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TradeSpace:
Designing A Wargame for USSF Acquisition Program Managers

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TradeSpace: Designing A Wargame for USSF Acquisition Program Managers

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Abstract

The United States Space Force (USSF) Space Systems Command (SSC) worked with Toffler Associates, a future-focused strategic advisory firm based in Arlington, VA, to design, develop, and test an acquisition education wargame. This game fills a known gap in educating and training mid-level space acquisition program managers who have not had an opportunity to experience and practice acquisition-specific critical thinking skills in a realistic scenario. Toffler Associates' facilitators ran two instances of the game with teams of five and six participants from SSC's acquisition workforce. The game used a space acquisition scenario for which participants developed an acquisition strategy within the game mechanics. After a rapid briefing on their approach for approval to proceed, they played the game, creatively developing courses of action to mitigate risks and exploit opportunities. Feedback from participants indicated the game was logical and engaging, and met learning objectives. This initial playtest points to a future for this type of experiential environment in acquisition education as well as other acquisition strategy situations, including team building and real-world acquisition strategy testing.

Introduction

A USSF program management office is in trouble. Their plan: to regain space superiority over a peer competitor by delivering a new generation of space-based sensor. To mature the next-generation technology, they are working with a cohort of small startups, owners of the relevant intellectual property and expertise, guiding them to scale with generous cost-plus contracts. Unwilling to compromise on the capability they deliver to the warfighter, design

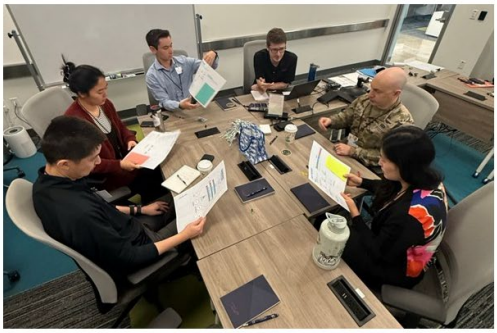
complexity escalates, and the team finds themselves 8 months behind schedule and 10% over budget.

The near-peer competitor demonstrates their version of this capability in orbit. Under pressure to accelerate, the team decides to transition the technology to production, despite outstanding technical risk and incomplete development. The manufacturers take on ambitious contracts but find themselves in a perfect storm of high interest rates and supply chain disruptions. Hat in hand, they inform the program team that it will take significantly more investment to get the capability's first tranche to the launchpad.

The capability is late and approaching obsolescence. Industry partners are threatening to pull out. The Service Acquisition Executive asks difficult questions about risk management and professional judgment. This is the kind of disaster that draws news headlines and Congressional testimonies.

Except, in this case, the scenario is unfolding in a tabletop game. The participants are sitting around a table, drawing cards, throwing dice, and deliberating on the risks and the opportunities of different courses of action. This affords the program office the opportunity to *experiment*. They could reset the clock: if they return to technology maturation and risk reduction, are there steps they could take to begin manufacturing with lower risk? Would a different contracting approach have provided more options? Or perhaps they play out the scenario as it unfolds. If this is an acquisition disaster, what steps can they take to mitigate the impact? What risks can they take to try to steer the program toward a successful outcome?

USSF SSC worked with Toffler Associates' team of futurists and strategic planners to develop the game—TradeSpace^{SM}—as a tool for program manager professional development. The game provides a unique chance to experience acquisition failure in a safe environment, affording an opportunity to build crucial skills. As a prototype, the game remains under development, and its initial playtest with space acquisition professionals demonstrated TradeSpace^{SM} as a powerful tool to improve acquisition workforce competencies.



USSF SSC Program Managers playing TradeSpace^{SM} with Toffler Associates facilitators at the SpaceDen, Los Angeles, CA (Nov 13-14, 2024).

