The Seven Deadly Risks of Defence Projects

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De-risking major defence projects means reducing the military competitiveness of the Australian Defence Force. Major defence projects are characterised by novelty, uncertainty and complexity. These inherent risks are exacerbated by the interdependence of projects, resource limitations, technological change and human ambition. Our democratic system imposes overarching constraints. Defence capability mangers and their political masters should therefore place less emphasis on precise forecasts of the process, schedule and cost of major defence projects. They should place more emphasis on the development of project managers as reflective practitioners rather than trained technicians.

The Problem

Why is it that we cannot get major defence equipment projects right? Over the past fifty years there have been repeated examples of cost overruns, schedule delays, performance failures and complete abandonment of projects at the cost of billions of dollars.

These failures are not restricted to any one defence ministry or any type of project. They are generic. This article seeks to identify and analyse these generic failures.

Inquiry after inquiry has been conducted by the most eminent of civil servants and business leaders. Each inquiry produces recommendations on how to avoid mistakes in the future. The recommendations are adopted; new procedures and protocols are mandated; the procurement manuals grow thicker and less comprehensible; acquisition strategies and contractual preferences are changed and changed again.

Blue ribbon presidential commissions, Royal commissions, eminent person inquiries and audit agency reviews follow one another in succession. Procedures recommended by one inquiry produce results that are condemned by its successor only to be overturned by the next one. The record suggests that, whatever the merits of individual reports, problems will continue to arise in defence projects. There will be delays and cost overruns and the performance delivered will not always live up to expectations. Some projects will fail. Why is it so?

The answer lies in a general failure to appreciate the true nature and extent of defence project risk. This article identifies seven deadly risks. It argues that each acquisition project has an irreducible quantum of inherent risk.

Errors, unexpected events, external shocks and divergences from cost and schedule estimates will occur. The quantum of that inherent risk varies from project to project. But for each project risk is real and unpredictable. It is like a plastic balloon. If you squeeze it in one place it will pop out in another.

Risks mean that a major defence project should rarely be expected to have a wholly predictable trajectory. Rather, project sponsors and regulators should recognise the seven deadly risks, acknowledge the likely need for adjustments to cost and schedule estimates and performance requirements and recognise the importance of adequate and highly capable management resources.

The key to successful project management does not lie in focusing attention on avoidance of problems. Instead, the focus should be on prompt, creative, forward looking and flexible responses to problems as they arise. Successful responses depend on the knowledge, experience, skill, imagination, energy and dedication of the project managers and their staff. They need to be given room to exercise their talents. The more they are pushed into a tick boxes mentality the less they will succeed.

This calls for greater attention to the theory and practice of higher level aspects of project management. Continuing development of that corpus of knowledge is a task for universities and the project management profession. Participation in that work and support for the profession and universities will reward acquisition agencies in the future.

Against this background, the next step is to identify and analyse the seven deadly risks facing project managers.

The Seven Deadly Risks

The seven deadly risks can seldom be eliminated or evaded. They are present in greater or less degree in most acquisition projects. The seven deadly risk factors are:

1. Novelty
2. Uncertainty
3. Complexity
4. Interdependence
5. Resource limitations
6. The Gale of Creative Destruction
7. Political constraints.

In what follows, each of these risks will be analysed in greater detail.

1. NOVELTY

When something is attempted for the first time it is in the nature of an experiment. There is no way accurately to judge whether it will work, how much it will cost or how long it will take. The great experimenters, Michael Faraday and Thomas Alva Edison, were forefathers of the technology at the core of modern defence systems. They understood experimental risk very well: "neither considered failed experiments to be anything other than a source of potentially useful knowledge."[1] By contrast a defence project manager's experiments are supposed to succeed every time.

The more a project incorporates any of the following elements, the more it embodies experimental risk:

- Development of a new capability
- Creation of a new design or modification of an existing one
- First construction of a new design
- Introduction of a new contractor
- Construction of a new factory, shipyard or other construction facility
- Creation of a new corporation
- Transfer of technology between countries or corporations.

