Autonomy in Military Engineering Phase 2

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1. https://www.defenceimagery.mod.uk/Home/Search?Query=45169800.jpg&Type=Filename

Agenda

- Requirement
- Background
- TRIZ Approach
- Wargame Approach
- Results

Requirement

Overview of Requirement

Arke were tasked with **identifying** and **recommending** areas for investment by MOD for **exploitation of Autonomy and Automation** technologies within **Force Support** Engineer Regiments.

Concepts should be generated against specific engineering tasks and assessed through a TTX or wargame

Background

Force Support Engineers

- Study was to target FS Engineer Regiments
- They conduct a wide array of civil and traditional military engineering tasks
- A down selected sub-set of tasks chosen for greatest applicability to the problem and reduce duplication of effort from other studies

2. https://www.defenceimagery.mod.uk/Home/Search?Query=440630.jpg&Type=Filename

Utility of A&A in FS

- A&A is being explored across a range of defence roles currently
- Some relevant and appropriate, others not so

- FS Engineer tasks are typically:
  - Well defined
  - Prescriptive
  - Repetitive
  - Conducted in comparatively benign environments *(compared to Armoured Engineers)*

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Task Refinement & Data Capture

Prioritised Tasks

- Securing Ground Lines of Communication
- General Support Bridging
- Rail Recce & Maintenance
- SPOD Entry
- Engineer Logistics
- Air & Aviation

- Review of previous OA
- Review of RE Training Publications
- Engagement with RE Officers and Soldiers, covering both training and operations

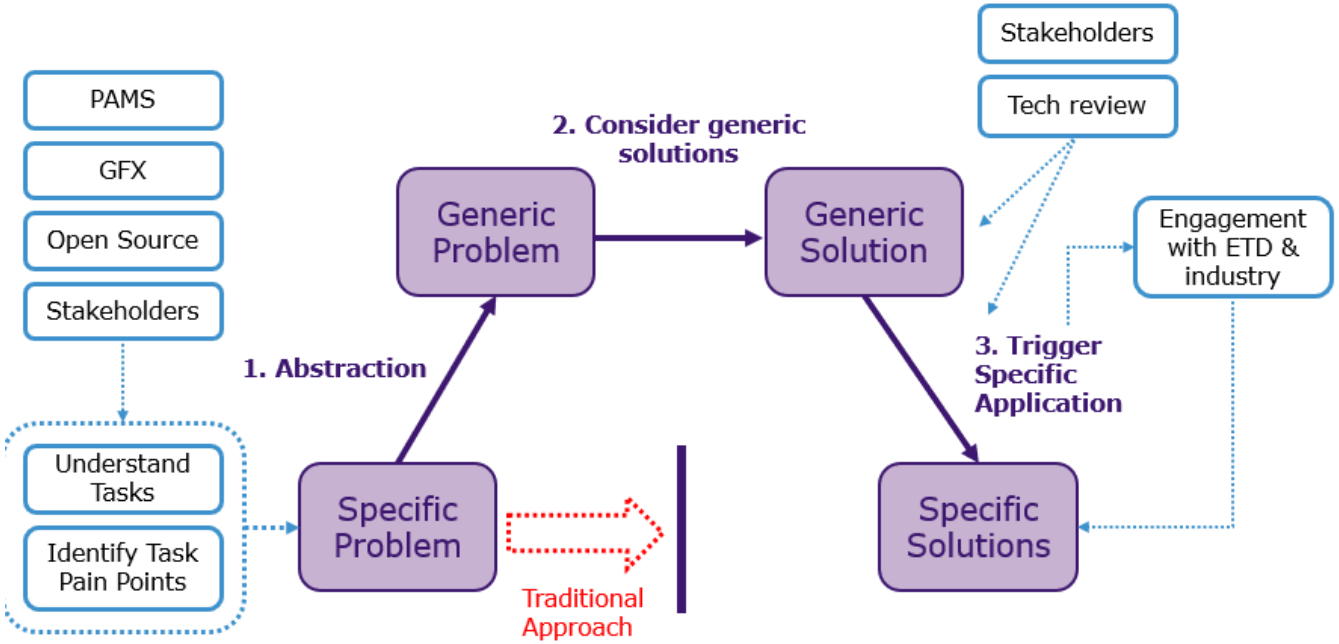
3. https://www.defenceimagery.mod.uk/Home/Search?Query=JIAG-OFFICIAL-20220110-OPROC-32ENG-108%20-003.jpg&Type=Filename