FIGURE 1 Images from Initial Playtest of TradeSpace^{SM}

Objectives

Training for most military operational specialties involves a progression that is not mirrored in DAF acquisition training. Using pilot training as an example, USAF pilots first learn how to fly an airplane at initial flight training (IFT). Upon graduation, they transition to learning how to fly the specific airplane with which they've been assigned. Over several years, they

spend countless hours in the classroom, in simulators, and in training aircraft. And their training continues when they arrive at their unit to learn how that unit employs the aircraft weapon system—*how do we fly the airplane*. At some point, many pilots get the opportunity to participate in a large-scale realistic exercise like the Air Force's Red Flag. Red Flag organizers often describe their objective as giving pilots the opportunity to fly their first five combat missions before they fly in combat. Only after this training and preparation are pilots ready to execute their mission in the real operational environment.

In contrast, DAF acquisition training starts with 100-level courses from the Defense Acquisition University (DAU). Then, the Air Force Institute of Technology's School of Systems and Logistics (AFIT/LS) offers the first two levels of operational training. Together, they provide the fundamentals of acquisition rules and regulations and DAF-specific lessons. However, unlike pilot training, acquisition officers are then thrown into the fire to execute the mission with real acquisition programs. Often, these officers do not receive any deliberate unit-specific training or the opportunity to practice their craft in a realistic environment where the only consequence for failure is learning.

Literature Review and Background of Past Efforts

Following Department of Defense (DoD) projections that more than 31% of the acquisition workforce would be eligible for retirement by 2026, Defense Civilian and Training Corps (DCTC) created an acquisition game to rapidly train early career acquisition civilians (MacGregor & Cuff, 2024). The creators of this game were motivated to develop additional training and experience methods to supplement traditional acquisition coursework, such as that provided by DAU, because studies suggest that building expert proficiency in acquisitions requires a minimum of 10 years of steady practice (Ericsson et al., 2007; Murphy & Bouffard, 2017).

Similarly, SSC developed the tabletop wargame, Operation Kodiak Dawn, for early career acquisition professionals in the science, engineering, and cyber career fields (Lin et al., 2023). Players were split into red and blue teams, with asymmetric starting conditions, in a cold war space race. The objective of the game is to help the players understand how successes and failures at early stages of technology and system development may have lasting impacts to meeting national-level security goals over time. Through team play, the players also experienced challenges reconciling varying levels of individual team members' risk tolerance when deciding on courses of action for technical maturation and system development strategies. Operation Kodiak Dawn adopted a rule-based approach for mechanically straightforward adjudications, although experienced facilitators were required for the game debrief to ensure lesson objectives were met.

With traction in using wargaming as a tool for defense acquisition training, Georgetown University's Wargaming Course designed a game for SSC around the acquisition process, focused on the defense industrial base and the challenges of developing dual-use technology. Titled "Acquisition Wars," the game's target audience is government acquisition professionals (Shala et al., 2024). Unlike Operation Kodiak Dawn and other DoD wargames, the players play as commercial and private industry partners. The game was designed to be stand-alone and playable in a box, without the need for white cell adjudication, though the ideal use-case setting would also include skilled facilitators for effective debriefing.

In non-education and training settings, DAF Global Futures employs foresight methods to build scenarios and exercises to understand how highly volatile, uncertain, complex, and ambiguous (VUCA) environments impact strategies, opportunities, and challenges. Predictive analytical tools capable of creating accurate and detailed predictions remain beyond state-of-the-art, and the report establishes that this analytical process does not provide predictions.

Instead, it offers future insights to improve decision making (HAF A5/7 Air Force Futures, 2023). Similarly, USSF holds Title 10 wargames for senior level decision-makers that focus on policy and operations, not force modernization at the program office level.