Where the novelty involves implementation of cutting edge technology or new information systems the risk is even greater. There are many examples from the Nimrod Airborne Early Warning (AEW) project which is still unfinished some four decades after it began to the current F-35 Joint Strike Fighter whose project director has just been sacked for cost overruns, schedule delays and a troubling performance record.[2] Problematic as it is, experimental risk cannot be avoided. Attempting to do so invokes a greater risk: that of going into battle with obsolete weapons systems.

The F-111 project had similar problems to the F-35. It was vastly over budget, years late and had serious structural integrity concerns. In Australia it became a major political scandal. Yet the aircraft "emerged as a superb long-range strike aircraft"[3] and was a mainstay of Australian defence for forty years. In that case perseverance paid.

[1] Paul Israel, *Edison, A Life of Invention* (New York: John Wiley & Sons, 1998), p. 96.
[2] *The Australian*, 3 February 2010.
[3] *Scramble The Aviation Magazine*, Schipol, July 2009.

2. UNCERTAINTY

Uncertainty arises whenever there is a lack of the data needed to make reliable predictions of performance requirements, cost or time schedules or other significant project elements. Since reliable data comes only from experience novelty means high uncertainty.

Cost and schedule estimates are normally made early in the life of a project when the data on which they are based are most uncertain and the estimates least reliable. The desires of project sponsors to gain project approval, the aim of bidders to win contracts and the goal of financial managers to limit obligations, subtly impact on cost estimates. All three groups have implicit tendencies to keep cost estimates down. Studies have shown that in western developed countries these tendencies have resulted in systematic underestimation of costs.

Equations of sciences such as aerodynamics, hydrodynamics and propellant and explosive chemistry may be indeterminate in practice. Scientists must rely to some extent on past experience of what works and what doesn't. Unanticipated factors may invalidate predictions.

Uncertainty may also affect performance requirements. Expected contingencies, threat levels and the evolution of military technology are subject to continual change which can invalidate the assumptions on which performance specifications are based.

3. COMPLEXITY

Modern weapons systems have become so complex that the parties involved can barely comprehend them. Weapon systems software, for example, may comprise a million or more lines of computer code and those software applications are built on foundations of operating systems and compilers that are even larger and less comprehensible.

Multiple sciences and their associated technologies are involved. Even a relatively small project like the Royal Australian Navy's Bay Class Minehunters involved sciences ranging from shock resistance and electromagnetism to hydro-acoustics and marine biology. No individual scientist or technologist has the range of professional skills required to understand all the issues involved in a significant project.

Contracts are large and complex. The Collins Class Submarine prime contract comprised 22,000 pages and there were 600 sub contracts.

Schedules are similarly complex. The Collins schedule contained some 250,000 events to be scheduled networked and managed.

Unexpected interaction between various complex elements exacerbates a project's inherent uncertainty and risk. A project can easily lose its way in this forest of complexity

4. Interdependence

No defence project is an island. The requirement for interoperability between the services, and with allies, affects projects in a variety of ways. Equipment may have to meet service-wide technical standards to facilitate the logistics of ammunition and fuel supply, optimise support arrangements or enable interoperability. Economies of scale may come from different services acquiring common equipment. Joint projects with other countries may offer design and production savings.

Dependencies of these kinds multiply the number of factors that are outside the control of the project office. Changes in those factors can seriously affect project progress, cost and schedule. In the case of the Super Seasprite project they contributed to total failure.[4] Less spectacularly, HMAS *Success* was conceived as a low risk project using an existing design for a vessel already in service with the French navy. During the production phase the Australian Navy adopted a new standard pallet which was heavier than the one provided for in the existing design. The heavier weight required structural changes to the lifts and deck which delayed and increased the cost of the vessel.

5. Resource limitations

It is crucial that a project be provided with adequate financial and human resources. Yet there are major obstacles to meeting this requirement. Budgetary pressures commonly result in the imposition of project cost ceilings. Cost ceilings are determined a priori instead of being the outcome of project analysis. When it becomes apparent that a project is underfunded it tends to be massaged in various ways to overcome the shortfall. Capability, quantity and provision for support are traded off against cost. Unintended and unexpected consequences commonly result.

