

**FUTURE** *takes*

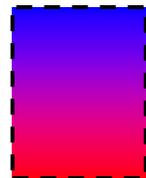
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*“Salami speech,” finally in Philadelphia!*

**FROM:**  
**Unknown Alternative Future Worlds**



**TO:**  
**Prudent Defense Technology Investments**

How does one optimize defense technology investment decisions that must be made now, when the resulting technologies may be long obsolete by the time they are fielded because of counter-technologies, counter-doctrine, and radical changes in the geostrategic environment? Indeed, given the long lead times, how does one develop the decisive military force to defeat any of several threats that may emerge 15-25 years from now, when one does not know what the threats will be? These challenges were explored in the October 2005 colloquium of the **Center for Frontier Sciences** in Philadelphia, presented by Dave Stein. An invitation to the colloquium was extended to the WFS Philadelphia chapter. (See companion article, “Center for Frontier Sciences,” for additional information about the center.)

### **“BRAVE NEW WORLD”**

Beginning with a discussion of the “brave new world” and its implications for defense planning, Stein explained why incremental thinking and planning, based on extrapolation from the present, is not enough in today's defense planning environment – a point evidenced all too well by the tragic events of 9/11, a fateful day that demonstrated that “out-of-the-box” operational planning and execution can trump military supremacy, albeit briefly.

Continued Stein, many warfighting paradigms, even those of recent years, are in now their death throes or beyond – perhaps not surprisingly in this era of ever-accelerating change, given the convergence of the new and changing geostrategic environment (multipolar world, non-state actors, culture clashes, and transnational problems beyond the control of a single nation-state), the new battlespace (asymmetric warfare, vulnerabilities, nonlethal warfare, parallel warfare, and operations other than war or OOTW), technology impacts, budgetary pressures, and the rapid obsolescence of doctrine. Emphasizing that multipolar worlds are not new, Stein noted that such worlds present more dyads across which conflict can start, especially if non-state geostrategic actors are considered. Indeed, noted Stein, recent times have seen a proliferation of non-state geostrategic actors including nationalist and ethnic groups, alliances and trade blocs (e.g., NATO, OPEC, NAFTA), multinational corporations, the media, terrorists, drug cartels, and the disenfranchised in general – all empowered by high-tech including instant communications. Dealing with terrorists is exceptionally challenging as they can privatize war and have no return

address or other vulnerabilities commonly associated with nation-states. The multipolar world presents additional challenges including the loss of superpower restraining capability over client states as well as the release of new tensions as old ones are relaxed with the collapse of regimes.

Another challenge is dealing with potential adversaries whose mindsets differ radically from our own, observed Stein. A common example is the suicidal terrorist who is not readily deterred and who places a low value on human life, but there is also the tyrant willing to sacrifice his people and country, who is out of touch with military reality (Hitler, in the waning days of WWII), or who derives strength from standing up to the US and not necessarily from military victory (Saddam Hussein). In cases such as these, conventional game theory is not readily applicable. Another formidable challenge can be found in “holistic warfare” based on non-military means such as public opinion manipulation (recall Vietnam), embargoes, manipulation of the stock market or exchange rate, or perhaps even election influence. Noted Stein, stock market or trade transactions considered normal in the US might be viewed as acts of war by other nations that are adversely impacted. This holistic thinking, which contrasts profoundly with the reductionist thinking that is more common in the West, also entails the prospect of being at war and not knowing it, perhaps even begging for a new definition of “peacetime.”

Non-conventional military operations present their own challenges that must be considered in planning force structures. Operations other than war (OOTW) such as peacekeeping, peacemaking, and humanitarian assistance require special training. Often protracted, they entail public opinion issues, especially in a “quarterly earnings statement” culture. Urban operations often entail high collateral damage risks and magnify the need for accurate and timely identification of friend and foe (IFF) – no trivial challenge. As in any conflict, there is the need to maintain escalation dominance and to implement a viable exit strategy to “get out of trouble faster than we got into it” – without sowing the seeds for another war to fight.

Adding to these challenges are the pervasive impacts of technology. As one might expect for a complex society, technology generates new vulnerabilities in addition to providing new capabilities. Indeed, observed Stein, even technologies that are seemingly mundane have had unforeseen impacts, as evidenced by the impact of food preservation technologies on the mobility of armies. Traditional service roles and missions are also being impacted – the laws of “bureaustatics” notwithstanding, as improved precision, range, and lethality are making it more possible for any service to strike nearly any target. Furthermore, technology has already lowered the threshold for going to war, since massive mobilizations are not as necessary and since nonlethal warfare might entail less public opinion risk. At the same time, the information age is empowering good guys and bad guys alike including non-state geostrategic actors. On one hand, it blunts information control by dictators as well as by the mainstream media, while on the other, it heightens discontent among the have-nots – all while influencing public opinion everywhere. Said Stein, this is all on top of the debate as to whether high technology lifts all boats, widens the “digital divide,” or does both.

