Technology Work Session for the South African Army; Hosted by the CSIR

MOBILITY

Introduction to future mobility

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Mobility chapter contributors

Braam Greeff – Introduction and trends in Mobility

Prof Schalk Els– Vehicle Mobility Trends of the Future

Danie de Villiers (Principal Engineer, DPSS) – Soldier Mobility

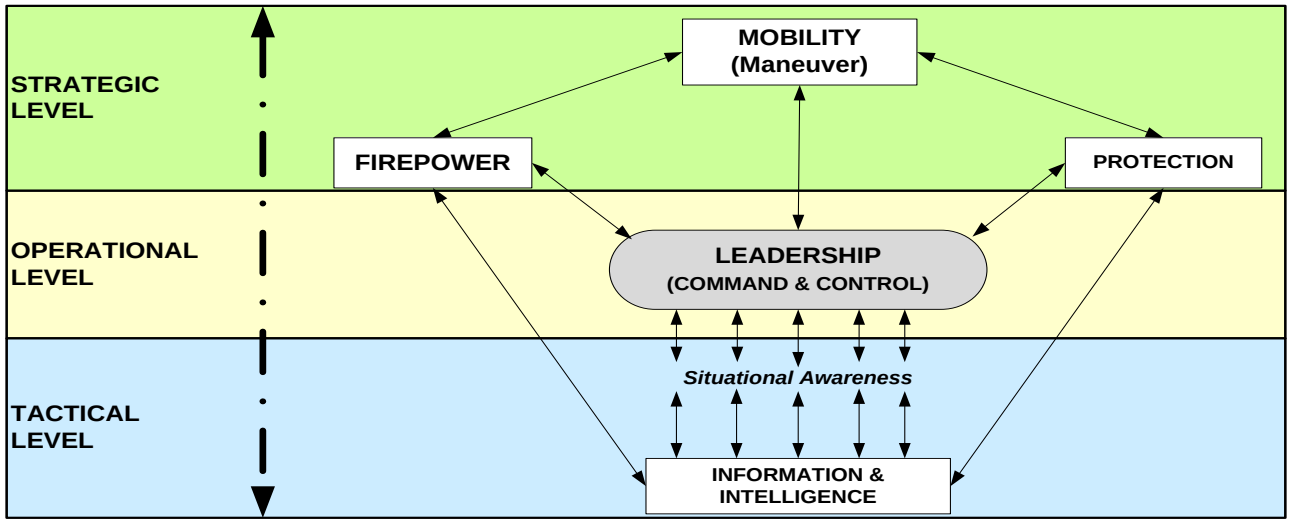
Importance of Mobility

.....superiority in tactical mobility would upset every tactical prescription in existence, precisely as our (British) methods were upset by Boer mobility in South Africa.....[Col Graham J.J (British), On War, translation of Clausewitz]

What is mobility…..?

.... the employment of forces, through movement combined with fire, to achieve a position of advantage with respect to the enemy, to accomplish the mission success.....

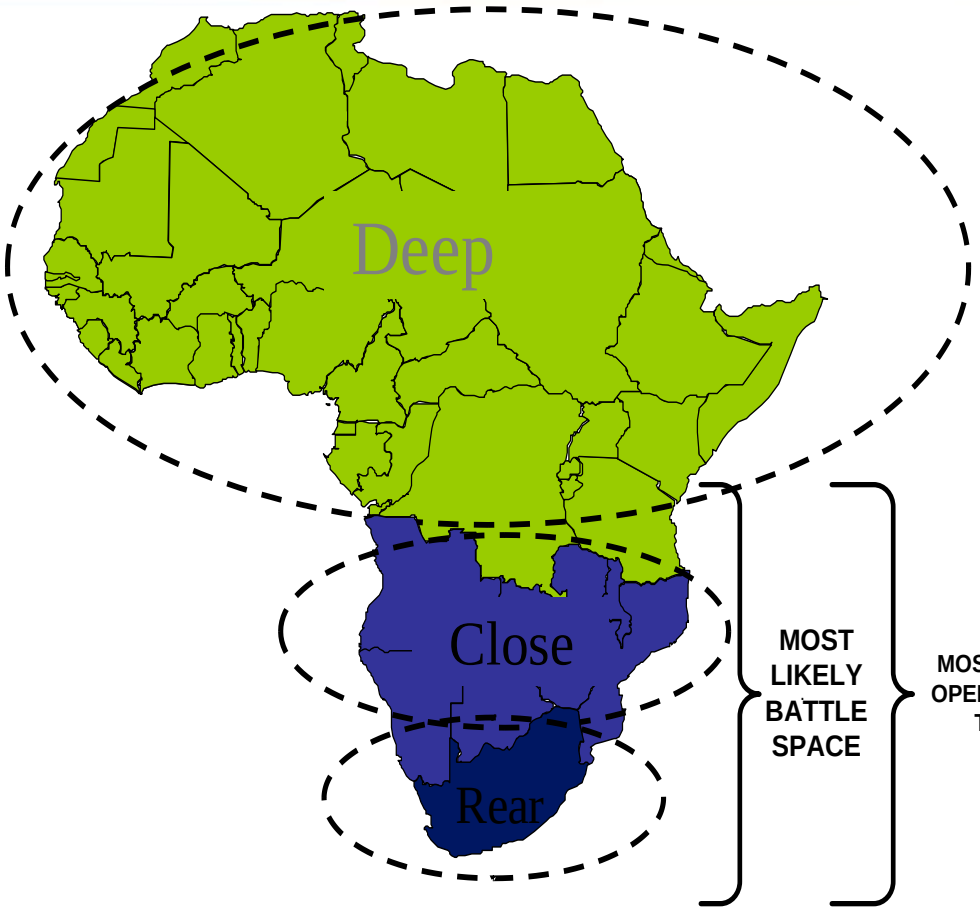
Mobility in context of combat power



- **Mobility (manoeuvrability), is a key element of combat power**

- **At the strategic level, mobility usually involves the movement of forces and resources to the theatre of conflict.**
- **At the operational level, mobility involves placing forces and resources at the critical place in time to achieve an operational advantage**
- **At the tactical level mobility and manoeuvre wins battles and engagements by keeping the enemy off balance, it also protects own forces.**

Future SANDF battle-space



MOST LIKELY BATTLE SPACE

MOST LIKELY OPERATIONAL TYPES

SPECTRUM OF CONFLICT & CONTINUUM OF OPERATIONS

PEACE | CONFLICT | WAR

OPERATIONS OTHER THAN WAR (OOTW) | WAR FIGHTING

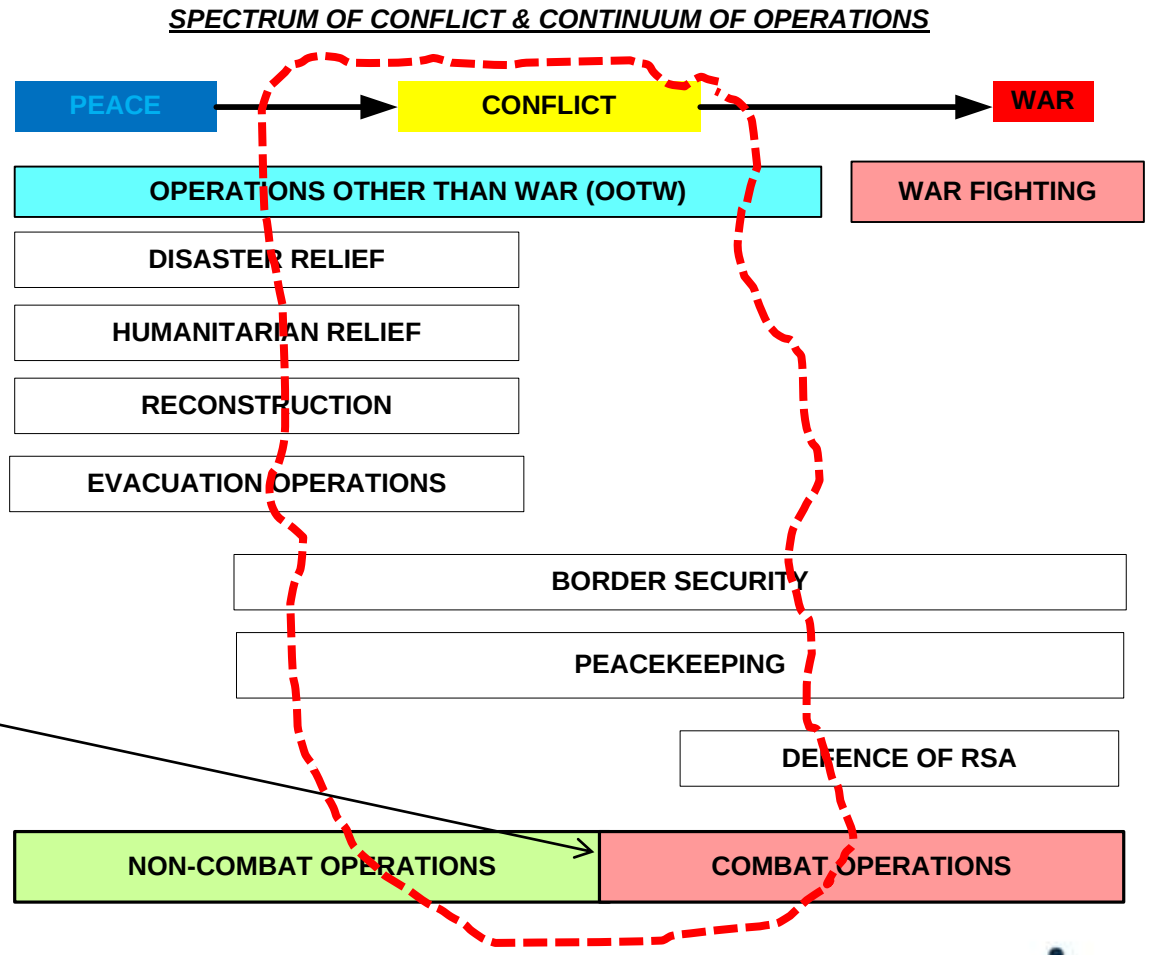
- DISASTER RELIEF
- HUMANITARIAN RELIEF
- RECONSTRUCTION
- EVACUATION OPERATIONS
- BORDER SECURITY
- PEACEKEEPING
- DEFENCE OF RSA