TRIZ Approach

TRIZ

- Soviet method of creativity developed from 1940s through to the 80s
- Acronym in Russian for “Theory of Inventive Problem Solving”
- Only 100 known solutions to fundamental problems
- Many variations on the original method – either simplify or tailor to specific needs

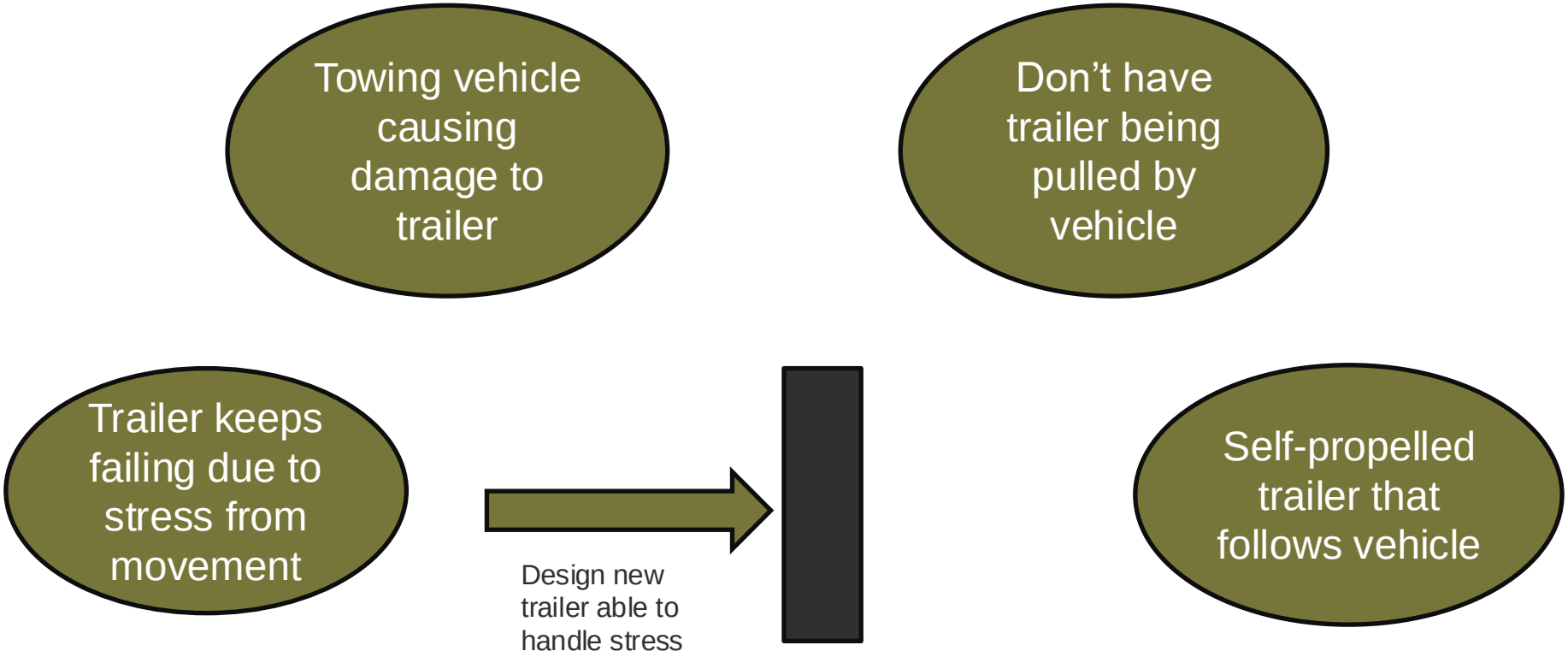
Approach



- 3 key step to avoid duplicating traditional solutions
- Took task pain points identified from stakeholders
- Compared against data set of A&A research projects from academia and industry

Solution Example

- Example of previous use of approach
- *Generified for Presentation*



Concept Generation

F: Optionally Manned Digger

ASTRID
ANALYSIS FOR SCIENCE & TECHNOLOGY RESEARCH IN DEFENCE

Description

Industry is seeing the roll-out of optionally manned plant vehicles. Future iterations of RE digger vehicles to include these capabilities to enable optionally manning of plant when situation demands. Level of automation to achieve desired abilities. The optional manning ranges from line of sight RC up to non-line of sight of remotely directed operation. System consist of remote control module connected to digital control bus on plant equipment, with operators able to control from protected vehicle or position.

