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Natural Evolution:

Adapting the military/industry relationship to support information-centric warfare.

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> ‘There is no reason anyone would want a computer in their home’.
>
> Ken Olsen, founder of Digital Equipment Corporation, 1977

Defence and security has become more information-centric. Successful innovation practices will be critical for maintaining suitable capability but acquisition, procurement and support mechanisms may have to adapt more than they expect as well.

Ken Olsen could be unfairly accused of having a lack of vision regarding the speed of development of computer systems. It is more likely that he failed to fully grasp the potential wider utility of these systems when he made the comment.

Now, as we enter the period that sees the Digital Revolution mature and humankind firmly ensconced in the Information Age, it is apparent that we cannot live our everyday lives without relying on data gathering and processing to provide information for our exploitation. The speed of development of the mobile telephone to the smartphone and beyond is staggering; not only do we now have a computer in our home, but we have one in our pocket too. In context, the modern smartphone has 105 times the computing power of the Tornado and 5 x 106 times the power of the Eagle lunar module that landed on the moon – at a mere fraction of the physical size.

We are reliant on timely information that is designed to increase our knowledge base. ‘Getting the right (and only the right) information, to the right person or system, at the right time’ is a much used expression, the meaning of which could get lost if it were to turn into merely a soundbite. What is important to consider is that the appropriate distribution of information provides the commander with a greater span of control, reduces the C2 layers required and allows for timely and accurate decision-making.

Capability focus

The Defence acquisition mechanism has in the past been somewhat platform focussed. Similarly, defence companies can become too focussed on selling ‘kit’ or spend so long developing a system that they contribute to its untimely obsolescence. In that period of development, the changing nature of the battlespace may ultimately mean that the original requirement, while appropriate at the time it was set, has been superseded by a more pressing requirement and the focus needs to be adapted accordingly. Industry might accuse Defence of requirement creep; Defence might accuse industry of having laborious development processes. In general, there is no right or wrong in these situations and there will inevitably be ‘fault’ on both sides. However, what is clear is that this method of development, acquisition and procurement is not fit-for-purpose in this rapidly-changing information age. The simplest answer could be that Defence and industry collaborate more in all aspects of capability development. This is not a new idea and there will be few detractors, but the methods and practices of collaboration will need to be reviewed and refined. The first step in developing the relationship should be that both Defence and industry have, and maintain, the same capability focus that is centred on operational effectiveness: ‘what does the system need to do in order to achieve its operational mission?’ But this will only be truly effective if both parties adopt a strategy that is also ‘bold and honest’. We need to accept what is happening, and what could happen, in the changing battlespace landscape, and ensure that tempo and agility in operations, training and procurement are viewed as the essential elements. We cannot ignore the ever-growing threat and delude ourselves that we can rely on legacy systems to counter hybrid warfare. We must ensure that we are producing essential information at a rate that outpaces the adversary and that allows us to keep them in ‘observe’ mode without giving them the time to react.

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Mission System outwards

The traditional method of buying or developing equipment and then deciding how it is to be used needs to be turned on its head. A platform's capability – its operational purpose – is determined by its mission system. A combat aircraft is designed to carry weapons and to place those weapons in the right positon for safe release so that they can have the desired effect while also having the ability for self-protection should it be threatened. An artillery piece is required to lay weapons precisely on the chosen target. A ground-based radar system is designed to provide situational awareness for tracking threats, coordination and separation. An ISTAR platform is designed so that it can place its sensors in the right place to collect the required data. In all cases where a piece of equipment has to provide an operational effect, the mission system provides the core capability. Therefore, it would seem to be logical that the mission system should be at the heart of the design process. Mission Systems concentrate on the flow, exchange and fusion of relevant data and are dependent upon having the correct and functional algorithms in place rather than an appropriate number of 'black boxes'. To ensure future Mission System effectiveness, speed of data flow and fusion will be critical; the use of the most appropriate algorithms and techniques will be critical as will the true emergence of an auditable machine learning system.