NON-COMBAT OPERATIONS | COMBAT OPERATIONS

[Source: JOPS, Armscor, African battle space]

Spectrum of conflict and continuum of operations

Conflict types shall by complex and hybrid



Environmental and surface conditions

Desert to Semi-desert Region

Mountainous Areas

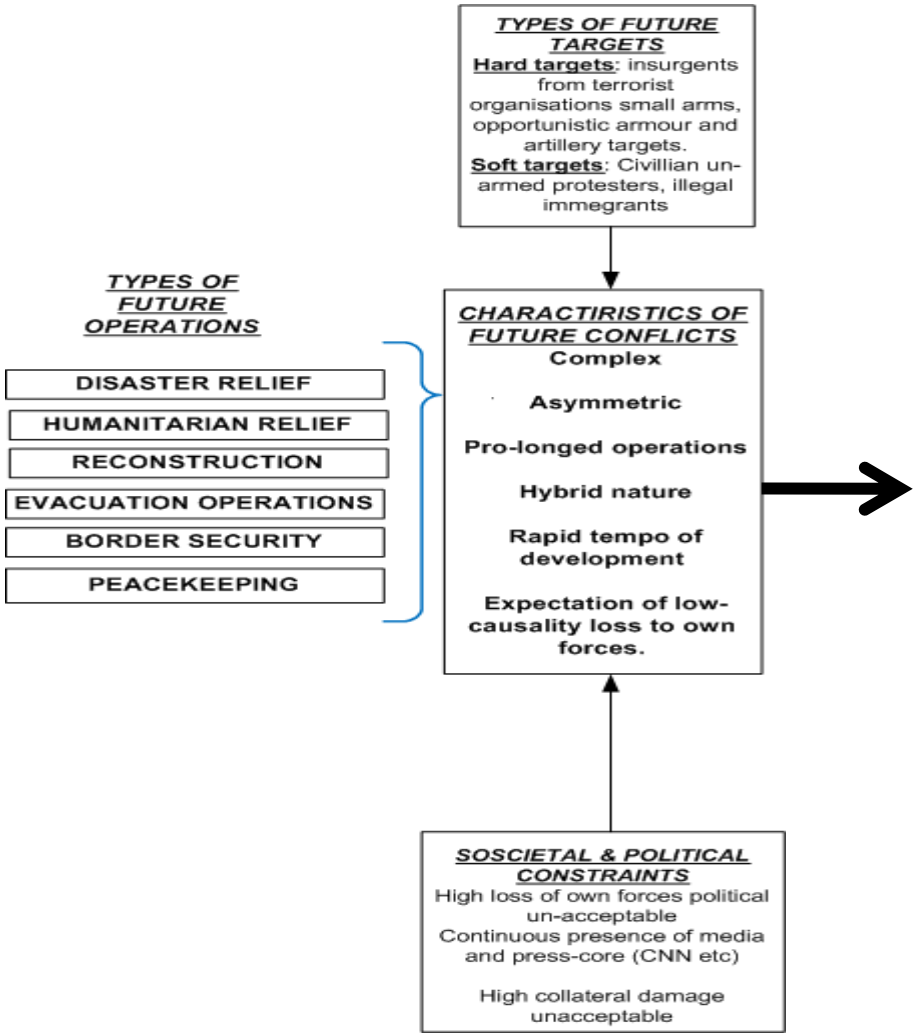
Tropical Wet Region

Tropical Dry Savannah Region

Urbanisation

[Source: JOPS, Armscor]

Nature of future mobility conflicts



- ***Flexibility*** - The ability to be effective over a range of conflict tasks, conditions and scenarios.
- ***Agility*** - The ability to manage a balance of effort over a range of conflict scenarios
- ***Resilience & Sustainment***- The ability to sustain sufficient operational capability , in the face of experiencing loss.
- ***Responsiveness*** - The ability to apply adaptive planning, the rapid identification of threats, and quick appropriate response to threat scenarios.
- ***Robustness*** - The ability to have sufficient control of a conflict theatre environment to account for operational uncertainties (surprizes) that might occur.
- ***Concomitant execution*** - The ability to execute dynamic concurrent operations.
- ***Low casuality expectation (own forces)*** - The ability to manage conflict with the minimal loss to own forces.

Where’s are the mobility platform need gaps?


OK


OK


OK


OK


Capability GAP → New protected patrol vehicle (IED protection, end-of-life)


Capability GAP → New operational supply/support vehicles (NGOSS)


Capability GAP → New light protected patrol vehicle (We dont have one)


OK

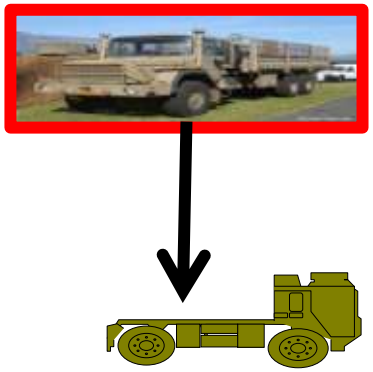

Capability GAP → Unmanned support vehicle(s) (Technologies & operational concepts to be explored)

Opportunities for future mobility technologies to be implemented

Requirements for a New Generation Operational Supply Support System (NGOSS)

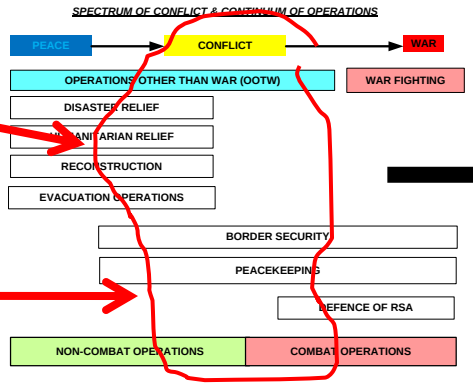
- The current fleet of SAMIL 50/100 vehicles lacks the mobility to support fighting forces in the tactical scenario.
- The load carrying capacity of the vehicles is inadequate.
- The current fleet was introduced 33 years ago, with the result that some of the vehicles are reaching the end of their useful life resulting in very high operating and support cost with severe obsolescence challenges.
- The need to address a family of support vehicles and common platforms in the combat vehicle environment to ease the logistic burden.
- Improve effectiveness and support through the use of a total systems approach.
- The current cargo handling equipment, both on-board and off-board, is inadequate to support an operational force and/or peace support operations.
- Current systems are not compatible with international ISO standards in terms of interfaces with removable superstructures and NATO compatibility.
- Interchangeability and Interoperability of sub systems must be ensured

[*Source recognition: JM Joubert, Armscor, Lt Col A Calitz*]



Need for a future light protected patrol vehicle

NEEDS ?



Typical needs

- Capability as a minimum to provide protection to against small arms fire, shrapnel.
-Capability to provide flexible/modular transport options.
-Common logistics support concept.
-Easy to change operational configuration according to required mission.
-Low Cost operation.
-Good off/on road capabilities.

