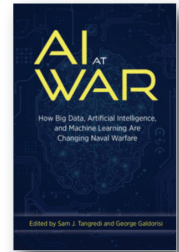


## BOOK REVIEW:

# *AI at war: how big data, artificial intelligence and machine learning are changing naval warfare*



Edited by Sam J. Tangredi and George Galdorisi

United States Naval Institute Press: Annapolis, Maryland; 2021; 432 pp.; ISBN 9781682476062 (hardback); RRP \$97.99

*AI at War* provides a practical understanding of artificial intelligence (AI) and its application to warfare, especially naval warfare. The intended audience is people working with big data, AI, and machine learning (ML) in the military context; and national security professionals, particularly those involved in educating the next generation of military leaders.

The book comprises 19 chapters, each an invited essay by one or more experts in the relevant field. Chapters 1 to 7 focus on the theoretical basis for AI and ML as they apply to naval operations. Chapters 8 to 15 examine the application of AI to specific warfighting functions. Chapters 16 to 19 examine the application of AI to policy, strategy and naval contributions to national security.

The book draws on a wide range of research and operational insights leading to differing emphases among the 30 or so contributors. While there is no editorial synthesis of the competing views, there are recurring themes, including the significant role of AI in the evolution of warfare, and the responses from competing world powers.

AI is partly based on ML from vast streams of data that must be trusted to ensure the AI systems, in turn, are trusted to make their extraordinarily powerful contributions. A real threat is that AI systems can be deceived by manipulation of the data that guide them. Indeed, the ML process itself is still being researched and developed.

Provided this potential vulnerability is considered, the benefits of AI flow from its ability to conduct vast pattern-matching tasks in superhuman timescales leading to an enormous range of options being considered for human decision and thence execution, often with autonomous systems assuming the more dangerous and demanding offensive tasks.

The processes adopted for selection of optimum strategic, operational and tactical concepts and plans is often unclear to operational commanders and their staffs due to unfamiliarity with AI practices. Chapter 14 accordingly addresses adaptations needed in officer training syllabi.

Chapter 5 assesses the progress of AI and ML research and development in China and the potential for their application by the Peoples' Liberation Army-Navy and compares it with experience in the United States Navy (USN) and United States Marine Corps. The USN has several active programmes employing autonomous unmanned air, surface and undersea vehicles, all of which employ some AI. Further research and development are needed to address the command and control of such vehicles in concert with manned platforms and in multiple 'swarm' groupings.

The laws of warfare and international agreements create moral and ethical constraints on the use of AI which are

hard to satisfy. This has inhibited the adoption of lethal autonomous vehicles in other than tightly constrained scenarios, such as offensive self-guided weapons countering a confirmed hostile attacker.

Central to expanded roles for autonomous vehicles is improved understanding of potential benefits and risks through research, development, wargaming, modelling, simulation, operational exercises, and detailed post-operational evaluation from live engagements.

The application of AI can be 'easier' in naval *vis-à-vis* land warfare, due to clearer delineation of participating forces and their respective command and control (C2). The distribution of the operational commander's intent and the assimilation of unit status reports is more readily accomplished with AI assistance. Communications, however, are open to cyber interference, so subordinate commanders must be ready to assume autonomous C2 for their assigned forces if higher echelon C2 are compromised.

Chapter 13 considers potential effects of AI on future force design and of integration of AI into the overall force structure. Maintaining military advantage *vis-à-vis* China and Russia requires a fundamental change in force structure and operational concepts. These include the disaggregation of forces with flexibility to reorganise to achieve localised superiority as a core principle of manoeuvre warfare, *viz.* mosaic warfare – the combination of various force elements to meet a time-critical operational task, then their recombination for employment in a different configuration for another task.

Chapter 15 looks at development of a decision aid for operational commanders and describes the Institute for Future Warfare Studies at the United States Naval War College.

AI is changing the character of war and United States defence leaders are committed to furthering the development of AI's ethical military applications. Looking ahead, as AI and ML are powerful but fragile, there is a need to independently assess their vulnerabilities. There is a trend to fewer, more powerful AI applications. Human-assistance tools are of increasing application and power and are resulting in societal change. Enhancing general intelligence will depend less on data volume and more on how well the data have been screened and refined. The future of warfare will involve less direct human participation and more machine involvement both in decision refinement and in execution of operational tasking.

I have greatly enjoyed reading this fascinating book even if it leaves many questions unanswered. I recommend it to all readers interested in the future of warfare.

**Chris Skinner**