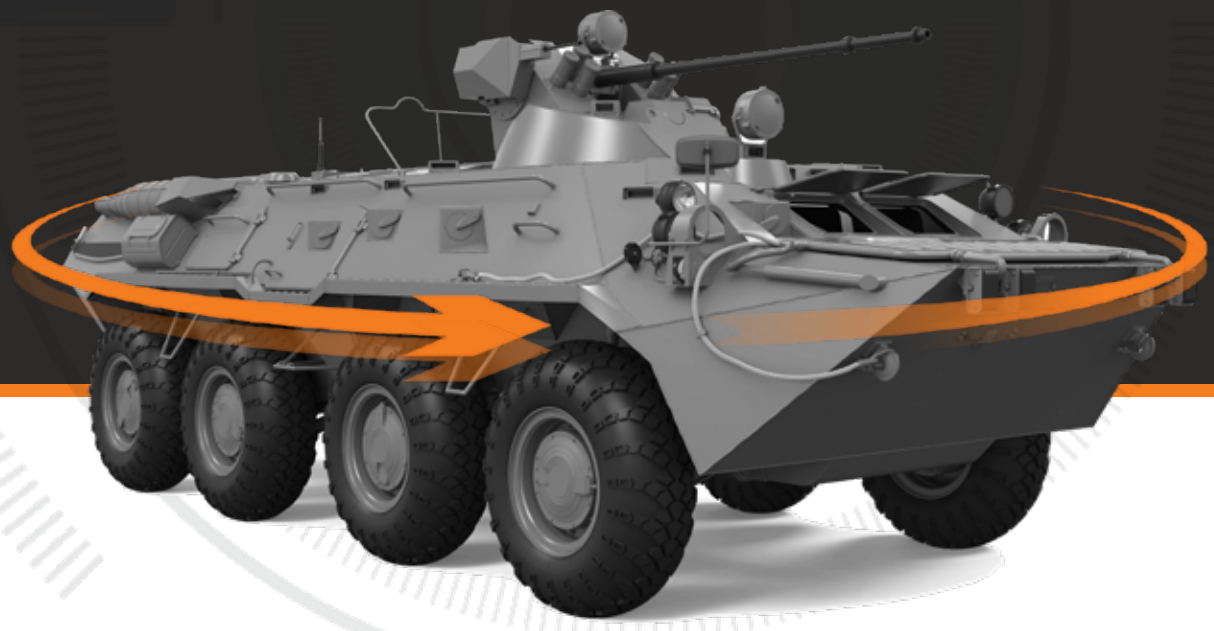
ARMORED VEHICLE SITUATIONAL AWARENESS SYSTEMS DESIGN

Overview and Recommendations

> *It's widely understood that every person, no matter how conscientious and skilled, is fallible, which is why technology was developed to backstop human vulnerabilities.*
>
> NTSB Chairman Christopher A. Hart



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THE NEED FOR SITUATIONAL AWARENESS

Inadequate situational awareness (SA) has been identified as one of the primary factors in accidents attributed to human error [1]. Because of this, SA is especially important in mission environments where the information flow can be high and fast, compromising the ability to effectively function as a soldier, where poor decision making may lead to serious consequences.

INFORMATION PROCESSING

SA is not about technologies themselves, but about the capabilities they provide to the user. The interaction between the operator and the system needs to be carefully considered during the design process, in order to reduce a crew member's cognitive load [2]. Another important factor is finding the right balance between the amount of information the systems will provide, and which information is useful for the combatant in a high stress situation.

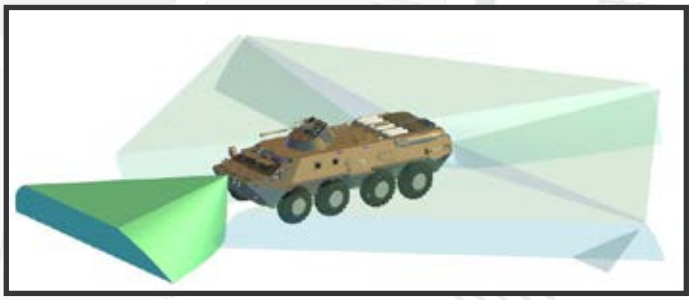
REACTIVE VS. PROACTIVE RESPONSE STRATEGY

Currently, the primary method of managing potential threats or direct attacks for many fleets is through reactive response protocols, but this is one side of the equation. A proper SA protection system can offer up to 360° of long range and local situational awareness capabilities, that give crews crucial information regarding a potential threat. This gives them time to act upon threats, increasing lethality and survivability, while improving on and off-road mobility [3].