In the case of the British Nimrod MRA.4 project, reduction in the number of aircraft sought caused a fourfold increase in the cost per aircraft. They are now estimated to cost some £400 million (approx. A$647 million) each.[5]

Procurement of the British Sheffield Class Destroyers shows how complying with financial restrictions without reassessing roles can impair the capability of weapons systems and create operational risks. The Royal Navy proposed a new class of air warfare cruisers, the Type 82. The government cancelled the project and approved an alternative design which became the Sheffield

[4] Australian National Audit Office, Audit Report No. 41 2008-09.
[5] *The Register*, 14. September 2009. Exchange rate as of October 2010.

Class. They were lighter and cheaper but intended to perform the same role of fleet area air defence.

A ceiling was imposed on the cost of the ships. When the cost of the first ship threatened to rise above this ceiling the size of the class was further reduced. The bow of the ship was cut 14 m and the beam to length ratio was reduced. As a result the first two batches of Sheffield Class ships were notoriously poor sea keepers, had very cramped accommodation and could not carry the weight of a full suite of air defence systems. They were fitted with the area-defence SeaDart missile system but not the point-defence Sea Wolf system or a close in weapons system. Two of the class were sunk in the Falklands war: HMS *Sheffield* by an Exocet missile and HMS *Coventry* by a low level air attack.

The role of the Sheffield class was to defend the fleet against air attacks but HMS *Sheffield* and *Coventry* failed to defend themselves.[6] As a result of this experience, the third batch of ships was made longer and wider and equipped with the Phalanx close in weapons system. The Sheffield Class are nearing the end of their life and are to be replaced by much heavier vessels, over 7000 tons as against less than 5000 for HMS *Sheffield* and *Coventry*.

Too often provision of the human resources needed to properly manage the project is either forgotten or left outside the control of the project managers. The Seasprite project was seriously affected in this way. In June 2004, in reaction to Defence Materiel Organisation plans to decentralise project offices, every uniformed engineer in the project office resigned or announced an intention to do so.[7] In 2002, 2004 and 2007 the project repeatedly reported inadequacies in the number or experience of project staff "which may have an impact on project schedule and cost."[8]

Seasprite was but one example. Project office resources are commonly allocated as part of a Defence wide human resource management plan. Billions of dollars in acquisition programs are put at risk in order to save millions in human resource budgets. The Seasprite project also showed how external reviews conducted with all the benefits of hindsight can have unanticipated adverse consequences.

Over twenty years ago J. Ronald Fox, who then had thirty years experience in high level management of defence projects identified the need for defence project managers to have "genuine decision making authority regarding

[6] The Board of Inquiry into the loss of HMS *Coventry* found that ships equipped with the Sea Dart also required a point defence system or a close in weapons system. See Ministry of Defence, Board of Inquiry—Report Into the Loss of HMS *Coventry*, London, 22 September 1982, Section 139.
[7] See Australian National Audit Office, Audit Report No. 41 2008-09, p. 63-4.
[8] Ibid.

personnel assignments, promotions, technical matters and budgets".[9] These are hallmarks of successful private sector managers of major projects. It appears that after fifty years of experience the penny still has not dropped. Defence projects will not achieve their potential without high quality human resources and flexibility in assembling and leading them.

6. THE GALE OF CREATIVE DESTRUCTION

The process of industrial development in a modern developed economy has been aptly described by an eminent economist as a "perennial gale of creative destruction".[10] In a process driven by technological change and human ambition, new corporations and industries rise on the ruins of their predecessors. Corporations are constantly being formed, passing through phases of growth and decline, absorbing other corporations or being taken over or dismantled.

The competition for control of corporations is a fierce and unrelenting struggle in a legal, financial and commercial and industrial arena. Owners and managers come and go and their abilities ambitions and priorities wreak changes in corporate ethos and strategies. Special interest non-government organisations such as environmental groups and trade unions join in the struggle for a share of economic and political power and rewards. In extreme cases criminal behavior can be involved.

The following examples illustrate the impact of these dynamics on defence projects.