Tasks

- ME Construction

Industry Investment

Yes

CONUSE Description

Mobility –
Assess –
Plan –
Prepare –
Execute –

Fact file

Speed: as per existing	Crew: optional
Weight: as per existing	Endurance: as per existing
Comms Range: X	Level of Autonomy: X

Logs Requirement: as per existing

Additional functionality

- Could enable contractors to remotely operate plant from UK

Considerations

- Likely to take form of digital control that interfaces with digital control bus of future digger systems, that are being fielded by industry.
- Remote operation ranges from that seen on similar in-service vehicles (given suitable threat environment)
- Long range operation enables personnel to become specifically trained on select equipment rather than maintaining skills on variety of vehicles

Key DLOD Enablers

Training – Adjustment training to control C-fleet through RC
Equipment – Control stations in engineer vehicles

- Engagement with Engineering Liaison Officer in US and ERDC
- Down select conducted with 12 FS Eng GP & AHQ

War Game - Design & Develop

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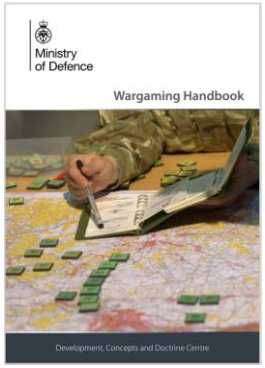


Design

- Design steps – based on MOD guidance
- Settled on historical Royal Engineers Force Support (FS) tasks
- 3 tasks chosen
- Bosnia (Op. Grapple) Historical scenario chosen with relevance to:
  - Route Recce
  - Road Route construction and maintenance
  - Base building

5. https://www.gov.uk/government/publications/defence-wargaming-handbook
6. Defence Imagery (mod.uk) AKR-20221003-342-Ex Austere Wolf-0161.jpg

Sources

Sources

- Primarily open source

Books: "The Muslim-Croat Civil War in Bosnia, A Military History, 1992-1994" , Charles R. Schrader.

Contemporary video: Forces.net documentary (30 min from 1992/1993)

Contemporary maps: Perry-Castañeda Library, University of Texas at Austin (US Def. Map. Agency.)

- MOD internal: Sketch from deployed personnel alongside historic accounts

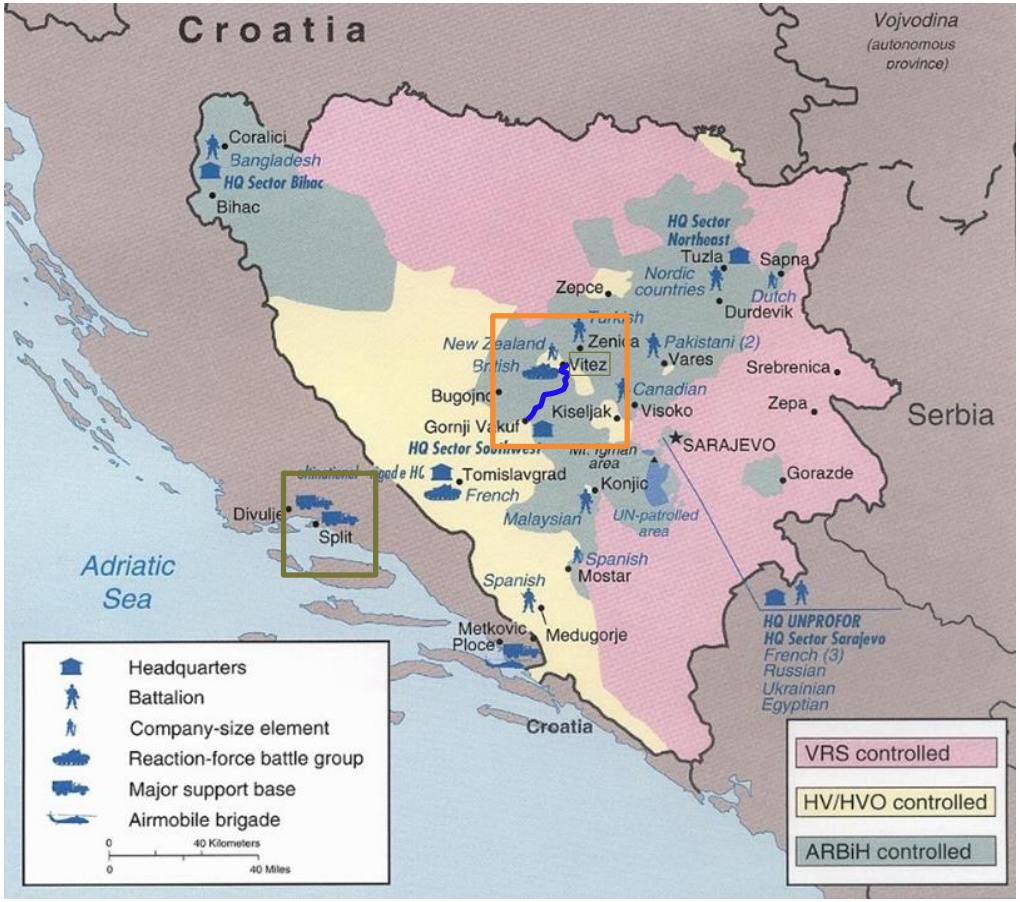
7. Former Yugoslavia Topographic Maps - Perry-Castañeda Map Collection - UT Library Online (utexas.edu) https://maps.lib.utexas.edu/maps/topo/former_yugoslavia/zenica-bosnia_and_herzegovina-50k-2683ii-1996.pdf