Protected patrol vehicles

"Workhorses" for the future OOTW's

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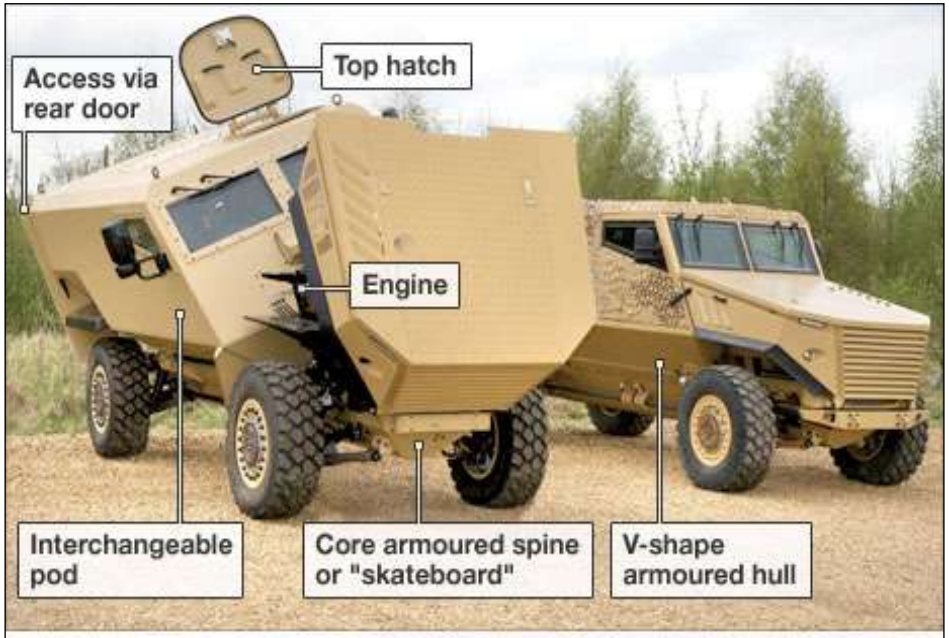
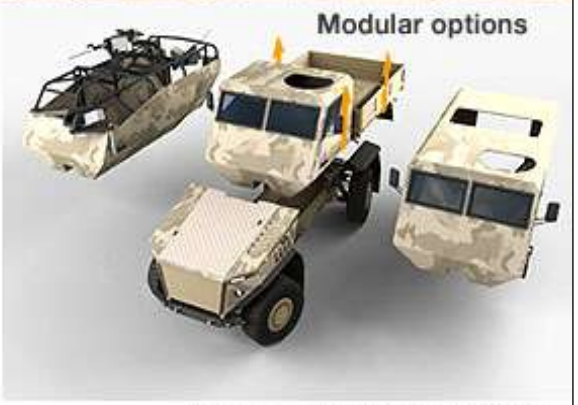
A Possible platform approach : Light protected multirole patrol vehicles

The British Ocelot is an excellent example for the modular approach

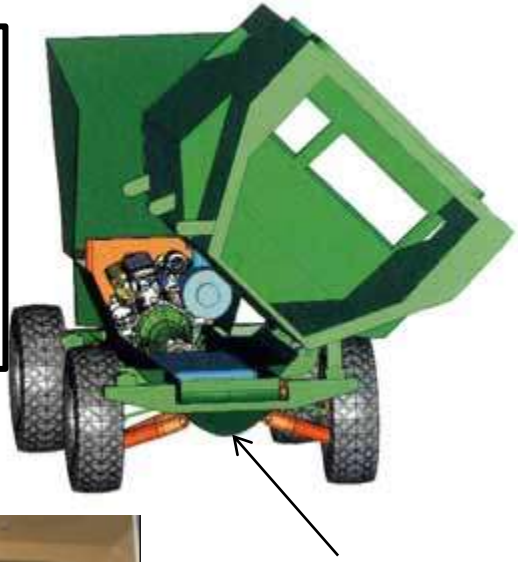


Length: **5.32m**
Width: **2.1m**
Height: **2.35m**
Weight: **7500kg**
Max speed: **110km/h (70mph)**
Engine: **Turbocharged diesel**



Images source: Force Protection

Practical Modular Approach (Changeable in the field)



Common spine or “skateboard

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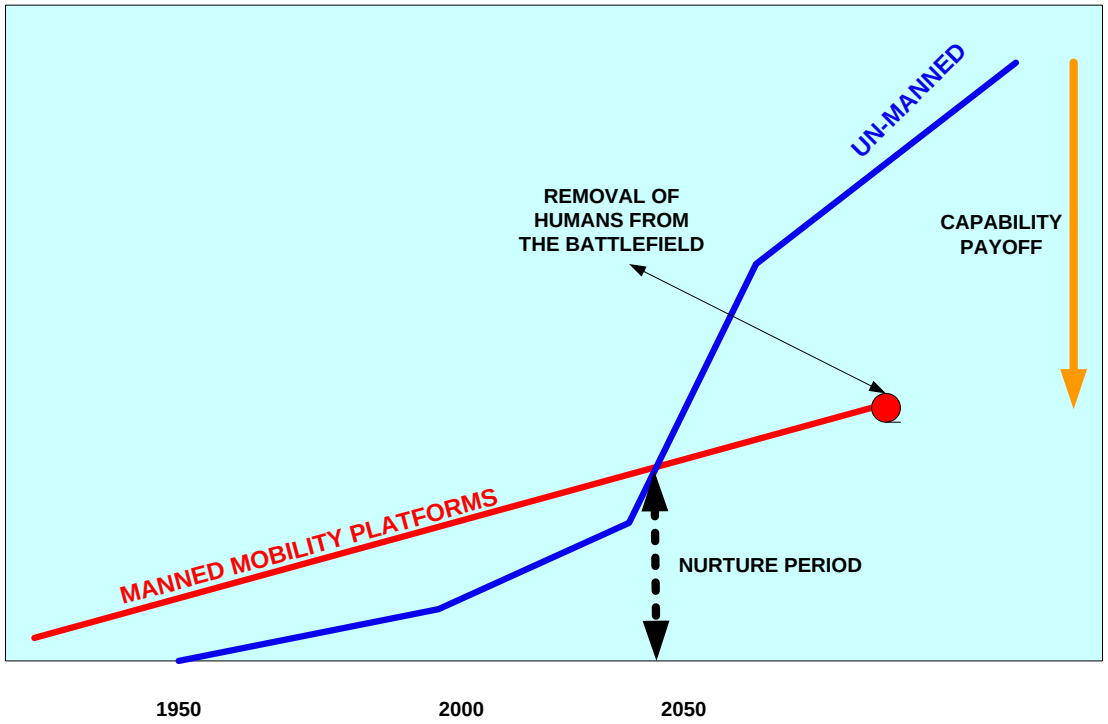
Trends in un-manned mobility



Their will come a time in future where the pay-off of un-manned systems (UGV's) will become so attractive that it will become integrated with normal operational drill. (See Video)

What's the un-manned advantage?

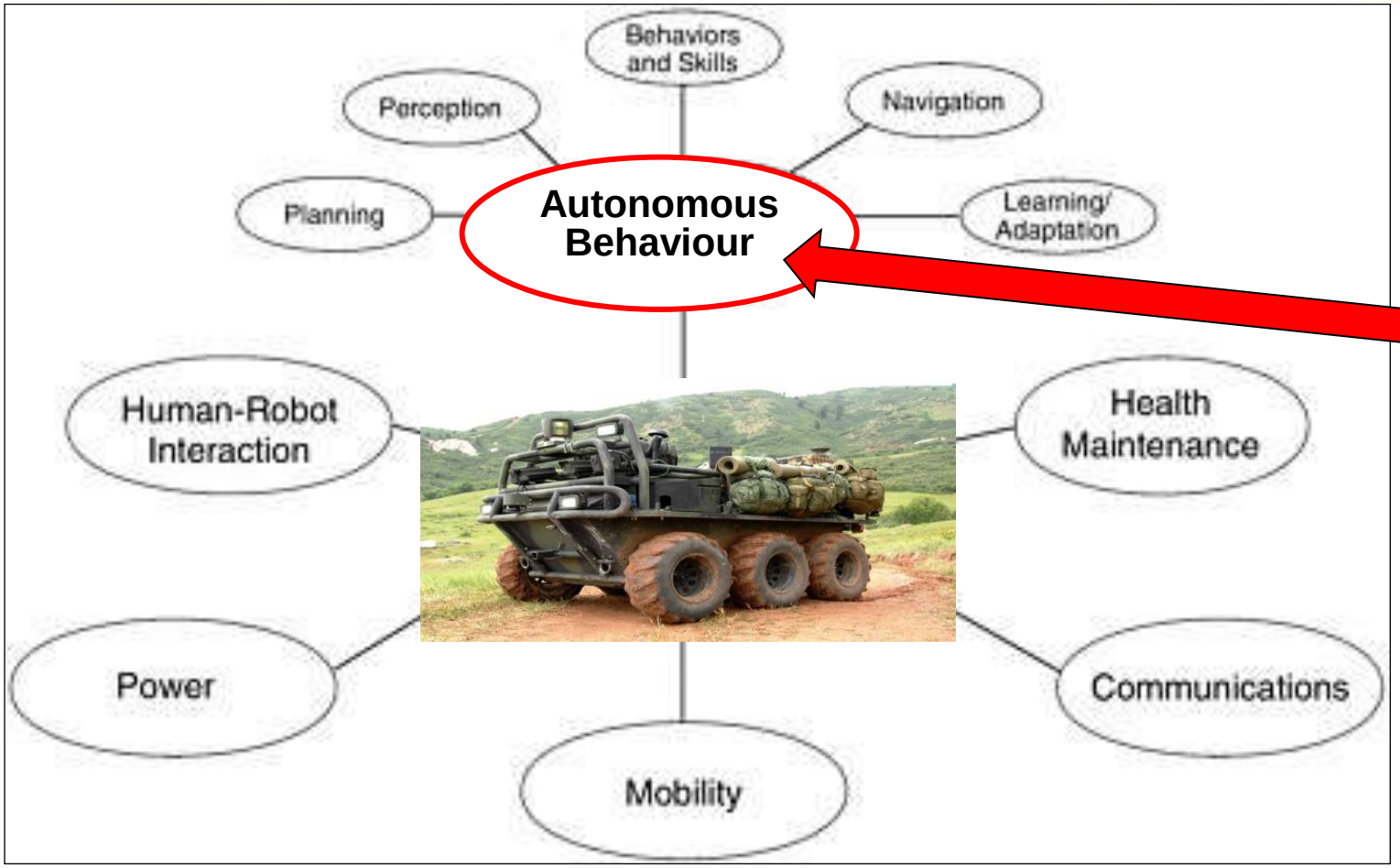
-Reduced loss of life, own forces

-Better off-road mobility

-Support to the dismounted soldier

[Source: Becker, 2009]