In 1987, not long after the prime contract for the Collins Class submarine project was let, control of the lead corporation in the successful consortium changed hands. Wormald was taken over by the Reil Corporation, which was used as a vehicle by a group of ambitious "entrepreneurs". "Wormald lost most of its senior management and the new management had no knowledge of the business".[11]

The chairman of Wormald was also the chairman of the Australian Submarine Corporation (ASC). He was removed from the Wormald board and as a consequence ASC lost its head. The following year his replacement was also removed from the ASC board following his reassignment to a senior position in the Swedish company Hagglunds. "The early loss of two outstanding leaders had a serious impact on the project".[12]

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[9] J. Ronald Fox, *The Defense Management Challenge: Weapons Acquisition* (Boston, Mass.: Harvard Business School, 1988), p. 308.
[10] Joseph A. Schumpeter, *Capitalism, Socialism and Democracy* (London: Allen & Unwin, 1947), p. 84.
[11] Peter Yule and Derek Woolner, *The Collins Class Submarine Story* (Cambridge: Cambridge University Press, 2008), p. 183.
[12] Ibid., p. 123.

The Wormald takeover was funded by borrowings. Interest rates rose and the company defaulted on its loans. It was dismembered and “its electronics research laboratories, among the most advanced in Australia were closed.”[13] In 1990 Wormald sold its share of ASC and the consortium had completely lost a key Australian participant.

The US Navy 688 Class nuclear submarine illustrates the impact of criminal behaviour. In mid project Electric Boat was taken over by General Dynamics. The general manager appointed by General Dynamics was later indicted for conspiracy, wire fraud, racketeering and perjury. He left the United States as a fugitive.[14] The project was described as “a story of ambition, commercial greed, and the exercise of unmoderated power in the peacetime system of defense procurement”. It “collapsed the nation’s shipbuilding program into an industrial quagmire”.[15]

The struggle for business success contributed to the Challenger space shuttle disaster. In order to avoid risking loss of the contract for booster rockets the contractor suppressed engineering concerns about the danger of failure of the O rings that caused the disaster.[16]

7. Political Constraints

It is in the nature of politics to promise more and admit to less, making political constraints—arguably—the deadliest risk. Large amounts of taxpayer’s money are involved and they demand value for it. The pressure to promise more and admit to less leads to overestimation of project benefits and underestimation of costs and risks. When reality asserts itself, the imperative not to admit to failure leads to project squeezing which, as in the cases of the Nimrod and Seasprite, incurred more difficulties and costs.

In any major project there is a long queue of contenders for the benefits that have been promised. There is contention for the employment opportunities and industrial developments that have been expounded. In a federation like Australia or the United States interstate rivalry for political plums also harries major projects.

Political interest tends to focus on cost and schedule performance and they become prime measures by which the performance of project managers is judged. There is no surer way of putting the success of a project in jeopardy. Cost estimates and schedules are important project tools and disciplines but they are not the project objectives. Those objectives are always to obtain or develop a military capability. Project management

[13] Ibid., p. 183.
[14] Patrick Tyler, *Running Critical* (New York: Harper & Row, 1986), p. 328.
[15] Ibid., p. 1.
[16] Roger M. Boisjoly, *Ethical Decisions—Morton Thiokol and the Challenger Disaster*, Online Ethics Centre for Engineering, National Academy of Engineering, Washington DC, 15 May 2006, <http://www.onlineethics.org/cms/7050.aspx> [accessed 24 September].

should primarily be judged on that criterion in the context of the risks and shocks encountered by the project.

As has been said, cost and schedule estimates are subject to uncertainty and bias. They are also, typically, wrong. In 1985 the US Congressional Budget Office found that:

> the budget for aircraft had increased by 75 per cent but the number of planes bought increased by less than 9 per cent. The budget for missiles increased by 91 per cent but purchased only 6 per cent more missiles. The Pentagon bought 30 per cent more tanks but spent 147 per cent more doing it.[17]

If adherence to estimates is used as the prime measure of performance project managers will be pressured to sacrifice the real objectives in order to avoid condemnation. To avoid compromising capability, the inherent uncertainty of cost and schedule estimates should openly be admitted. Such estimates should be presented as ranges rather than single figures and revised as necessary.

Since it is politically imperative to be seen to be doing something about real or apparent failures, governments institute a plethora of inquiries and efficiency audits. If these were effective the problems plaguing defence projects would have been solved long ago. But such backward looking reviews are worse than ineffective. They drain project management resources away from their only effective focus which is a forward looking one on the management of their projects. Hindsight is a wonderful thing but of little use to a manager who needs all his time and energy to do battle with the seven deadly risks.