TradeSpace^{SM} builds upon the existing body of work in wargaming and more specifically, wargaming the acquisition process. It expands on the concepts of previous games to allow players greater opportunity to exercise critical thinking and decision-making about defense program management in a no-risk environment, over and over. The DAF needs new ways to create an experienced acquisition workforce, because it cannot afford to wait for experience through time alone. This urgency is even greater with the implementation of USSF's Officer Training Course, where future force modernization officers will only be identified after their initial 4-year operational tour, reducing the amount defense acquisition experience in comparison to their predecessors at the same time point in their careers. Thus, TradeSpace^{SM} provides the experiential learning environment for the next generation of acquisition officers to do more "sets and reps" in less time.

Designing an Experiential Learning Environment

The design for TradeSpace^{SM} sought to simultaneously reflect complex real-world acquisition challenges and appropriately abstract those challenges into an executable game.

For the game to be accepted as a learning tool for program managers, it had to challenge players with the experience of managing major acquisition programs. The defense acquisition system is notoriously complex, with a huge variety of processes, stakeholders, and variables. That complexity is an important feature of the system. The struggle to identify and pursue clear strategic priorities despite that complexity is an important learning experience for players.

Simultaneously, for the game to be engaging and playable, it had to be as straightforward as possible to play from both the perspective of the players and the facilitator. The game is intended to be played in iterative loops: teams or players repeatedly experience failure, observe the consequences, and carry lessons over into their next play session. To achieve that goal, the game was designed to be playable with no more than one support staff and rules that players can learn with no more than 30 minutes introduction.

To meet these competing goals, the game simulates the defense acquisition system at a level of abstraction that focuses players on strategic choices and trade-offs rather than processes. It does not teach acquisition law, policy, or regulations, and it assumes players begin the game with a basic understanding of acquisition authorities.

Game Phases

With some exceptions, defense acquisition follows a natural, repeatable phase structure: program managers define requirements, mature technology, transition it to production, and deploy it into the world. The Adaptive Acquisition Framework allows for flexibility, but this fundamental structure serves as a useful abstraction and facilitates game design as well: games benefit from phases because they allow a varied gameplay loop and encourage players to observe the consequences of their actions and adapt. Figure 2 illustrates how the phases of TradeSpace^{SM} (bottom) map onto the phases of the Adaptive Acquisition Framework. TradeSpace^{SM} thereby provides a general-purpose framework that can reflect any acquisition pathway while focusing players on the important differences between phases and how choices in each set up programs for success and failure in subsequent phases.