Unmanned Ground Systems: Technology focus

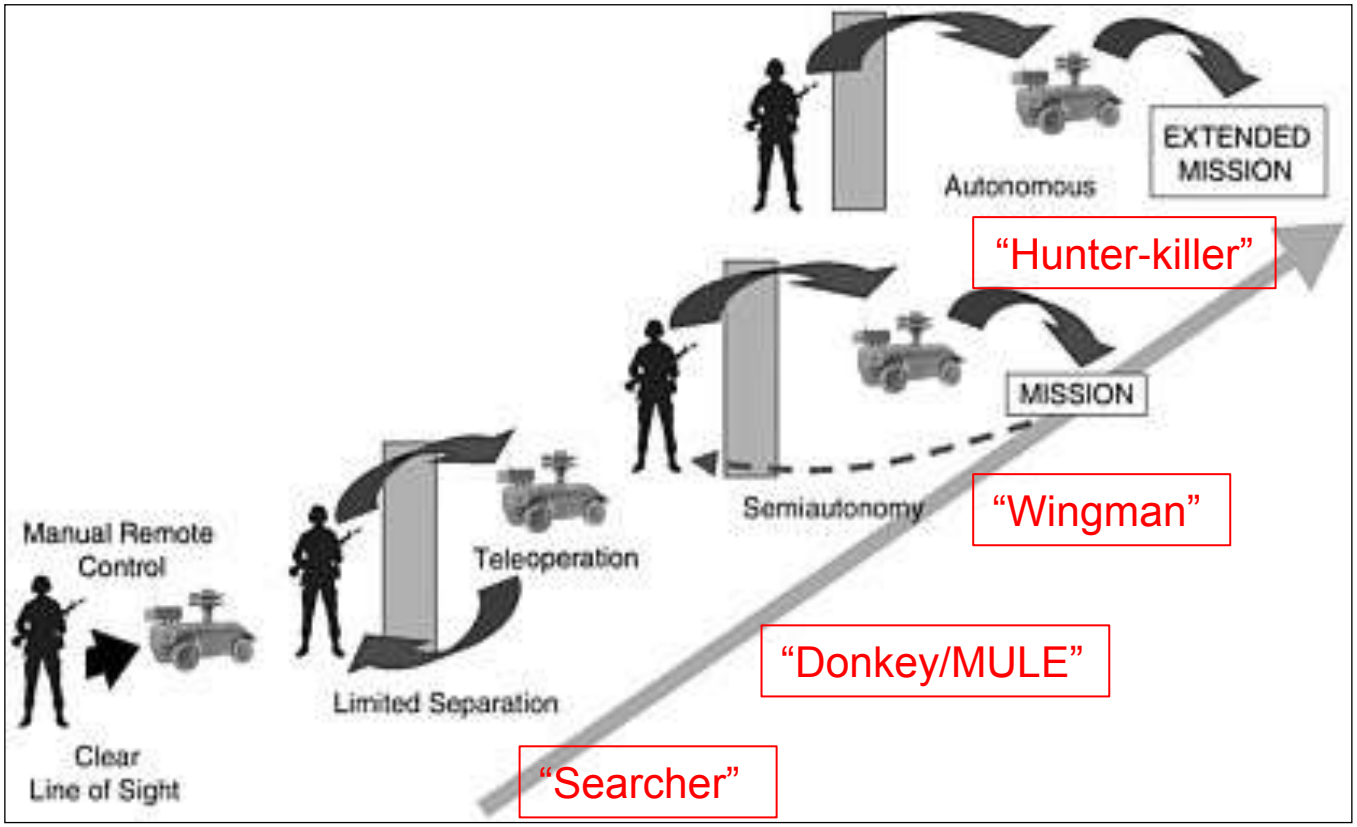


Current UGV technology focus

"Wingman"

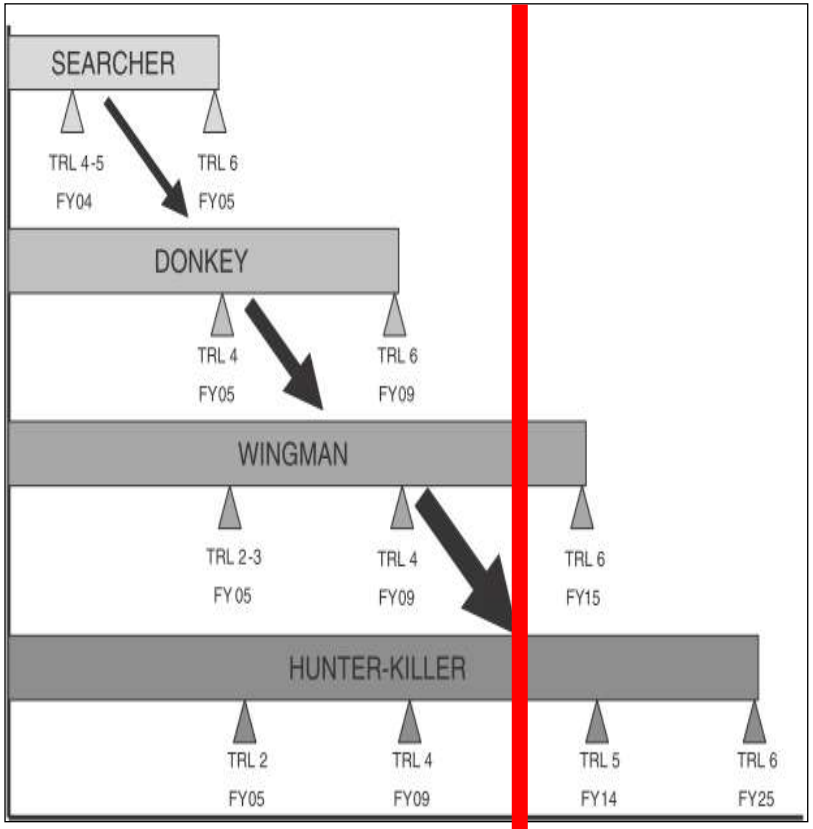
UGV's – the push towards autonomous behaviour

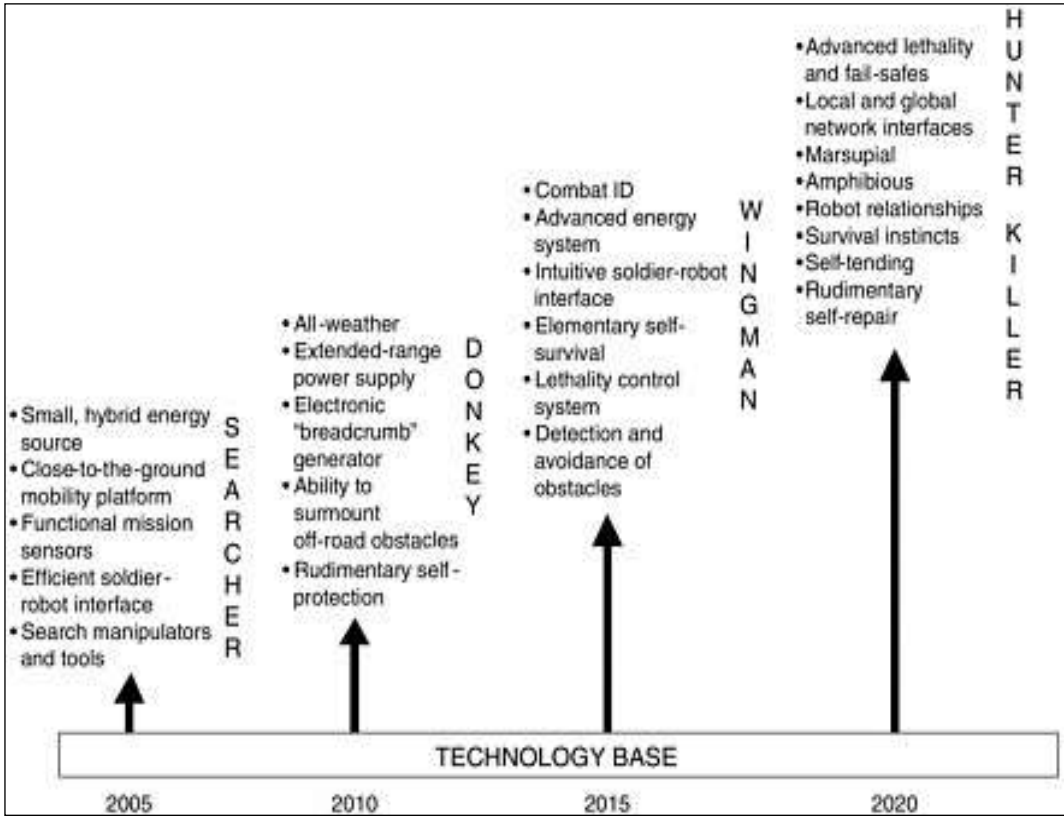
- There shall be a continues push towards autonomous UGV behaviour – soldier "follow-me" capability
- Future legal issues will have to be addressed – WHO PULLED THE TRIGGER?