Two political constraints had important effects on the Collins Class submarine project. The first was the requirement that the submarine consortium have at least 50 percent Australian ownership. The second was the requirement for 70 percent Australian content. These requirements were deemed necessary to gain support for the project among the caucus of the governing ALP.

The first requirement led to the creation of an unstable consortium comprising Wormald, the Australian Industry Development Corporation (AIDC), Chicago Bridge and Iron (CBI) and Kockums. Wormald was designated as the lead member and, as noted above, its Chairman was the chairman of ASC. This was a consortium of convenience with cultural conflict between the members. After the takeover, stock market crash and interest rate rises, Wormald’s management culture was one of survival by asset sales; AIDC was a government owned merchant bank and took little active part in the project in its early stages but wanted to take profits to fund

[17] Fox, *The Defense Management Challenge*, p. 331.

other ventures; CBI's approach was to build exactly as per the specifications even if was acknowledged that they were in error; and Kockum's intent was to act as 'agent' (all care but no responsibility).[18] Within three years of contract signature the consortium dissolved as Wormald and CBI withdrew. The contractor that emerged from the breakup was financially, technically and managerially weaker than the original consortium had appeared to be.

The requirement for 70 percent Australian content had many consequences, both positive and negative. The positive consequences included work for Australian companies and jobs for their employees. There were also significant contributions to in-country capabilities for submarine construction, support and future development. Those capabilities provide a much stronger base for the development of the next class of submarines.

The negative consequences flowed from the need for complex technology to be transferred to Australian companies. The extent to which technology was successfully transferred was remarkable but the process introduced a greater degree of novelty to the project and that entailed a higher degree of risk. The risk played out in problems of performance and reliability of the fleet.

The integration of the combat system is one case in which the necessary transfer of technology failed. An attempt was made to perform most of the computer programming with inexperienced recent Australian graduates. The sub-contractor, Rockwell Ship Systems, "scoured the universities and hired dozens of graduates who joined with enormous enthusiasm but 'they were old men after a couple of years'".[19] The task was made more complex by the use of the ADA programming language and tools, both of which were technically immature.[20]

Interactions

The seven deadly risk factors can interact with one another in ways that cannot be predicted. When any factor is present there must be inherent project risk. Where a project is substantially affected by all seven elements the precise trajectory is difficult to predict Nevertheless it will often be necessary to proceed into poorly charted waters if necessary capabilities are to be obtained.

The Seasprite project is an example that turned out to have all the elements of inherent risk. The project was originally assessed as a low risk because the helicopter had been produced in volume and was in service with US Navy. The project was linked to the proposed Offshore Patrol Combatant (OPC) project in order to provide volume production and reduce cost risks.

[18] Rear Admiral O. Hughes, *pers. comm*.
[19] Yule and Woolner, p. 156.
[20] Rear Admiral O. Hughes, *pers. comm*.

The linkage created a weight limit on the helicopter and led to a new weapons suite. Significant design modifications were required and these could not be made within the capabilities of the weight limited platform.

The OPC was a joint project with the Malaysian navy. Further problems arose when the joint project was cancelled. The number of helicopters to be produced fell and this led to cost increases per aircraft. Thus the project attempted to squeeze the risk balloon with the result that new risks emerged in other aspects.

Acquisition Policy

Given the diversity of defence acquisition projects and the extent and variety of the risk factors, there can be no universal acquisition strategy. Each one has to be framed with close attention to the characteristics of the project. A prudent acquisition policy will set out to minimise inherent project risk but this must be done with eyes open. The ideal situation might be one where there is a stable performance requirement and a product exists that meets that requirement and is in volume production; the supplier is well established and financially robust and has other substantial customers. Needless to say such projects are rare and even those rare cases deserve caution.

The life cycle of major defence acquisition projects is measured in decades rather than years. A product that meets the above standards must have been designed at least decade or more in the past and risks early obsolescence.

Possession of a military asset is only a beginning. It needs to be supported and maintained. In future contingencies it may need to be repaired, adapted or integrated with other defence systems without the benefit of support from the original supplier. To deal with this type of contingency it is necessary to maintain a minimum national core of scientific and technological capabilities.