Other factors influence force structure options. A primary consideration is whether to rely on allies to share weapon system development and acquisition costs and on coalitions in time of conflict. Stable coalitions and reliable allies argue for cost- and burden-sharing, given the costs of big-ticket weapons systems against the backdrop of competing fiscal priorities. Yet in the extreme, the likelihood of fluid coalitions argues against burden sharing, forward basing, and even the guaranteed availability of ports and airfields – at least in the case of some countries – because of the technology transfer risk (if it cannot be outpaced) and also because divergent national interests in the fact of a crises can force concessions and render the coalition itself a Clausewitzian center-of-gravity (COG) that the adversary can target via ally intimidation. It has also been argued that in years past, forward basing underscored the US commitment to their host nations while also deterring regional arms races. However, if rapidly-changing coalitions, the geopolitical cold shoulder, or domestic considerations preclude forward basing, the potential need for long range power projection increases.

Furthermore, fluid coalitions can limit targeting options, as today's adversary may be tomorrow's ally. Other adversaries of tomorrow may lack a Clausewitzian COG that is vulnerable to strategic strike – not unlike today's terrorists who have no return address, and this needs to be considered in tailoring force structure.

The anticipated shelf life of technological advantages is yet another consideration. Then, too, one must consider the possible roles that the armed forces will assume – e.g., conventional missions only or OOTW also. Additional considerations include the possible relative roles of the various instruments of national power (e.g.,

military, diplomatic, economic, and those yet to come) and of the nation-state to the multinational corporation. Compounding these challenges is doctrine obsolescence. Drawing upon examples from business as well as from spectator sports, Stein explained that warfighting doctrine is like a match – useless after it is used once – that is, after it becomes known to potential adversaries.

All of these factors, challenging enough even today, point to long-range uncertainty regarding alternative future worlds and the threats that they will present. This uncertainty, itself exacerbated by the ever-increasing rapidity of change, complicates defense force structure and technology investment planning, as though (to borrow a military euphemism) the rate of change is getting inside the defense planning decision loop. In this planning environment, it is not enough to build an incrementally better tank, combat ship, or fighter aircraft, as military supremacy in this context has only limited relevance. A better planning methodology and framework are needed.

## THE METHODOLOGY AND ITS PAYOFFS

So how does one plan for those wars that have not yet been fought? As Stein indicated, this challenge is roughly akin to asking a physicist to identify those elementary particles that have not yet been discovered! Careful to emphasize that he was but one of many people involved in the Air Force long-range planning studies and not a principal investigator, Stein then outlined one of the long-range planning methodologies used within the US Air Force during the 1990's (see disclaimer<sup>1</sup>). A simplified description is as follows.<sup>2</sup> The methodology starts with a “time warp” to a future characterized by any of several alternative geostrategic worlds (scenarios), themselves postulated on the basis of geostrategic planning space drivers and representing discontinuous jumps from the present. Each world to be considered in the study is selected on the basis of the national security challenges that it presents. For each world, a draft “history” is developed by “backcasting to the present” and checked for self-consistency. The details of the specific worlds considered in the Air Force planning studies are documented elsewhere.<sup>3</sup>

The next step postulates the various threats that these worlds present and military capabilities (weapon systems) needed to counter the threats. In turn, these hypothetical weapons systems, which range from evolutionary to revolutionary – “mild to wild” – require enabling technologies that are themselves identified. A “scoring” process, sometimes iterative as well as interactive, evaluates the utility of each hypothetical weapons system for each alternative future world as appropriate – thereby yielding a separate score for each world – and it also evaluates each system’s susceptibility to countermeasures, be they technology-based or tactics- and doctrine-based. To this end, it is necessary to have a “Red Team” or at least a robust representation of a hypothetical adversary’s own military capabilities and their possible countermeasures against “Blue Team” (friendly) forces. Scoring criteria can range from precision, range, and lethality to reliability, sustainability, deployability, personnel and training impact, risk (development, acquisition, and obsolescence), cost, and even political acceptability considerations. For each world, the weapons system results are then correlated with the enabling technologies to obtain a score for each technology, again by alternative future world.

The end product is a list of the enabling technologies, the scores of which are roughly correlated with their “pervasiveness” across the hypothesized weapons systems and their relative utilities across the alternative future worlds examined. For a given technology or weapons system, a low spread or variation of scores indicates that the

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<sup>1</sup> DISCLAIMER: Although the methodology presented in the colloquium was used in 1990's-vintage United States Air Force long-range planning studies and has long been in the public domain, this synopsis and the colloquium that it summarizes do not necessarily represent the official position of the United States Air Force or the Department of Defense. Furthermore, the speaker did not present the colloquium in an official capacity as a representative of the United States Air Force or the Department of Defense. This synopsis makes no express or implied statements regarding any use of the results of these studies.