Sensor to Effect

The purpose of the mission system is to ensure that the right information is provided to the right person or system, at the right time. It deals in data flow and management and includes the gathering, processing, assimilation, and fusion of data to produce the required information for exploitation; the sensor-to-effect chain. The sensor-to-effect chain applies to any system that has an input/output requirement and the design process is the same whether the end product is an intruder alarm system or the most complex fighting ship in the inventory. Ensuring the 'right' information is reliant on having a smart and effective data fusion system, to the 'right' person or system is contingent on having a smart distribution service, and at the 'right' time is conditional to the data being gathered, processed, assimilated fused, and distributed in the shortest possible time. The challenge for Defence and industry is to ensure that the capability requirement is understood collectively, that the focus remains constant and that tempo and agility remain the key development characteristics.

War of 0s and 1s - Challenging the parochial

We must accept that information advantage is a key tenet for the modern and future battlespaces. Gaining the upper-hand in Information Advantage will be determined at the computer terminal rather than the draughtsman's board. Thus a new breed of technically gifted and enthused mathematicians and coders areindustry going to be central to the development of future mission systems where rapid processing, testing and deployment using advanced machine learning techniques are going to be the key characteristics required to stay ahead of the adversary. Industry will have to work even more closely with Defence in order to agree and maintain the collective aim and focus; from the concept stage, through design to delivery and on to constant assessment, improvement and redeployment at a high tempo and with complete agility. Industry will have to play a major part in the requirements phase through honest assessment of the rate of technology advancement that will allow Defence to make more considered – and bolder – requirement choices. We need to break from the constant cycle of fighting fires with sticking plasters and providing yesterday's solutions to yesterday's problems today. Defence and Industry need to team early on projects and programmes and agree to longer commitments that will ensure continuity while still providing the checks and balances to safeguard the best possible outcome. There needs to be greater trust and understanding within the teams that can only be achieved by embedding Industry within the Defence environment or vice versa throughout the life of the programme.

By extension, and in order to remain agile and maintain a tempo that meets the requirements of a developing battlespace, a new philosophy of 'Prototype Warfare' (or training) will need to be considered, introduced and accepted.

Our current mindset places a premium on certainty that promotes waiting until technologies, tools and techniques have matured before they are adopted. Clearly, this fails the information advantage test and risks us being out-innovated by both state, non-state and hybrid adversaries.

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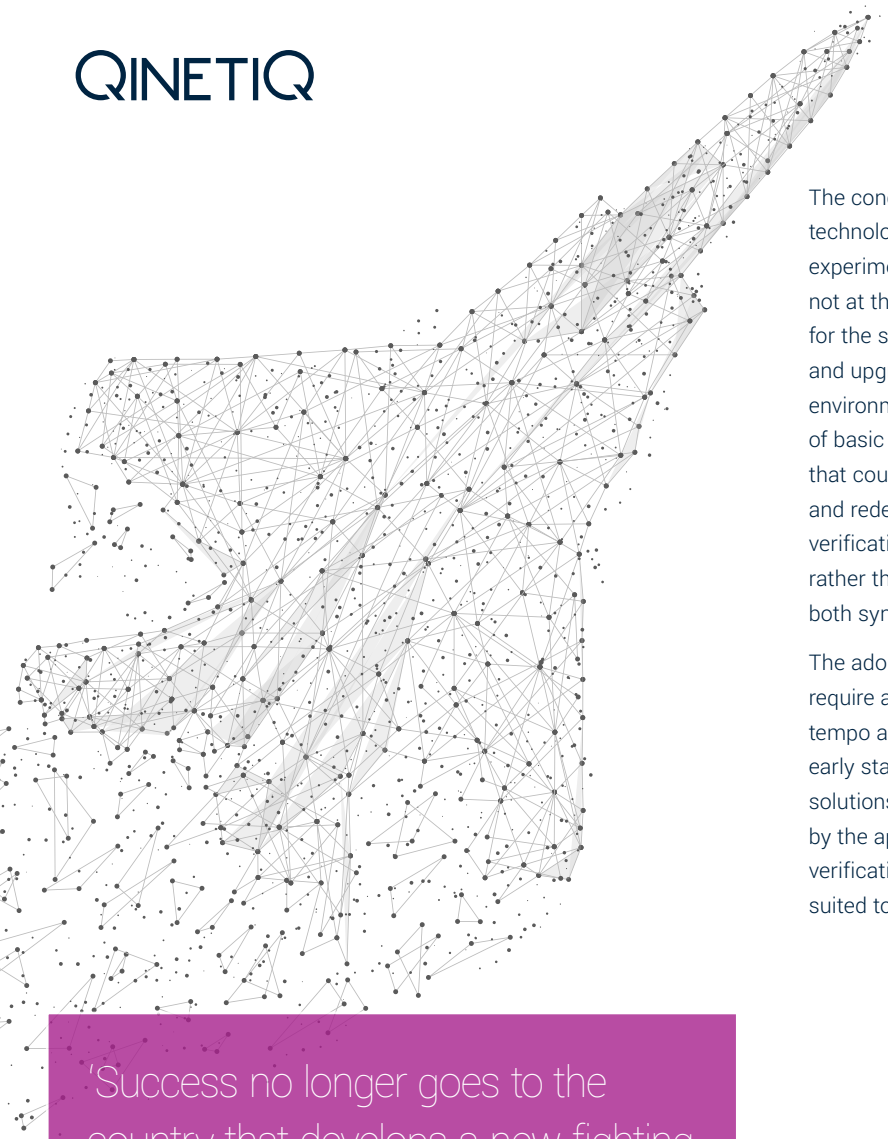