8. https://www.iwm.org.uk/history/25-photos-from-the-bosnian-war-of-1992-1995

War Game – snapshot

Scenario. UNPROFOR in Bosnia

- Security corridor established by UNPROFOR
- Route selection: minimise 'switching' through zones of different control.
- Relief cargo to be distributed



9. https://upload.wikimedia.org/wikipedia/commons/d/d8/UNPROFOR_1995.jpg

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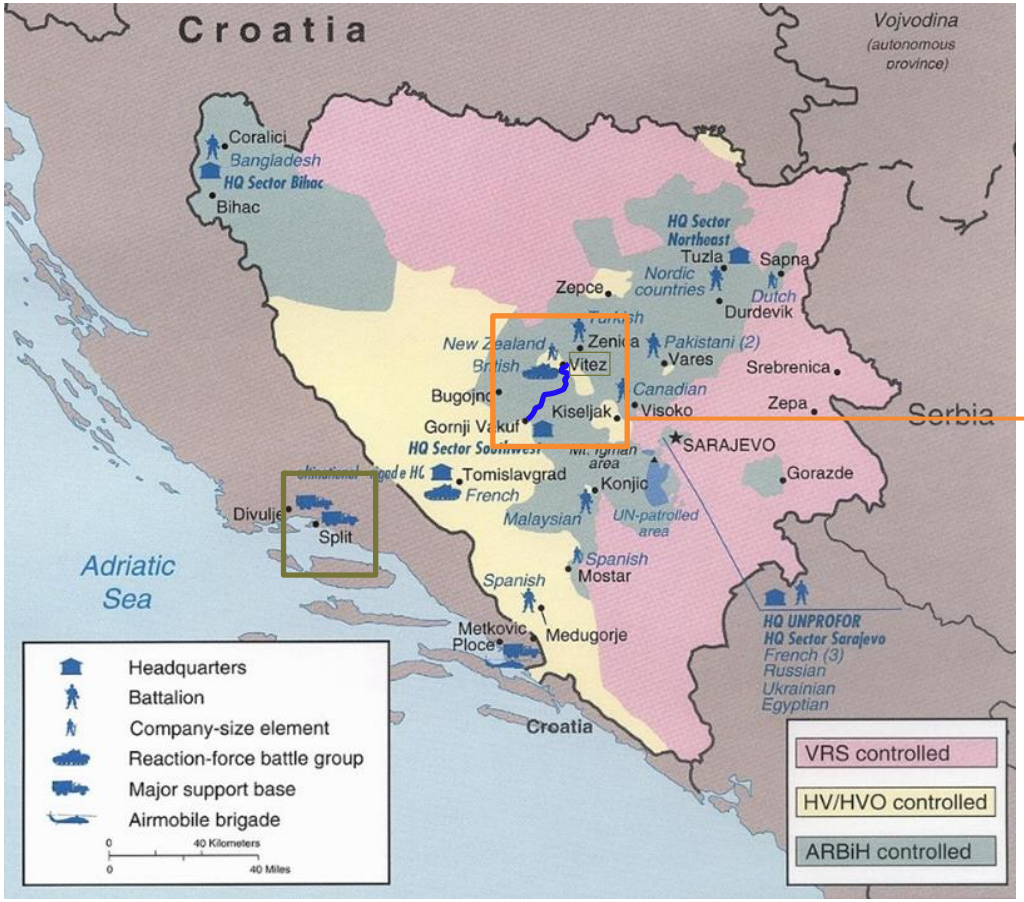
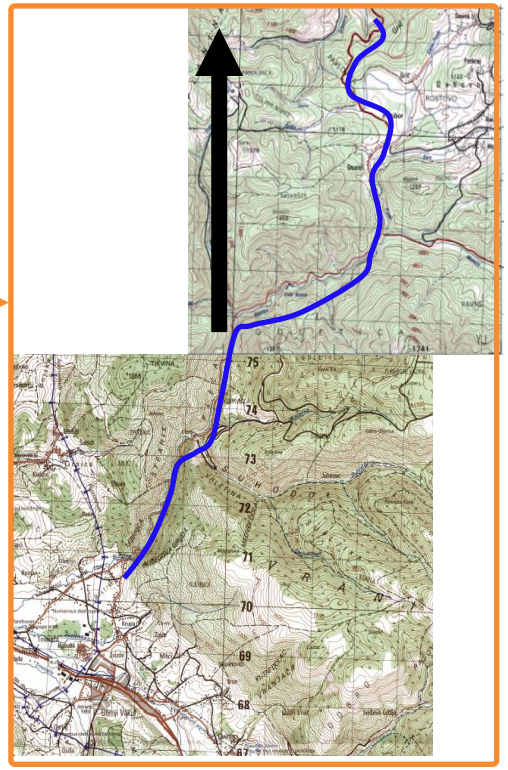