[Source: Higgins, 2009]

Evolution of UGV Operational Roles





We are here

Required Technologies for UGV Evolution over Time

[Source: Higgins, 2009]

Typical un-manned configurations evaluated & deployed

MULE (Multi-Role-Logistics) Vehicle – Evaluated, but needs urgently a *follow me* WINGMAN capability – US Army

Deployed GAURDUIM Autonomous UGV on Border patrol - Israel

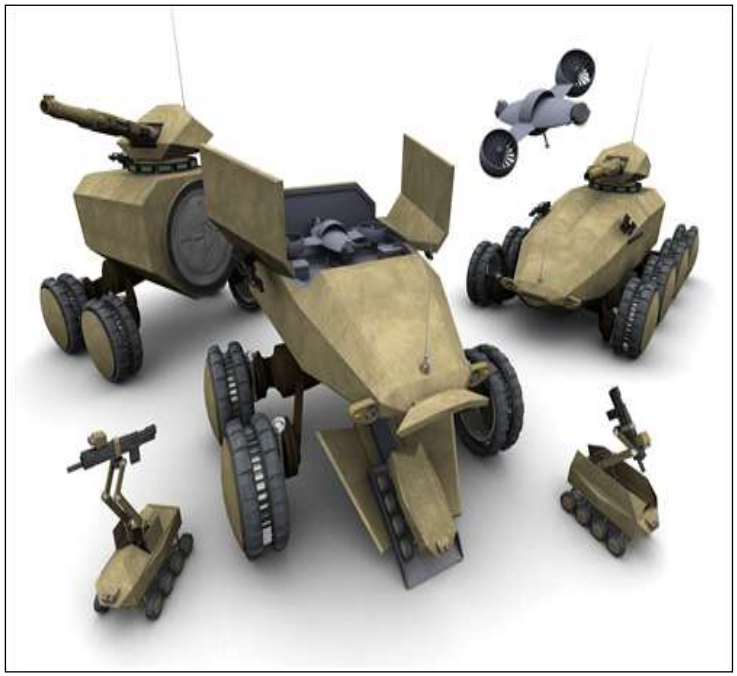
Other UGV implementations – saving lives

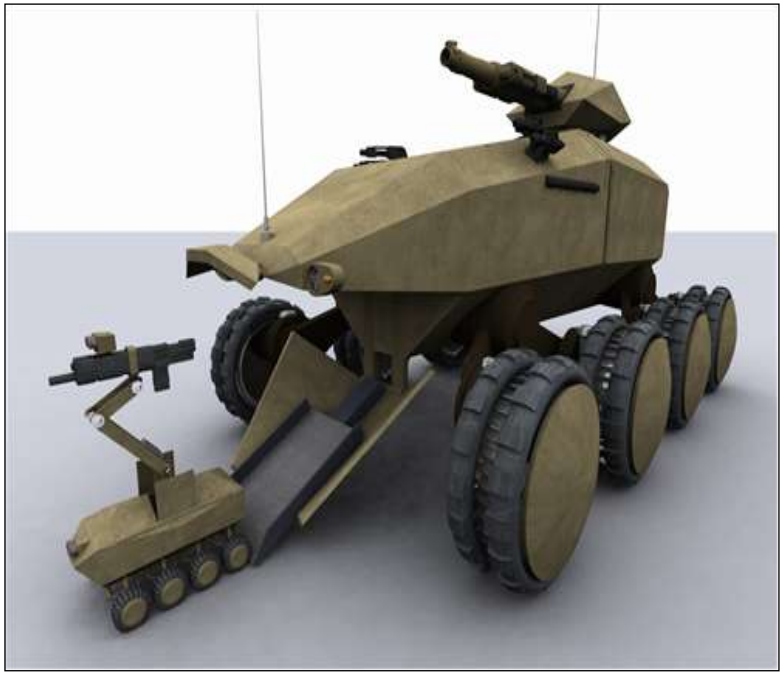
G-NUIS AvantGuard as Landmine Detector – semi-autonomous

Un-Manned Oskosh TerraMax Logistics Support Truck – autonomous application

UGV design implications on manned vehicles

Future manned and unmanned mobility platforms shall have to develop interfaces and SOP's to operate jointly with UGV's – a futuristic look.

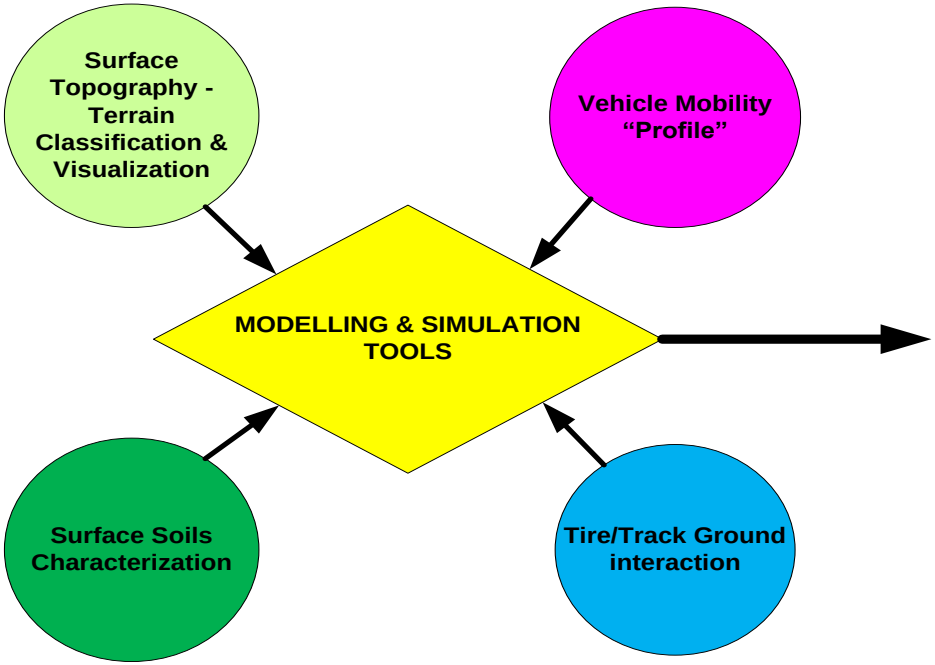




Improving mobility with Situational Awarness

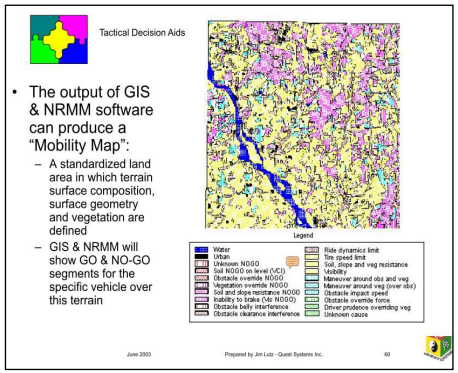
GO-NO GO MAPS: Terrain planning and mobility maps

If you know what to expect – you can adapt or avoid to improve mobility

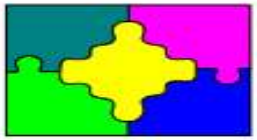


TACTICAL DECISON AIDS:

-Go-NoGO MAPS
-Recommended speed over terrain

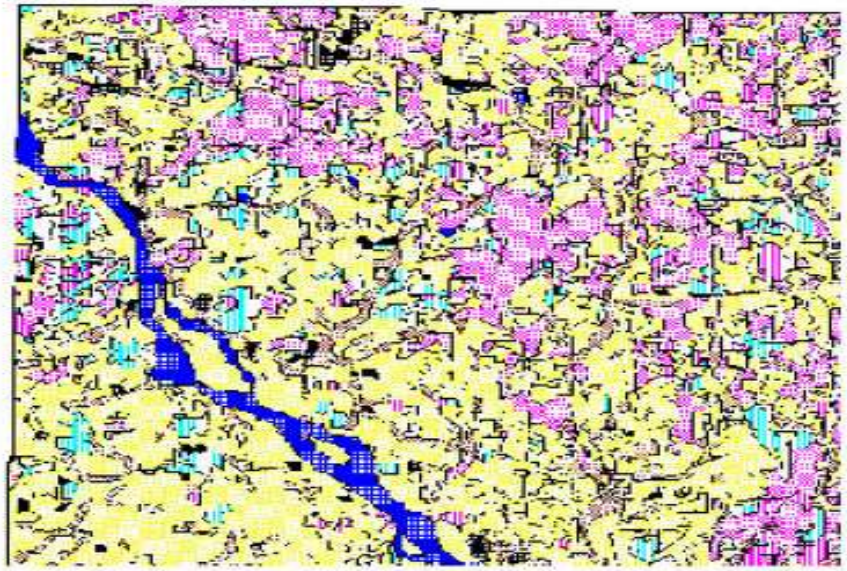


GO-NO GO MAPS: Terrain planning and mobility maps – rural area



Tactical Decision Aids

- The output of GIS & NRMM software can produce a "Mobility Map":
  - A standardized land area in which terrain surface composition, surface geometry and vegetation are defined
  - GIS & NRMM will show GO & NO-GO segments for the specific vehicle over this terrain



June 2003 Prepared by Jim Lutz - Quest Systems Inc. 60

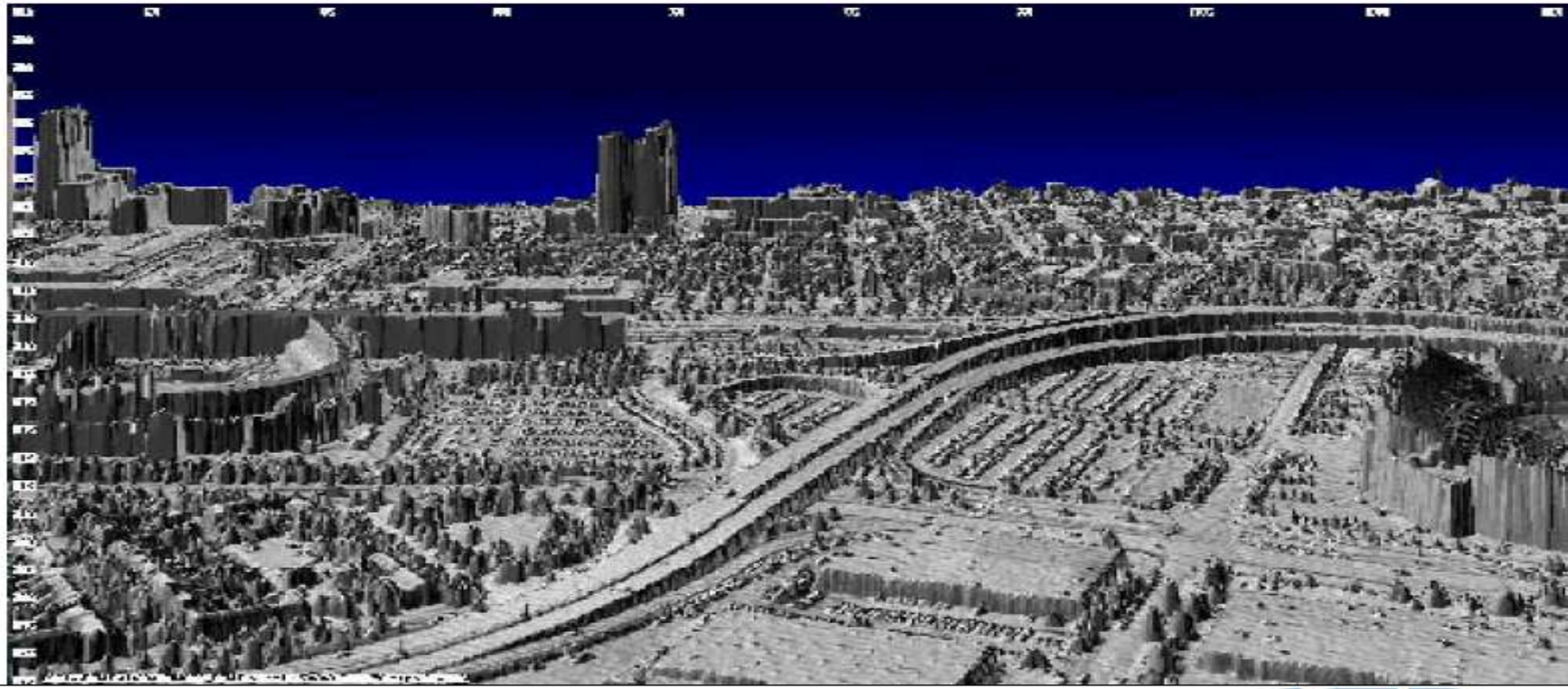
[Source: Quest Systems]

Other forms of mobility maps – urban map

LIDAR High Resolution Image of Operational Urban Terrain

Surface Topography - Terrain Classification & Visualization

High Resolution Data:
1-meter Light Detection and Ranging (LIDAR/LADAR)

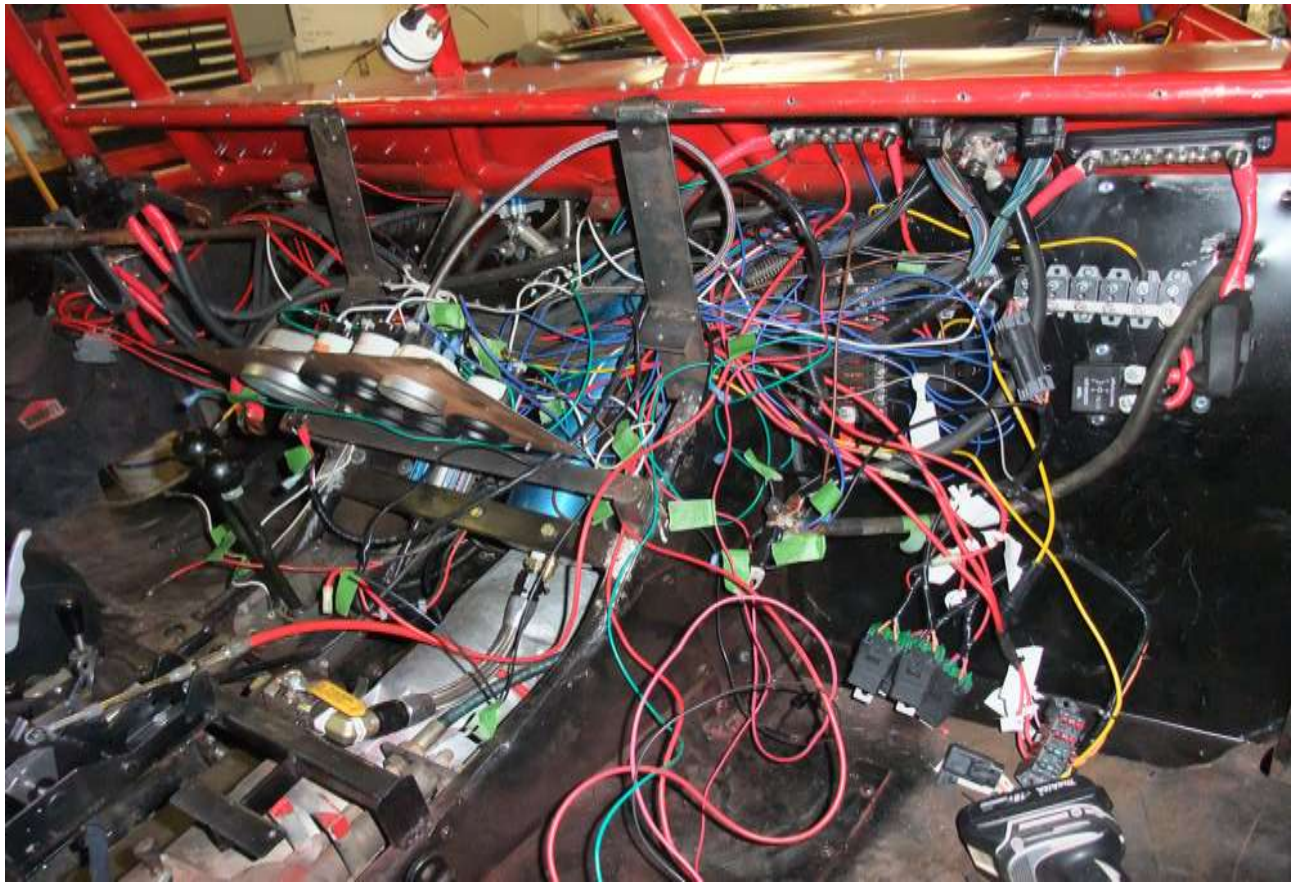


Vehicle electronic integration challenges

Multiple electronic and sensor systems need to be integrated and upgraded over 20 – 30 year operational period