The concept is not tied to specific technologies; in fact, these technologies will change over time as new research delivers new experimental tools that can be applied to the necessary scenarios but not at the expense of safety and security. Prototype Warfare allows for the swift introduction of capabilities that are constantly reviewed and upgraded to meet the changing demands of the battlespace and environment. In information terms, this would involve the introduction of basic but functional algorithms and machine learning techniques that could then be deployed, analysed refined modified and improved, and redeployed in a cycle that is agile and responsive. The testing, verification and accrediting process would be completed in parallel – rather than separately – to the design and deployment process using both synthetic and live techniques.

The adoption of Prototype Warfare (or Prototype Deployment) will require a cultural change both within Defence and Industry. The price for tempo and agility will inevitably be an increase in risk, certainly at the early stages. However, as long as the requirements and technological solutions are closely tied throughout, these risks could be mitigated by the appropriate, and simultaneous, introduction of revised verification and accreditation processes that are equally suited to the information age.

> 'Success no longer goes to the country that develops a new fighting technology first, but rather to the one that better integrates it and adapts its way of fighting... our response will be to prioritize speed of delivery, continuous adaptation, and frequent modular upgrades.'
>
> US National Defense Strategy

There is therefore a requirement to create a shift in both Defence and Industry mindsets beyond making a series of costly and inefficient tactical changes towards a more systematic pan-DLOD approach of introducing innovation as part of a continuous cycle of learning, development and adoption – assessing how new technologies and systems allow our forces to operate differently, and constantly adapting to reflect those findings. Prototype Warfare could be defined as a willingness to engage in military operations (and training) with capabilities that are not normally considered ready for operational deployment, and a willingness to use experimental technologies, tools and techniques at an earlier stage of readiness.

Final Thoughts

The argument could be made that the complexity and rate of change of information provision in the contemporary operating environment have been increasing to an extent where it would now be impossible to 'catch up' using legacy acquisition, procurement and support techniques. To remain in a position where we can dictate the structure and nature of the battlespace ahead of our adversaries, we need to adapt and adopt more agile techniques that enable us to dictate the operational tempo. The provision of the right information, to the right person or system, at the right time will remain the key requirement to achieve this agility and tempo. And to achieve this, the military-industrial relationship will need to develop to a point where both parties work in collaboration from inception to grave and adopt Prototype Deployment (Warfare) as a means of maintaining capability while staying in touch with the requirement space. A new breed of military technologists, drawn primarily from the fields of mathematics and machine learning, will need to evolve who will not only understand the solution space (the How) but also the requirement space (the What and – especially – the Why), thus enabling them to provide the right solution at the appropriate tempo.