Task Example: Route Construction, Route Diamond

- Several road routes.
- Route Diamond ~35km
- More widely ~60km+ Recce, construction, widening*



9. https://upload.wikimedia.org/wikipedia/commons/d/d8/UNPROFOR_1995.jpg

7. Former Yugoslavia Topographic Maps - Perry-Castañeda Map Collection - UT Library Online (utexas.edu) https://maps.lib.utexas.edu/maps/topo/former_yugoslavia/zenica-bosnia_and_herzegovina-50k-2683ii-1996.pdf

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11. Bosnian War: The Road To Vitez (forces.net) (30 min documentary from 1992/1993)

7. Former Yugoslavia Topographic Maps - Perry-Castañeda Map Collection - UT Library Online (utexas.edu)
https://maps.lib.utexas.edu/maps/topo/former_yugoslavia/zenica-bosnia_and_herzegovina-50k-2683ii-1996.pdf

Seminar Exercise

X8 Concepts

Assessed in

Capture/review

Assessment factors.

- Merits per concept: effect, *time, resource, risk*
- Issues ID: *achievability (logistics, data and comms)*

War Game

Task 1. Sea Port hub

Task 2. Road Route

Task 3. Base Build

In each Task Phase

- Recce
- Build
- Maintain

Outcome

Post-Analysis & Outcome

Analysis and Reporting

- Priority ranking based on the metrics and exercise outcome (top 4 concepts)

- Outcome: Recommendations to Army HQ
  - given wider context of industry investment
  - pointing to where MOD should act, spend money
  - proposed actions for the top concepts

Post-Analysis & Outcome

Observations

- **TRIZ:** useful ideas, mindset, for concept development
- **Historical tasks and scenario:** excellent resources available including
  - Map libraries hosted by University of Texas in Austin
  - Books
  - Forces.net, Imperial War Museum and other media
  - Contemporary Dstl experiences – support to Ops
  - And facial hair in the British Army in early 90s…: impressive, highly competitive environment.

Questions

References

1. Title image, C fleet vehicle https://www.defenceimagery.mod.uk/Home/Search?Query=45169800.jpg&Type=Filename
2. Force Support Engineering task - simple illustration of sand bag filling and fortification construction https://www.defenceimagery.mod.uk/Home/Search?Query=440630.jpg&Type=Filename
3. Force Support task - simple illustration of route construction or maintenance https://www.defenceimagery.mod.uk/Home/Search?Query=JIAG-OFFICIAL-20220110-OPROC-32ENG-108%20-003.jpg&Type=Filename
4. Wikipedia TRIZ overview https://en.wikipedia.org/wiki/TRIZ
5. Defence Wargaming Handbook https://www.gov.uk/government/publications/defence-wargaming-handbook
6. Force Support task - Defence Imagery (mod.uk) AKR-20221003-342-Ex Austere Wolf-0161.jpg
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8. Imperial War Museum photograph collection https://www.iwm.org.uk/history/25-photos-from-the-bosnian-war-of-1992-1995
9. Overview map of UNPROFOR deployment https://upload.wikimedia.org/wikipedia/commons/d/d8/UNPROFOR_1995.jpg
10. Books: “The Muslim-Croat Civil War in Bosnia, A Military History, 1992-1994” , Charles R. Schrader.
11. Contemporary video: Forces.net documentary (30 min from 1992/1993) https://www.forces.net/services/tri-service/bosnian-war-road-vitez
12. Dstl: deployable analyst contemporary sketches (not shareable)