DESIGN CONSIDERATIONS

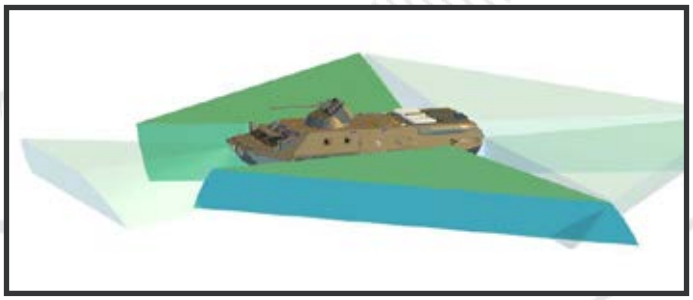
A 2D approach to designing SA protection systems is still the most commonly used method. However, advanced 3D design allows system providers to customize views, coverage, dead zones, and horizontal & vertical fields of view (HFOV & VFOV). While designing a protection system, engineers can take elements like height of the vehicle, slope of the surfaces, and tilt & placement of the sensors into account, providing a better sensor-to-coverage ratio. While the standard 360° AV retrofit package usually includes six or more sensors around the vehicle, proper design can result in the same coverage with fewer sensors.

Cameras are strategically mounted on the vehicle



Front mounted cameras provide advanced DVE

The rear of the vehicle has full coverage



Side mounted cameras provide wide angle views

With all of this in mind, the following are the points you and your system provider should consider when designing an SA system:

a) Type of Threat

- IEDs
- Vehicles, both friendly and enemy
- Human targets near and far, as well as on high floors in urban areas
- Anti-tank missiles
- Geographical obstacles (cliffs, large boulders)

b) Physical Attributes and Constraints

Number of cameras needed, and placement of cameras based on:

- Size and type of vehicle: varies greatly across fleets
- Height: how high the camera is off the ground
- Slope: Of the mount surface for the camera
- Tilt of the camera: to clear the vehicle while providing the most relevant view to a crew member for their specific needs (lower is usually better but threats may come from above)
- HFOV: horizontal field of view of the cameras (the wider the FOV, the shorter the range)
- VFOV: vertical field of view of the cameras

Other system features to consider:

- Resolution: higher resolution of the thermal and color video feeds has a higher cost
- Environmental conditions: expected theatre's atmospheric conditions
- DRI: detection, recognition, and identification capabilities

c) System Applications

- Driving (enhanced vision)
- Long or short-range threat assessment
- Mobile threats or those on foot
- Target detection and recognition
- Parking
- Vehicles or humans approaching while stationary
- Threat identification while vehicle is moving

d) Unique Personnel Needs

- Drivers need to see directly ahead, but they also need the option to see side-roads as secondary information. While one 110° field of view camera approximates normal human binocular vision, this is not a natural or comfortable view for a driver, as there is too much information to process while in an active mission or under fire. A 45° field of view is closer to what humans can easily process. To improve a driver's tactical edge, a different screen display orientation may be preferable with options for secondary views of the remaining periphery, and supporting analytics to alert operators to important events.
- Commanders need to be alerted of suspicious objects so they can quickly adjust the long-range sight to view a possible threat.
- Crew sitting inside the vehicle have different considerations. They may need a wide screen view with the ability to select a point of interest anywhere on the screen, and the capability to zoom in to investigate further, or the option to switch between multiple views or camera feeds.

ABOUT OPGAL

With 40 years of field experience, a variety of sensors, and extensive platform integration knowledge, Opgal is a leading global provider of innovative infrared (IR) thermal imaging solutions for situational awareness. Utilizing vast knowledge in system integration, Opgal offers a variety of capabilities to modify its systems to match specific vehicle and mission needs. Using advanced 3D design software, and unique image processing algorithms, Opgal can provide optimal 24/7 360° coverage of a vehicle with less sensors, making it the perfect choice for system integrators in the field of armored vehicle retrofits.

CONTACT US

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REFERENCES

1) Hartel, C. E., Smith, K., & Prince, C. (1991 April) Defining Aircrew Coordination: Searching mishaps for meaning.

2) Adam Stone C4ISRNET (2017 March) Challenges for Situational Awareness, quoting Col. Manuel Jesus De Hoyos Sanchez, head of 8x8 VCR programme, Spanish Army

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