<sup>2</sup> A more complete description is available in the following two references:

- a. J. A. Jackson et.al., “Air Force 2024 Operational Analysis,” *Military Operations Research* V3, N4, 1997, pp. 5-21.
- b. Air Force 2025 Final report Homepage, [www.au.af.mil/au/2025](http://www.au.af.mil/au/2025), accessed November 8, 1996.

<sup>3</sup> *Ibid.*

results are relatively invariant to whichever alternative future world emerges, at least among those worlds considered. Thus, a technology or weapons system with high value-added scores and low score spread is a relatively attractive investment from a future uncertainty standpoint. However, the analysis does not stop here. The methodology also considers cost-to-benefit ratios in terms of two additional criteria – the challenges associated with developing a particular technology, and the extent to which the commercial sector is driving the development. Technologies being developed primarily by the commercial sector generally require less public sector investment, and commercial off-the-shelf (COTS) technologies may be available with shorter lead times and at lower costs. However, the military leverage in steering the development is correspondingly reduced, and there is sometimes the additional risk of technology transfer (to potential adversaries). If the methodology is properly used, these scores provide useful insights on which technologies will have maximum payoff in the face of uncertainty. Furthermore, the built-in audit trail self-documents the scores, so that the reasons for high, midrange, or low scores are readily apparent.

### **DON'T SLICE THE SALAMI!**

There are added bonuses, including further insights on long-range threats, needed capabilities, and joint warfighting doctrine as well as improved dialog among the warfighting, acquisition, technology, and futurist communities – dialog that helps move them beyond incremental thinking. Still another payoff is management guidance for technology budget cuts that result from reprogramming of funds. The methodology is a powerful alternative to the “peanut butter spread” or “salami slice” approach that “spreads the pain” evenly (on a percentage basis)!

As in all futures exercises, care is necessary in choosing the drivers, the alternative future worlds (scenarios), the hypothetical weapons systems, and the scoring criteria. The complexity of the world notwithstanding, a relatively small number of drivers is preferred so that the set of drivers is manageable. This facilitates the identification of underlying issues, thereby lending additional insights into the future. For their part, the number of alternative future worlds and of hypothetical weapons systems should also be manageable. Too many worlds or systems lead to skewed results, and the differences among them become fuzzy. Conversely, the too few extreme invites just the “Pearl Harbor” that one is trying to avoid, and in the case of systems, it can relegate the fielding of promising technologies to a risky “eggs in one basket” approach. Finally, the scoring criteria should also be examined for orthogonality to preclude double-weighting.

### **LIMITATIONS**

Stein was quick to point out that even a scenario-based methodology such as this one is only as good as the out-of-the-box thinking that goes into it. If the thinking that goes into identifying the drivers, the alternative future worlds, and the capabilities and limitations of the hypothetical weapons systems is too incremental and lacks vision and imagination, the value of the resulting study is degraded substantially. It is especially imperative that the hypothetical adversaries' capabilities be sufficiently robust to stress the capabilities of the Blue Team's proposed weapons systems.

Inadequate breaking of existing doctrinal paradigms, Red or Blue – for example, deploy-buildup-defend-counterattack – can fatally flaw a study or at least render the findings less generic, continued Stein. The Air Force 2025 study, pioneering though it was, had been based on the overarching objective of “air and space dominance” as a given, together with its three functions of awareness, reach, and power. Consequently, the technologies were evaluated through the lens of air and space dominance and not necessarily through the wider lens of overall value to national defense.

An additional potential pitfall is over-reliance on high tech as a panacea. Contrary to the predictions of some futurists of their day, airpower never made armies and navies obsolete, and nuclear weapons never prevented war across the entire spectrum of conflict. Likewise, technological superiority did not win the Vietnam War.

Still another potential pitfall is assumed benign operational circumstances such as favorable weather or port and airfield access. Finally, proper identification of the enabling technologies and the associated technology challenges is essential. For these reasons, an after-the-fact re-examination of the assumptions regarding roles and

missions, doctrine, vulnerabilities, adversary mindsets, risks, technologies, and geostrategic considerations is advised, said Stein.

## **WAYS FORWARD**

The program concluded with Stein's thoughts on ways to extend this proven technology investment methodology. One logical extension is to service roles and missions, with all services (Army, Navy, Marine Corps, and Air Force) participating on an equal basis. Another possible extension is to dual use technologies and to tradeoffs among defense, homeland security, and non-defense investments such as infrastructure, education, environmental remediation and management, foreign assistance, and perhaps even paying down the national debt if a good economic model can be incorporated into the methodology. There is even the additional possibility of migrating the methodology beyond the military instrument of national power to encompass the economic, diplomatic, and technological, so that the challenges presented by holistic warfare are met.