The Argentine military went into the Falklands war with imported Military Off The Shelf (MOTS) equipment that should have been capable of defeating the British fleet. The most potent weapon system was the Super Etendard aircraft equipped with Exocet missiles. At the outbreak of war the Exocets were being refitted with upgraded inertial navigation systems. The upgrade had only partly been completed when France withdrew the upgrade team. Deliveries of aircraft and missiles already on order were cancelled as a result of British diplomatic efforts.

The handful of available missiles sank the destroyer Sheffield and large supply ship Atlantic Conveyer. The air-launched Exocets were regarded by the British as a serious threat to the carriers and Argentina claimed to have damaged one. If more upgraded missiles had been operational the course of the war may have been different.

Given the evolution of Australian industry towards resource based exports and away from elaborately transformed manufactures, the core of intellectual capabilities is unlikely to be maintained by market forces. Maintaining them by government subsidy is expensive but this expense can be spread, and the strategic benefit maximised, if each significant project makes a contribution to future in-country capability. A pure MOTS procurement makes little or no contribution and indirectly poses a risk to future national sovereignty.

MOTS procurements can often have hidden risk factors. Each defence force operates in its own strategic, threat, operational, climatic, industrial, transport and support context. National differences in these elements affect the performance envelopes required of military equipment. The envelope for the nation that developed the equipment may turn out to differ from that of the purchaser. Where problems arise the response in the country of origin may not be practicable for the purchaser.

The F/A-18 Hornet aircraft is a case in point. After the contract was signed, serious concerns emerged about the structural integrity of the airframe through the planned service life of the aircraft. The barrel of the airframe where wings and fuselage come together developed fatigue cracks. The problem arose because the actual operational envelope for the aircraft differed from that assumed by the manufacturer at the design stage.

The US Navy responded to the problem by rebuilding its F/A-18 fleet with redesigned barrels. Such a radical response was not practicable for the Royal Australian Air Force because of lack of in-country expertise and the smaller size of the Australian fleet. The problem was managed by Defence Science Technology Organisation developing procedures for monitoring and rectifying fatigue cracks. This was a good example of the need for inventive in-country repair and modification capability.

In wartime, the speed of development and deployment of new technology accelerates. As a relatively small defence force, the Australian Defence Force relies on a technological edge in conflict with larger forces. Failure to keep the focus on capability, or to keep in-country skills up to date, would risk the loss of that edge. The result would be more examples of the fate of Australian crews of Wirraway aircraft over Rabaul and Darwin or members of the British crew of HMS *Coventry* off Pebble Island.

Conclusion

Return now to the opening question. The uncertainty inherent in major projects and the numerous risks to their progress mean that few projects will escape perceived failures if they are assessed in terms of the conventional ‘iron triangle” of expectations of time, cost and specification established at the outset. The best of project managers will be unable to avoid this but with the right approach they will be able to produce worthwhile results.

What is the right approach?

The first step is to openly acknowledge the high levels of uncertainty and risk applying to complex, technologically advanced defence equipment projects.

The second step is to understand that the consequences of those uncertainties and risks extend beyond the acquisition stage into the following stages of operations and support. Those consequences have the potential to impair broader national defence capabilities. They will be felt long after the end of the acquisition project's life cycle, for as long as the equipment remains in service.

These two steps can only be taken if our two main political parties adopt a less partisan approach to major projects. It is curious indeed that we can have bipartisanship on our main strategic alliance and on the Afghan war, but on the vital question of how best to equip our military forces Australian governments and oppositions play politics. One will use projects that are important to our national security as electoral ammunition and the other will use them as vehicles for political attack. Our leaders must be challenged to put national security above temporary political advantage. Surely our political parties are mature enough to meet this challenge.

Once the first steps have been taken we can discard the notion that the process, time schedule and cost of such projects can be forecast in a meaningful way in their early stages. The long list of sources of risk and uncertainty presented above and the past record of major projects demonstrate beyond reasonable doubt that this notion is unsustainable except perhaps in the case of MOTS procurements.

