X-ing the Gap

Barry Peter Kirby, Amanda Georgina Kirby & Jim Wilson

K Sharp Ltd

SUMMARY

The GAP X project aimed to develop a lightweight gap-crossing solution for Armoured Fighting Vehicles (AFVs) to improves mobility on the battlefield. This paper summarises the project's three key phases, spanning 16 months, with a particular focus on the role and value of Human Factors Integration (HFI).

KEYWORDS

Human Factors Integration, Defence, Bridges, Armour

Project Overview

The GAP X project developed a short gap-crossing capability for Armoured Fighting Vehicles (AFVs). The system, developed by Beardsell & Son with Human Factors (HF) support from K Sharp, is a short-span temporary bridge to improve battlefield mobility of vehicles like the Boxer Infantry Fighting Vehicle (IFV). This project ran from March 2023 to July 2024, with three phases of HF involvement, managed through a tailored Human Factors Integration (HFI) approach. The GAP-X system is aimed to be operated under high-stress, time-sensitive conditions by military personnel. The integration of HFI at this pre-concept/early prototype stage ensured that the system was designed with the user in mind, focusing on ease of operation, safety, and reliability in adverse environments.

Approach

The HFI aspects had three main interaction phases as described in Figure 1. Each phase focused on a review of progress and developing feedback for the client to build into their next evolution of work.

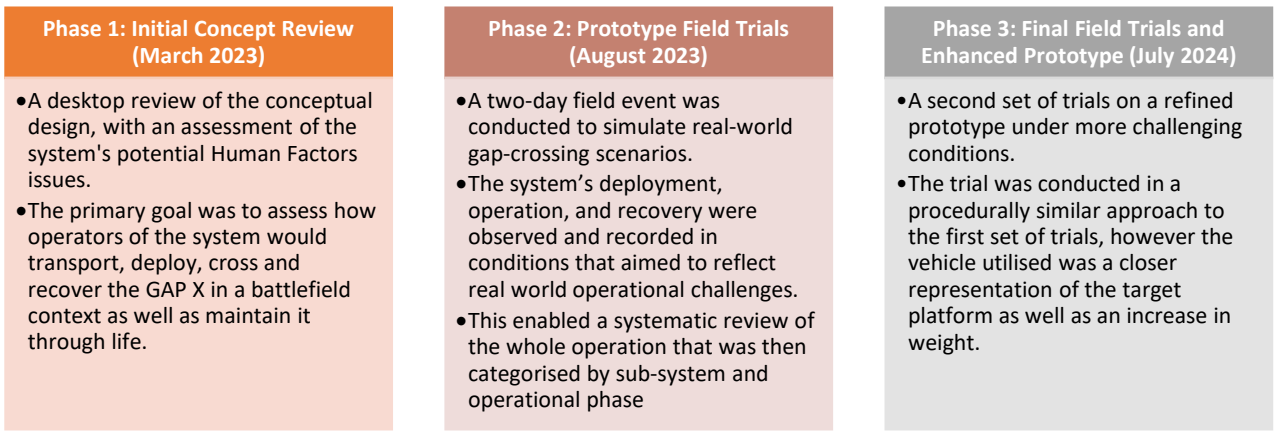

Figure 1: Methodological Approach

Main Findings

The main findings can be split down into the three phases, which demonstrates how they evolved over the life of the project.

Phase 1: Initial Concept Review: This review identified 47 issues that were fed back to the client to enable them to consider as they moved into their prototype development stage.

Phase 2: Prototype Field Trials: This review identified 44 new issues and enabled a refresh of the 47 issues from the phase 1. Some examples of issues found were:

- *Hitching and Disconnection*: The NATO hitch proved difficult to disengage under certain conditions, leading to delays and potential safety risks.
- *Controller Accessibility*: The handheld controller was awkwardly positioned and difficult to access, increasing the time required for deployment and posing risks in high-stress environments.

Phase 3: Final Field Trials and Enhancements: Improvements were made to the GAP X system. The final field trials in July 2024 demonstrated changes including the following:

- *Improved Hitch Mechanism*: A quick-release mechanism was added to the hitch, making it easier and safer to disengage the system under challenging conditions.
- *Controller Repositioning*: The controller was moved to a more accessible location, and the connection process was streamlined, significantly reducing the time required for setup.
- *Wider Deployment Surface*: The bridge surface was widened to increase stability during crossings, especially for heavier vehicles like the Boxer IFV.

New Findings from Phase 3: 129 potential issues were identified through observation of the trial activity and the previous analysis. Examples of the issues highlighted included:

- *Roles and Responsibilities*: The operator roles and communication channels need to be clearly defined to ensure everyone knows what is going on.
- *Operator Training*: While the system's technical improvements reduced complexity, proper operator training was still critical to ensuring smooth deployment and recovery.

Key Contributions of Human Factors Integration (HFI)

Throughout the GAP X project, HF was provided input to the system's evolution, ensuring that user safety, operational efficiency, and environmental adaptability were considered at each stage.

1. *Early Identification of Critical Issues*: HF assessments provided insights into potential operational challenges. These early observations allowed for proactive design changes, reducing the likelihood of costly rework later in the development cycle.
2. *Design Improvements Based on User Feedback*: The phased approach allowed the team to incorporate feedback at each stage of development. Observations from the live trials in Phase 2 directly informed the modifications made in Phase 3.
3. *Operational Reliability and Environmental Adaptability*: HFI recommendations ensured that the system could adapt to a variety of environmental conditions, from muddy terrain to uneven surfaces.

Conclusion

The GAP X project demonstrates the critical importance of early HFI involvement in the pre-concept phases of military systems. Through continuous assessment and user feedback, the project was able to refine its design, addressing key usability and safety concerns that emerged during trials. On the face of it, the number of issues rose during this project, however the team reviewed the previously identified issues at every stage and retired those that had been demonstrably closed and then added those issues identified on the new version. Whilst the product was demonstrably

more mature, it was still at the Concept/Prototype stage, and the ideal time to provide the feedback because it was the most cost-effective stage of procurement to implement solutions.