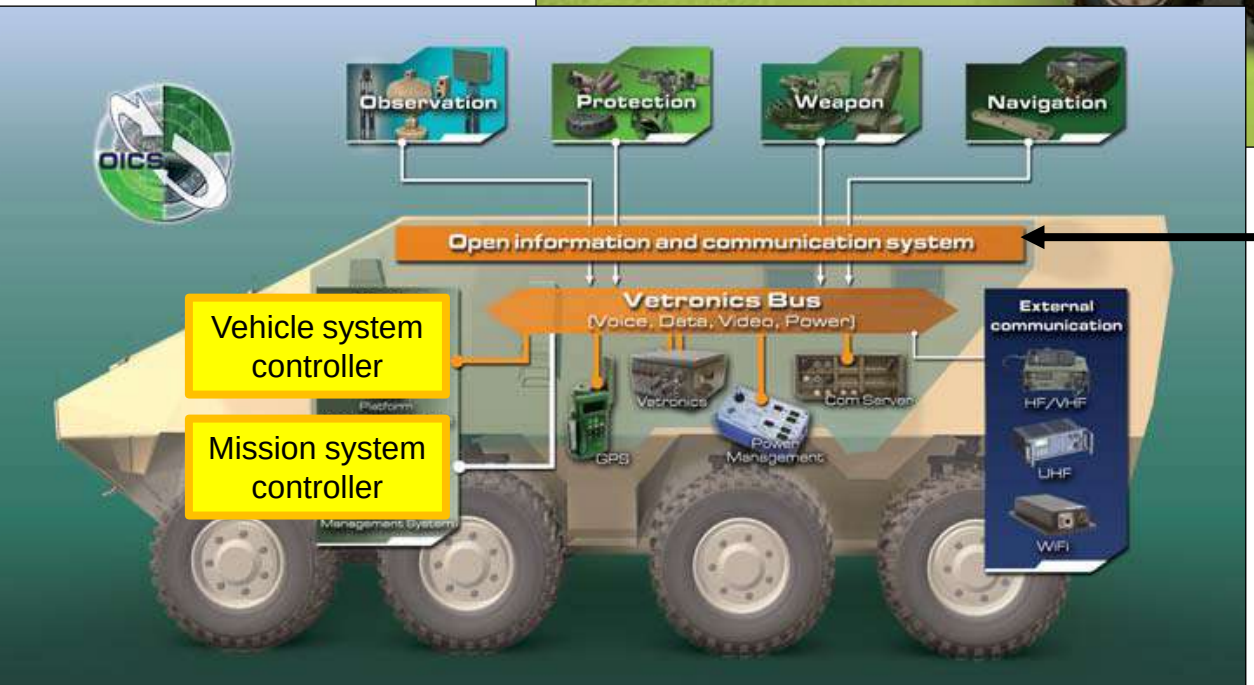
Old , vehicle specific, electronic integration practices not OK!

Traditional vehicle integration methods – not good enough for future integration & modular operational support concepts.



Vetronics : Enabler for modular support/upgrade concepts – and the net centric battlefield

VETRONICS – networks form the backbone for inter- and intra vehicle communication
-Common maintenance systems is possible between product variants.



Maintenance

On-Board training

Source: Information Communication System (OICS), branded by THALES as *VSys*

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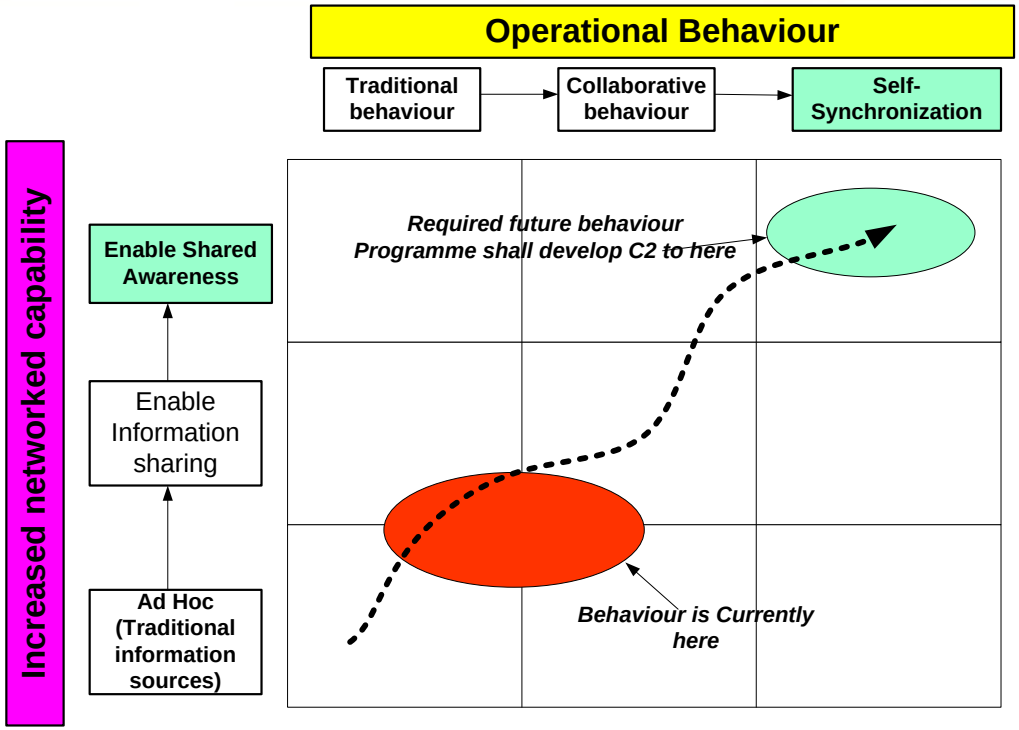
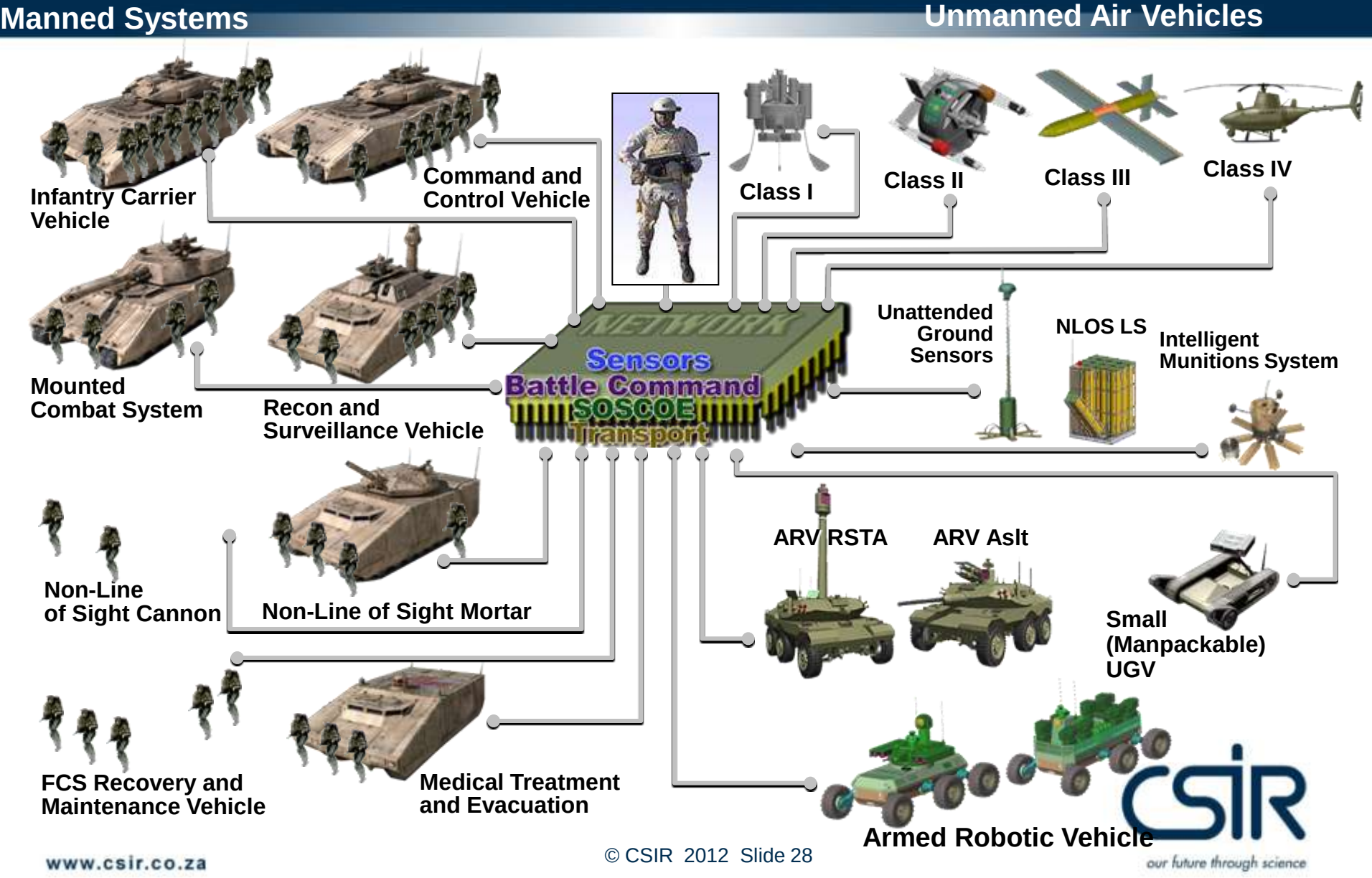
Self-synchronized mobility behaviour

Mobility Operations will in Future move Towards Self-Synchronising behaviour



(Source: Maturity model from :" Power to the edge")

The future multi-role combat unit: Interconnected mobility



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Active & adjustable suspension systems

Malaysian 8X8 PARS vehicle

105mm Tank destroyer on PARS vehicle

Advantages

- Less crew fatigue, better ride
- Better protection – adjust ground stand-off distance
- Improved mobility

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Improve tactical agility – All wheel steering

All –wheel commercial Jeep vehicle

7,8 m turning circle German 35mm turret on Malaysian 8X8 PARS vehicle

Future mobility & protection improvement – The “Plastic Tank”?

