



# Program Complexity

*Can We Understand It? Can We Overcome It?*

*Stephen Hayes ■ Daniel Kopunic ■ Roy Wood*

In a 2009 Rand report on defense acquisition, Jeffrey Drezner, a senior policy researcher, wrote, “The products of the Department of Defense (DoD) acquisition process are perceived as becoming increasingly complex, emphasizing multifunction and multimission system configurations.... The management and oversight of these complex programs have similarly become more complex. Changes may be needed in the organizations and procedures used to manage the development, production, and sustainment of these complex weapon systems.”

## Report Documentation Page

*Form Approved  
OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>MAY 2011</b>	2. REPORT TYPE	3. DATES COVERED <b>00-00-2011 to 00-00-2011</b>			
4. TITLE AND SUBTITLE <b>Program Complexity. Can We Understand It? Can We Overcome It?</b>		5a. CONTRACT NUMBER			
		5b. GRANT NUMBER			
		5c. PROGRAM ELEMENT NUMBER			
6. AUTHOR(S)		5d. PROJECT NUMBER			
		5e. TASK NUMBER			
		5f. WORK UNIT NUMBER			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Defense Acquisition University, Defense AT&amp;L, 9820 Belvoir Rd, Fort Belvoir, VA, 22060-5565</b>		8. PERFORMING ORGANIZATION REPORT NUMBER			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)			
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)			
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	<b>Same as Report (SAR)</b>	<b>3</b>	

Complex systems are typically systems of systems, which possess emergent characteristics and are created when many independent (and not-so-obvious dependent) factors interact and interconnect in ways that are non-linear, often unexpected or unknown, and sometimes even chaotic in nature. One often-quoted idea from chaos theory holds that a butterfly flapping its wings in one part of the world may be responsible for causing a typhoon in another. Small, seemingly innocuous decisions or initial conditions that are established early in an acquisition program can create far-reaching and surprising downstream consequences to cost, schedule, and performance, thereby eroding longer term benefits. These nonlinear and seemingly unknown effects are undoubtedly present in most of today's complex acquisition programs, but as yet, we do not possess the tools, techniques, or holistic understanding of unknown system tipping points to predict or even measure this type of phenomenon.

How then does one go about deciding what changes to make that will successfully or even adequately address this complexity? Congress and the Department of Defense have certainly tried. In the past 15 years, Congress has added more than 500 sections of acquisition provisions to Title VIII of the National Defense Authorization Act. Similarly, the Federal Acquisition Regulation and Defense Federal Acquisition Regulation Supplement now contain nearly 3,000 pages of acquisition regulations to try to control the system processes—in spite of which, defense acquisition hasn't been substantially improved. Secretary of Defense Robert Gates, testifying before the Senate Armed Services Committee, said that “a risk-averse culture, a litigious process, parochial interests, excessive and changing requirements, budget churn and instability, and sometimes adversarial relationships within the Department of Defense and between DoD and other parts of government” have created “unacceptable problems” in acquisition programs. Gates' description highlights all four types of complexity: structural, technical, directional, and temporal (as identified by Kaye Remington and Julien Pollack in their 2007 book *Tools for Complex Projects*).

### A Global Solution for a Global Problem

Fortunately or unfortunately, these problems are not unique to U.S. Defense acquisition. Case studies from around the world demonstrate that existing linear processes, tools, and approaches are not in themselves sufficient for the consistent successful delivery of complex projects. Addressing the global problem of program waste calls for a multinational partnership and collaboration to explore the ideas of complexity in program management; to create tools and methodologies; and to exchange complex program knowledge through understanding lessons learned and better practices.

The International Centre for Complex Project Management (ICCPM) was established to accomplish just such a mission. The ICCPM is directly supported by Australian, United Kingdom, American, and Canadian government partners as well as many major multinational defense and industry corporations.

It is now a substantial network of global corporate, government, academic, and professional organizations committed to better management and delivery of complex projects/programs across all industry and government sectors.

The ICCPM provides international leadership in the advancement of knowledge, applied practice, and delivery excellence in the management of complex projects, enabling the global community to better deliver sustainable complex projects with real social, environmental, and economic benefits for the future.

Through a series of roundtable discussions and knowledge-sharing forums in Australia, North America, Europe, and Asia, the ICCPM developed its first paper addressing complexity: “Conspiracy of Optimism” (authored by Michael Cavanaugh in 2009). The study explored technical, psychological, and political reasons for chronic cost overruns in large, complex projects. The study purports that the conspiracy of optimism occurs among the parties involved in large, complex projects even though they know their own reality but won't (or can't) admit it to one another or themselves. This behavior is tacitly encouraged by the various incentive systems in which industry and government decision makers know that “pessimists don't get programs,” to quote Cavanaugh. The paper concludes with 11 specific issues to help frame the important aspects of program complexity:

- **Unaccommodated or misaligned stakeholder views of success.** Failure to align expectations of powerful program stakeholders can slow, or derail, even the best efforts.
- **Tension between product success and project success.** Paradoxically, project outcomes like Boston's “Big Dig” tunnel and Sydney's Opera House are considered successful in hindsight, though at the time, they both were behind schedule and grossly over budget.
- **Programs bending to political and public relations pressure.** Lack of awareness and planning for events in a complex program's external environment result in rework costs, schedule slips, and possible cancellation.
- **Lack of understanding or acknowledgement of nontechnical risk.** Current program risk tools and techniques are focused on technical risks, but many program risks result from nontechnical leadership, organizational behavior, and human factors issues.
- **Use of competition as a weapon.** In a competitive environment with few bidders, winner-take-all competitions can threaten the very survival of the losers, driving undesirable behaviors like underbidding to win, protests, etc.
- **Institutionalized procurement practices.** Rigid, one-size-fits-all procurement practices limit agility and flexibility in complex programs to respond to risks and opportunities.
- **Few project managers are equipped to be project-delivery leaders.** Effective complex project managers must be trained and experienced leaders in a wide variety of disciplines, including engineering, law, economics, and human resources. They must also be selected from those

leaders who have the personality to deal effectively with uncertainty and volatility inherent in complex projects.

- **Lack of opportunity for engagement between government and industry.** Pre-award protocols are rigid and not well suited to full understanding and alignment of goals regarding the outcome and mutual benefits of the program.
- **Future capabilities are predicated on obtaining rational estimates.** Today's incentives drive unconstrained requirements, coupled with unrealistic cost/schedule estimates, leading to an unaffordable and unachievable warfighting portfolio.
- **Current tools and decision processes are unsuitable for analyzing uncertainty.** New tools and techniques are needed for managing complex projects.
- **There is an inevitability of scope creep, especially if the project is contracted too early.** Programs dependent upon scientific or engineering breakthroughs for success are all too prevalent in the portfolio.

One early implication was the need for a different type of educational approach and implementation mindset, if the issues of complex project management are to be successfully met in practice. The ICCPM has partnered with the Queensland University of Technology in Australia to develop an executive master's degree program in complex project management. The program is an integrated and intensive program that facilitates leadership, behavioral change, and transference of skills and knowledge into complex project environments. Students are taught advanced risk management techniques; systems thinking; innovation and change management; and, among many other things, to recognize and counter the psychological and behavioral factors that contribute to poor decision making and the conspiracy of optimism. ICCPM and Queensland University of Technology are looking to export the curriculum to the United States and Europe through partnerships with high-caliber universities. Short training courses drawn from select curriculum modules and materials are also being developed and deployed in a variety of government and industry venues.

### Developing a Body of Knowledge

ICCPM's current project is to develop a comprehensive complex project management body of knowledge and stand-alone white paper/executive summary, to frame the issues contributing to program complexity and to discuss areas for improvement within complex program dynamics. Contributors and subject matter experts from around the world are collaborating to produce the white paper with a projected delivery in spring 2011. The Defense Acquisition University, the Industrial College of the Armed Forces, and many other recognized individuals and groups from U.S. industry and academia are contributing to the effort.

The final consolidated documents are expected to guide and inform governments and businesses on the investments they need to make to improve complex project management and service delivery. The white paper will also outline advice for

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future policy design and implementation. As a framework, the white paper will also recommend a global research "agenda" to prioritize deeper study into contributing areas impacting program complexity and successful delivery.

Contents of the white paper are expected to address (or at least pinpoint for more research) the underlying factors that make a complex project complex, and to develop understanding into what unique competencies are required to manage a complex project. It will also discuss the implications of executive behaviors and decision making, risk management, improvements in commercial management, stakeholder management and engagement, and knowledge management. One of the longer term goals is to identify or create a specific suite of tools to assist with the management of complex projects. The white paper will also address organizational culture, communication, and relationships.

### Bringing Order to Chaos

Large programs tend, by their very nature, to be (or become) very complex. Much of the complexity has to do with the cognitive understanding of ourselves as humans and how we interrelate with hard systems. The traditional tools and techniques used to manage project cost, schedule, and performance fall short when trying to manage programs in a complex environment with significant uncertainty and ambiguity. Improved, ongoing research is needed into the specific issues that complexity brings to project management to develop better policy, practices, and tools. The ICCPM, together with its global partners, has launched an aggressive campaign to bring order to chaos by creating global awareness and is forging a new paradigm in complex project management.

*Hayes is the chief executive officer of the non-profit International Centre for Complex Project Management (ICCPM). He can be reached at [ceo@iccpm.com](mailto:ceo@iccpm.com). Kopic is seconded to ICCPM by the Australian Defence Materiel Organisation. He can be reached at [taskforce@iccpm.com](mailto:taskforce@iccpm.com). Wood is dean of the School of Program Managers at the Defense Acquisition University, an ICCPM partner organization. He can be reached at [roy.wood@dau.mil](mailto:roy.wood@dau.mil).*