At present, and because of political partisanship, this truth cannot be told. Instead of adopting pro-active risk management processes, governments and procurement authorities are forced into denial. Denial in turn leads to risk averse strategies like MOTS which is now the default acquisition strategy for Australian defence projects.

Risk averse acquisition strategies create an illusion of lower risk. But by precluding innovation, or changes to meet Australia's unique needs and circumstances, those strategies expose future military operations to higher risks. To withstand larger forces Australia's relatively small defence force depends on the highest quality in personnel and the best and most suitable equipment. But a MOTS based procurement strategy risks sending our forces into battle with yesterday's weapons, designed to meet the needs of a different defence force, in a different theatre of operations, and unsupported by in-country capability for repair or adaptation to changing operational conditions.

The next step is to embrace the new theoretical model of project management emerging from reviews by professional project management institutes across the world. In this model, project management is no longer seen as a linear mechanistic process involving the application of the tools of trade in the old bodies of knowledge. It is a creative, heuristic, recursive process requiring leadership and management skills of the highest order. We need to replace project processes and schedules that are preordained for the full life cycle of the project with recursive stage by stage processes that include continuous review of project objectives, progress, plans, schedules, costs and management and staffing arrangements and opportunities to adjust them. As Dwight D. Eisenhower put it: “Plans are nothing, planning is everything”.

We also need to acknowledge that the path to more effective project management is not primarily to be found in more manuals, rules, formal procedures, stage-gate processes’ certifications and default strategies. Important as these are, they have been pushed past the level of diminishing returns. There is indeed a crying need for further development of manuals and tools of trade and the theory and practice of high level project management, but these must be in forms which support project managers and expand their options for dealing with emerging difficulties rather than limiting their options and stultifying their initiative.

Perhaps the key to successful defence project outcomes is higher quality, better educated and more experienced project managers. They need, above all, the essential personal qualities of leadership, determination, resilience and the wisdom that comes from mastery of the theory and practice of all levels of project management, and deep understanding of the strategic, organisational, commercial, industrial and political environment in which the project is embedded. As Chapman and Ward point out, “The biggest source of risk and risk inefficiency for most projects is a failure to attract and keep the best people”.[21] Davidson, Woods and Griffin go even further in stating that “If general managers are the stars of the organization, then project managers are the superstars”.[22]

The better managers will need to be developed through a planned, graduated career path which avoids the risk of allotting heavy responsibilities to managers who are not yet equipped to carry them. The acquisition authorities are to be congratulated on sponsorship of scholars for the

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[21] Chris Chapman and Stephen Ward, *Project Risk Management: Processes, Techniques and Insights*, 2nd Edition (Chichester: John Wiley and Sons, 2003), p. 52.
[22] P. Davidson, A. Simon, P. Woods and R. W. Griffin, *Management*, 4th Australian Edition (Milton, Qld: John Wiley and Sons, 2009), p. 608.

Executive Masters Degree in Project Management conducted in Canberra by Queensland University of Technology. The curriculum for this degree reflects the new project management theory. Another important initiative is the establishment of the International Centre for Complex Project Management. These developments put Australia in the forefront of the international professionalization of project management and the upgrading of graduates "from trained technicians to reflective practitioners".[23] The services should follow through with the establishment of a professional career stream for acquisition specialists as recommended in the Mortimer Review.

We should also desist from the practice of the destructive, hindsight driven "efficiency audits" of project management against the traditional "iron triangle" criteria of cost, schedule and specification. In its place, a peer review process performed by experienced project managers, against the framework of the new theory and taking into account the ambiguities, dilemmas and emergent circumstances confronting the project team. If the peer review is conducted by qualified professional project managers it can also contribute to the further development of the theory and practice of the profession.

We should provide each project manager with a team of qualified project staff that is appropriate in composition to the demands of the project and commensurate in size to the value of the total resources committed to the project.

In the final analysis, though, it would pay all concerned—harried project managers, senior defence executives, service chiefs and ministers—to remember Burns' admonition that "*The best-laid schemes o' mice and men/ Gang aft a-gley*".

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[23] See Lynne Crawford, Peter W. G. Morris, Janice Thomas and Mark Winter, 'Practitioner Development: from Trained Technicians to Reflective Practitioners', *International Journal of Project Management*, vol. 24 (2006), pp. 722-33.