New materials could provide light protection options – improved mobility

<u>A vat of D30 intelligent shock absorbing material</u>

<u>Question</u> : Could new materials be used in composite configurations to provide protection?

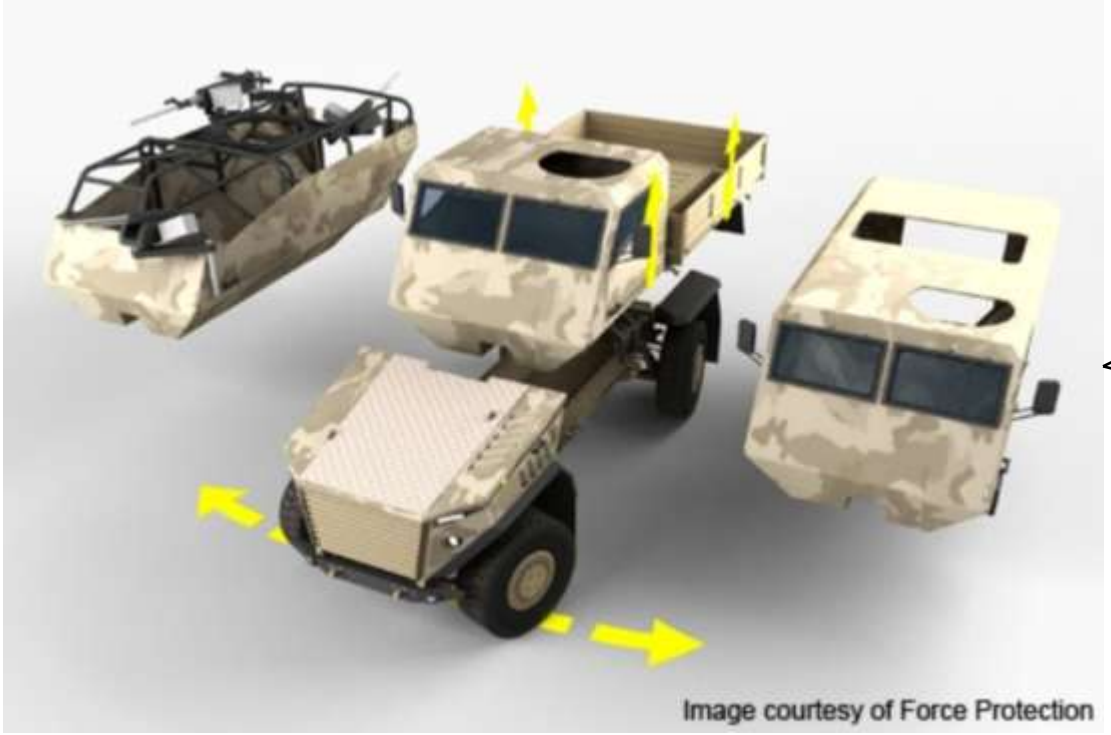
- ***Reduced weight***
- ***Improved mobility***
- ***Improved protection***
- ***Field configurable***
- ***Reduced cost***

Energy mobility – more & more the responsibility of mobility platforms

•Proliferation of mobile electronic equipment, will require from mobility platforms to supply power to various systems.
•On-board energy generation & interfaces to mobile generation methods

Conclusion and implications

- Development of a modular future Light multi-role protected patrol vehicle concepts – Light protected patrol vehicles, to be re-configured in the field.



Conclusion and implications.....continued

- The development of a modular, multi-platform Vetronics architecture – low cost fast maintenance & upgrading options

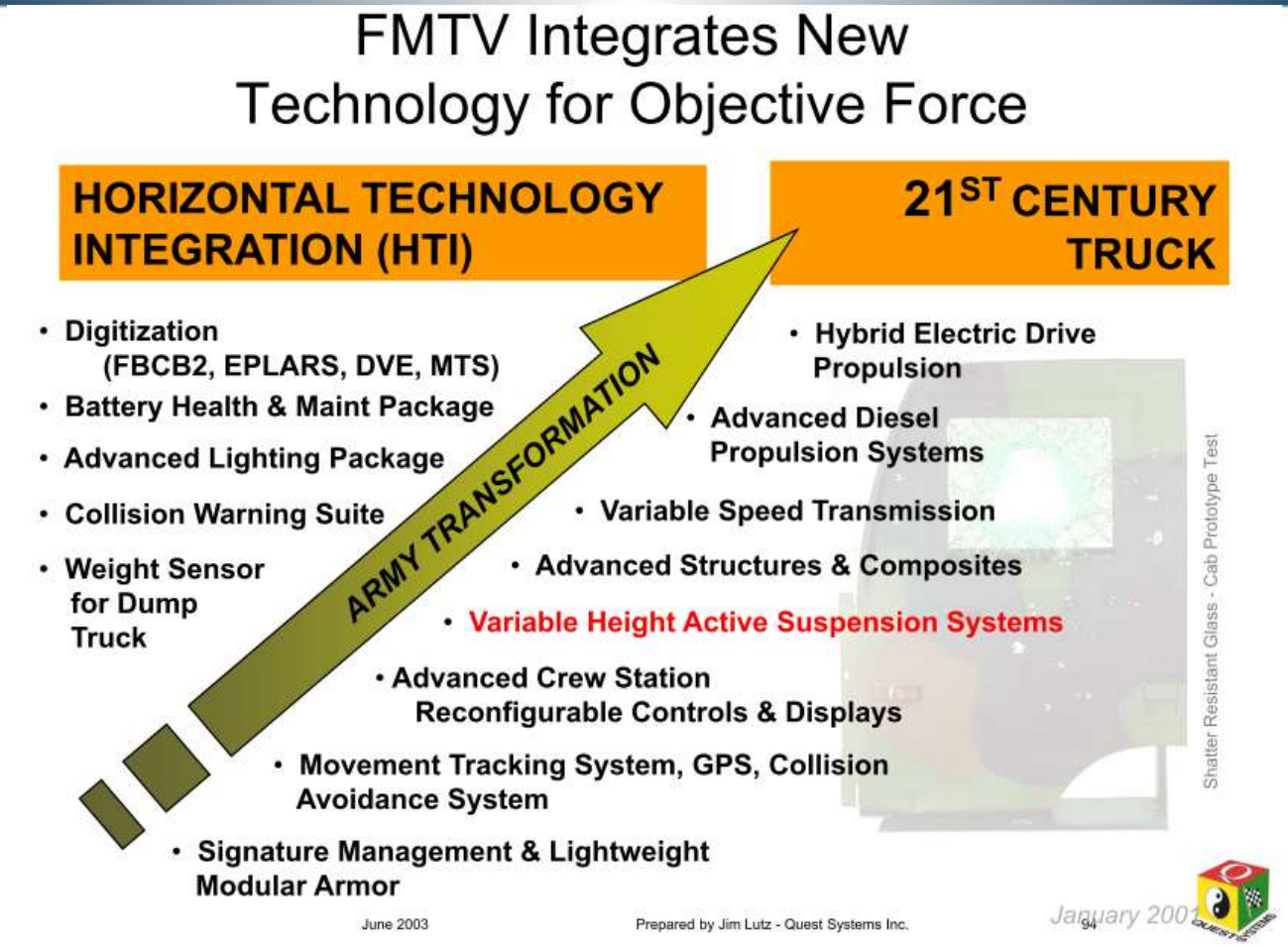
- Unmanned platforms & especially the concept of operations (CONOPS) together with manned systems.

- Advanced structures and lightweight composites should be explored for future vehicle development – focus on protection & eight saving

- Mobility maps and the advantages on mobility should be investigated.

- Adjustable active suspension systems should be investigated - increased mobility, landmine protection purposes, drive comfort.

In summary the mobility platform



Thank You

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