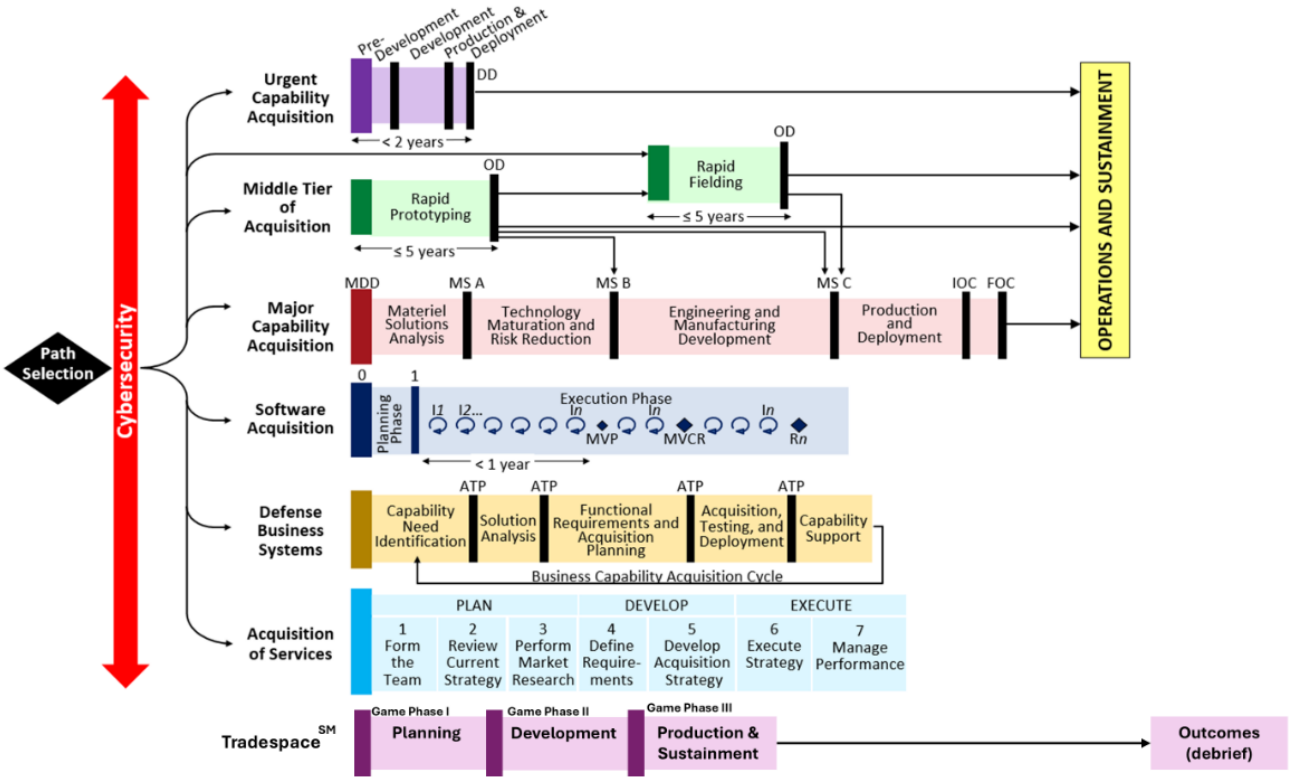


FIGURE 2 Alignment of TradeSpace^{SM} to the Adaptive Acquisition Framework

Modeling the Defense Acquisition System

TradeSpace^{SM} presents players with a discrete set of variables to represent an abstraction of the defense acquisition system. These variables are the "tradespace," in which players must respond to challenges by making strategic trades to protect some priorities at the expense of others. Players define their game objectives in terms of these variables (e.g., deliver ahead of schedule and support the growth of industry partners) and then objectively assess their progress through reference to them. The variables include:

Program Scores. The classic "iron triangle" against which program performance is conventionally measured:

- Cost
- Schedule
- Performance

Contextual Scores. Scores that represent the program's relationship with its environment. High scores allow the program flexibility, and low scores can pose crises:

- Favorability
- Industry Health
- Mission Alignment & Interoperability

A final variable, **Complexity**, captures the relative technical challenge of the program. Complexity is determined by planning choices, presenting players with the trade-offs of designing exquisite versus minimally viable capabilities, and increases the risk that vendors will fail to deliver and engineering challenges will incur cost and schedule penalties.

Other variables matter in acquisition, but we found that in practice these seven provide tools to enforce consequences for all player actions. And important for the game's usability, they are few enough to form a comprehensible tradespace for players to visualize their decision-making. We also found that the mere existence of any variables at all beyond the "iron triangle" was a

powerful revelation for program managers, who reported that it opened their eyes to the true scope of tools at their disposal to manage their program.

