2 nor 5.10.3.2.4. Standard 5.6.2.2 is concerned with the vertical adjustment of the chair. The chair in the HDT Storm is stationary, therefore, it cannot move in any direction. This helps in the evaluation of standard 5.10.3.2.4 because since the chair is immobile, the user must be of a specific height, or in this case, have a specific leg length. The vehicle is not compliant with this standard either; the driver is forced to separate both legs into separate compartments; this could lead to major consequences if an extreme rollover were to occur or damage to the front end of



*Figure SEQ Figure * ARABIC 6*

(USAF GAARV ~ HDT STORM SRTV, 2021)

the vehicle. Leg entrapment is a possibility if the structure of the vehicle is compromised in any way. Furthermore, the driver's leg position is not proper. The legs stay straight out, keeping the upper leg and lower leg over 90^0. Ergonomically, this is not beneficial to the driver; a discomfort in the back and legs along with potential hip contractors may occur after long periods of time.

Displays

The final standard that was evaluated was display standard 5.12.3.3.2. Having a centralized display for each user is the basis of this standard along with the necessity for system status within the displays. For the driver, the display is analog and provides information on the status of the vehicle including a speedometer, engine temperature, fuel gauge, etc. For the commander, three different displays are available and are centralized to their position in the vehicle. The status of the vehicle and alerts could not be assessed with the information found due to the Special Ops regulation of the vehicle.



*Figure SEQ Figure * ARABIC 7*

(USAF GAARV – HDT STORM SRTV, 2021)

Conclusion

Overall, the evaluation of the HDT Storm SRTV using MIL-STD-1472-G was successful. Some things were determined to be non-compliant which should be addressed in future iterations of the vehicle. For instance, seating in the vehicle was of high concern, and addressing this in redesign should be a priority for the design team. Overall, this evaluation provided a lot of insight into the different levels of compliance that can be seen in designs. A future evaluation

would be interesting to see completed using different standards based on more specific parts of the vehicle.

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