



## DARPA's Role in Radical Innovation

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**I**n a recent *Forbes* magazine article, Peter Drucker<sup>1</sup> reviewed the business world and concluded that major, previously held “truths of management” will need to be abandoned if institutions are to survive and grow. Arguing that institutions are most affected by externally generated forces and not their own knowledge base, Drucker notes that to survive, institutions must adopt an entrepreneurial attitude and essentially pursue the “organized abandonment of products and markets” that are no longer optimal allocations of resources. Institutions must realize that entrepreneurialism and management are merely two different parts of the same task. The entrepreneur who cannot manage will not last long, nor will the manager who cannot innovate.

According to Drucker, managers must organize for (1) systematic, continuing improvement; (2) exploitation of successful endeavors, i.e., they must organize to build a different tomorrow based on a proven today; and (3) innovation with a goal to create the products of tomorrow that will replace and make obsolete even the most successful products of today.

These three management thrusts—organizational improvement, exploitation of current success, and innovation—are directly applicable to our defense needs. Like any other enterprise that desires improvement, the Defense Advanced Research Projects Agency (DARPA) must be concerned with those three areas. However, DARPA is uniquely positioned to accomplish one of these goals—*radical innovation*.

### CHARACTERISTICS OF INNOVATION

Innovation has certain attributes that are independent of the details of business, and they are common both to the defense and commercial arenas. Innovation is much more than invention. It is the process of using inventions, whether technical, operational, or financial, to change the way we do business.

There are generally two categories of innovation. Evolutionary innovation, which refers to predictable and dependable advances in capability, is normally part of a long-term plan. It starts where progress becomes evident, goes through a maximum rate of

change, and flattens out, eventually decreasing in the face of competition. However, revolutionary, radical innovation uses an enabler (technical or otherwise) and a new paradigm to achieve a level of performance that in time far exceeds the limit of current, evolutionary advances.

For large institutions, innovation takes a long time. It requires experimentally based iteration to link new operational concepts and new technical ideas with the acquisition of products and services. It is these products and services that ultimately increase the effectiveness or performance of the business.

Radical innovation is always risky. The new paradigm may not be obvious and almost always initially underperforms existing paradigms. Radical innovation depends strongly on creative people and is therefore subject to their vulnerabilities, eccentricities, and weaknesses. It almost always displaces, challenges, or disrupts some well-established operation. It represents a paradigm change—it is *precisely not* the next step in the evolution of an established, well-understood model. Any radical innovation and its practitioners, therefore, must be protected, since those involved with the operation it displaces will almost certainly attack it and attempt to eliminate it. Radical innovation also requires leadership and dedication. In almost every case study, successful radical innovation has involved both high-level champions to support and protect it and zealots who, for their own reasons, choose to make this paradigm change the hallmark of their careers.

## DRUCKER'S PARADIGM AND DOD

Drucker's paradigm can be directly applied to DoD. The "revolution in military affairs" is the analogue to Drucker's organized abandonment of products and markets. The warfighter's emphasis on training and experimentation, such as that taking place through Service and Joint battle exercises, is the method whereby we get Drucker's systematic, continued improvement. The requirements-based research and development performed by the military Services is the analogue to Drucker's call for managers to build tomorrow's systems based on our proven capabilities and processes. DARPA's mission, restated for the 21st century, becomes Drucker's last innovation pillar—DARPA is DoD's technical enabler for innovation designed to make obsolete, and to a large extent replace, even the most successful current products.

Clearly, successful defense innovation requires both radical innovation and requirements-based research and development in order to provide our nation with needed defense capabilities for the future. As Drucker indicates, the key to survival is the parallel pursuit of

continuing improvement while exploiting current strengths and conducting systematic innovation.

## APPROACH TO NEW PROGRAMS

When DARPA examines a new program or idea, we must ask key questions: What are we trying to do? How is it done now? What are the limitations? What is new in our approach that will remove today's limitations or expand performance and by how much? If we are successful, what differences will it make? What are the mid-term and final examinations or full-scale applications required to prove our hypothesis? What is our strategy to exit the technology area and to transition out? How much will it cost?

The answers to these questions determine whether a new program gets started and whether it continues. Programs are reviewed twice a year, and people with new ideas are always welcomed.

Because DARPA's budget is constrained, this approach will, by necessity, cause certain technology areas to receive priority over others. This is not to say that DARPA changes its investment strategy, but that it changes its portfolio of investments to reflect both changing military needs as well as technological advances.

The Agency's current focus areas include those technologies and systems that

- Solve key national security problems such as protection from biological and information attack
- Support military operations such as dynamic battlefield preparation, surveillance, and replanning; mobile, distributed command, control, and communications; and affordable, mobile, precision target engagement
- Facilitate future warfare concepts such as combined manned and unmanned warfare

## DARPA AS ENABLER

DARPA has several attributes that make it uniquely suited to act as the enabler for radical innovation. The Agency

**Possesses a much broader research horizon than a commercial venture capital firm.** It can fund an idea or build a full-scale prototype of a system. It can focus its work on outcomes when needed without using the peer review process prevalent in university research. The Agency can work on national security needs that do not necessarily have corresponding, well-established military requirements.

**Applies a simple but forceful strategy.** Its highest priority is flexibility and the ability to quickly exploit emerging situations. This is a reflection of DARPA's

view that in our changing world, events taking place outside the customary DoD establishment may very well have the greatest effect on national security.

**Emphasizes problems that are both technically difficult and focused on a desired outcome.** DARPA encourages competition at all levels, believing that outside stimulation is essential in the quest for innovative solutions.

**Operates more like an investment house than the traditional government research and development institution.** It owns no facilities or institutions and has a lean staff and a flat organizational structure. It contracts with industry, laboratories, and universities to accomplish its work.

**Stresses constant examination.** The Agency reviews programs and rotates its people to ensure that resources are available for new ideas and that the necessary, experimentally based iteration is obtained. It has highly flexible contracting and hiring authorities to allow it to rapidly exploit new opportunities.

These attributes, as well as the Agency's overall approach to new challenges, will enable DARPA to be a major force for change in the 21st century.

#### REFERENCE

- <sup>1</sup>Drucker, P. F., "Management's New Paradigms," *Forbes* 162(7), 152 (5 Oct 1998).

#### THE AUTHOR



F. L. (FRANK) FERNANDEZ became the Director of DARPA on 10 May 1998. He is responsible for the management of the Agency's projects for high-payoff, innovative research and development. Dr. Fernandez received a B.S. in mechanical engineering and an M.S. in applied mechanics from Stevens Institute of Technology in New York (1960–1961). He received his Ph.D. in aeronautics from the California Institute of Technology in 1969. In 1976, Dr. Fernandez founded and served as President and Chairman of the Board of Directors of Areté Associates. Prior to coming to DARPA, he was President and Chairman of the Board of Directors for AETC, Inc., which he founded in 1994. He is Director of the Green Foundation and is a member of the New York Academy of Sciences. His e-mail address is [ffernandez@darpa.mil](mailto:ffernandez@darpa.mil).