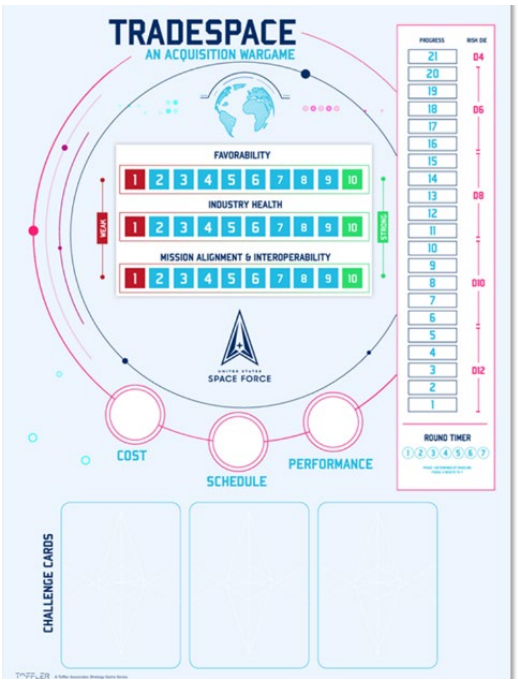


FIGURE 3 TradeSpace^{SM} Scorecard

Challenge & Response

The core gameplay loop of TradeSpace^{SM} challenges teams with a series of interruptions to their acquisition process: new threats or opportunities that impact the program negatively or positively. The game represents the team's time and energy as an Attention resource, the scarcity of which forces an immediate and highly consequential choice: what crises *must* be dealt with to deliver the acquisition strategy and which do the players believe can be ignored? To experience that not all crises are worth the cost of distraction is itself a valuable learning objective. We frequently observed teams struggling to prioritize the *important* over the *urgent* in accordance with their acquisition strategy. In these cases, the facilitator can play a valuable role in shepherding players through analysis paralysis by challenging them to recall their priorities.

Players resolve challenges by describing a course of action to the facilitator and allocating the requisite Attention resources. TradeSpace^{SM} uses a semi-structured adjudication framework. The facilitator interprets the team's course of action in terms of either a *trade-off*, one variable traded for another, or an *uncertain outcome*, in which they must roll a twelve-sided die (adding modifiers representing their investments in program office capabilities) to determine if their course of action succeeds or fails. This approach increases the burden on the facilitator, as they must fluently translate player intention to game mechanics but allows the players complete freedom to creatively define their courses of action. We observed significant learning occurring in this process as players shared lessons-learned from their professional experience and experimented with novel, and in many cases entirely unexpected, courses of action.

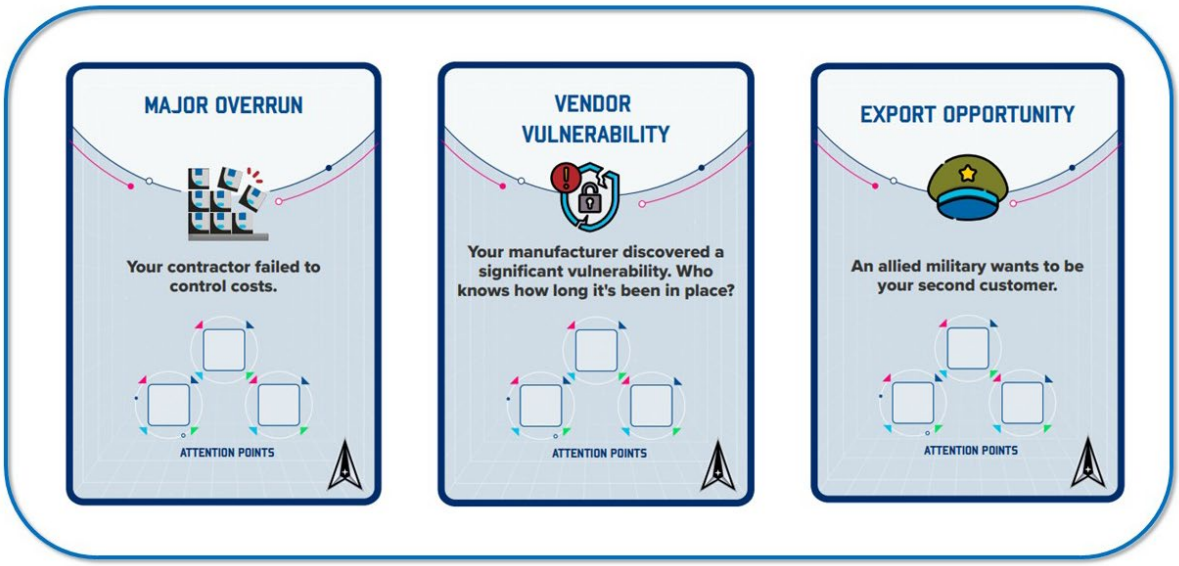


FIGURE 4 TradeSpace[SM] Challenge Cards

Gameplay Experience

TradeSpace[SM] was designed to be played by groups of three to six over six to 12 hours. The game is flexible, allowing it to be played in a variety of different formats:

- Small teams testing a real-world acquisition strategy or using the game as a team-building activity.
- Larger professional education cohorts playing multiple games in parallel to test different approaches and observe different outcomes.
- Simple games with one facilitator, or self-adjudication, and expedited discussion.
- Complex games with dedicated facilitator roles (such as a dedicated "Service Acquisition Executive" to provide realistic input) and discussions structured to address specific learning objectives.

The most crucial component of the experience of playing TradeSpace[SM] is discussion. Experiential learning is effective when the experience allows participants to independently arrive at learning objectives. In TradeSpace[SM], players learn by talking about how the experience represented in the game reflects their actual experiences and their formal acquisition education. As such, the game prompts discussion at multiple points.

In the Planning Phase, the facilitator prompts players to discuss the scenario and their strategy to respond to it, with an envisioned end state and a theory for how to deliver it. The game places players (or groups of players) in the roles of the Program Manager, Contracting Officer, and Chief Engineer. This encourages players to share information and approach the problem from different objectives.

In the Development and Production & Sustainment phases, the cycle of each round promotes discussion at two points. First, players discuss *which* challenges and opportunities need a response. The challenge for them is to identify how each will impact their program and then prioritize them according to the elements of their strategy. Second, players discuss *how* they will respond to those challenges and opportunities. This provides an opportunity for them to

draw on their professional experience and weigh the pros and cons of different courses of action.

Lastly, the Outcomes phase provides a forum for open-ended, forward-looking discussions of the consequences of the acquisition for all stakeholders.

TradeSpace[SM] functions as a structured framework for facilitating scenario-based discussion. It has significant promise for professional development applications where participants already possess subject matter knowledge but have not had the opportunity to develop expertise through practical applications.

Findings

Toffler Associates and SSC playtested TradeSpace[SM] with a group of acquisition professionals over 2 days in November 2024. The playtest group primarily consisted of early-career acquisition professionals who have received practitioner-level textbook and classroom education.

Two groups played through the game in parallel using a common scenario. The scenario challenged teams to develop a counter to a revolutionary new near-peer adversary communications technology, grappling with significant schedule urgency and an underdeveloped domestic vendor base. Although each group made different strategic choices in response to injects, both successfully realized a strategy of prioritizing rapid delivery in exchange for significant cost overruns and mild underperformance. The game concluded with a facilitated discussion of the consequence of those trade-offs.

Players provided feedback on their experience and learning progress against objectives through surveys. These revealed two primary themes.

First, players found the game to successfully create a safe environment for experiencing risk and the consequences of failure. Players commented that:

- “It was valuable to experience the consequences of choices made in planning.”
- “I liked the dilemma of having many decisions and consequences.”
- “The game encouraged big picture decision making: look at a problem, critically think about possible courses of action, learn from team member experiences throughout.”
- “It was important to maintain margins for dealing with unexpected contingencies.”

This feedback corroborates behaviors observed during the course of the game. Players routinely proposed unconventional solutions to challenges and robustly debated the potential consequences. These included strategies to leverage international collaboration, to sustain the business operations of failing vendors, and to use competition to promote better, cheaper solutions. Not all of these strategies succeeded, but by taking the risk players improved their ability to weigh and manage the consequences.

Second, players found that the game generally improved their critical and creative thinking skills in defense acquisition:

- “The variety of difficult challenges led to valuable discussion.”
- “The hard dilemmas and no-win scenarios were fun and informative to think through.”
- “I learned more about options for handling program risk.”
- “I enjoyed open-ended exploring of options for dealing with problems.”

- “The game gave a broader perspective than I get in my office.”
- “I can imagine a wider variety of challenges in the future.”

Players generally reported that the game presented a unique and thought-provoking challenge and noted that it opened their eyes to risks and opportunities associated with a wider variety of forces, including labor, technology, finance, and regulation.

The players were also evaluated in terms of their self-reported improvement in understanding of the Nine Tenets of Space Acquisition, a set of directives issued in a 2022 memo by Assistant Secretary of the Air Force Frank Calvelli. The overwhelming majority of players reported an improved understanding of seven of the nine directives.

Broadly, TradeSpace^{SM} succeeded in promoting adoption of an adaptive planning approach. Players managed their programs without strict adherence to baselines and instead engaged in nuanced discussions of the relative value of cost, schedule, and performance benchmarks. By presenting players with clear variables and constant demonstrations of the trade-offs between them, the game helped players determine the priorities for their notional program and challenged them to adhere to or evolve that value determination throughout the course of the game.

Future Development

The playtest feedback suggests several areas for refinement. One of the first considerations is applying the existing mechanics to cover trade-offs around cybersecurity, Special Access Programs, and overclassification. This mechanic could interact with challenge cards related to security leaks and opportunities for collaboration. Lower classification could potentially increase the risk of security leaks but enable international cooperation, and the decision to pursue higher classification incurs significantly greater program costs and fewer opportunities for industry collaboration.

On the event cards themselves, the randomness and distribution of the events sometimes created conflicting narratives that disturbed the suspension of disbelief, damaging the immersion and subsequently, the learning objectives. For instance, during the playtest, some teams drew “retiring SMEs” and “labor strike/mass layoffs” cards on the same turn, significantly derailing program schedule. While real-world 2025 events show that these events can certainly coincide, at the time of the playtest, it was considered unlikely. As the game continues to be developed, there are several potential mediations. One design consideration is to modify the distribution of event cards where there are more minor issue event cards than major issue cards, and even fewer catastrophic events cards. In addition, the next iteration may have event cards that more uniquely specify the type of attention, such as requiring “Engineering” attention or “Contracting” attention, rather than treating all attention costs equally. The intent is to have more constraints when dealing with the event cards per round, such that even a confluence of minor issues can present a challenge if all hardships fall on a single function to address. Additionally, opportunities to leverage a digital database of event injects creates opportunities for more deliberate inject timing and combinations to improve the flow of events from round-to-round.

Finally, regarding the functional roles, the playtest revealed that the team played fully cooperatively and collaboratively. While ideal, this is slightly negative learning, as in practice, PM, Engineering, and Contracting teams have their own internal objectives. Future iterations of the game may implement a system where each functional team must trade between meeting their internal goals and the goal for the entire program, that puts their function at odds with the rest of the team.

Bibliography

Caffrey, M. (2019). *On wargaming.* Naval War College Press. https://digital-commons.usnwc.edu/newport-papers/43/

Defense Acquisition University. (n.d.). *Adaptive acquisition framework pathways*. Retrieved March 31, 2025, from https://aaf.dau.edu/aaf/aaf-pathways/

Department of the Air Force. (2022, October 31). *Memorandum for the Department of Air Force space acquisition workforce*. https://www.safsq.hq.af.mil/Portals/76/documents/ASAF%20-%20Space%20Acquisition%20Tenets%20(31%20Oct%2022)%20FINAL.pdf

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. (2007). *The making of an expert.* Harvard Business Review. https://hbr.org/2007/07/the-making-of-an-expert

HAF A5/7 Air Force Futures. (2023). *Air Force global futures report: Joint functions in 2040.* HAF. https://www.af.mil/Portals/1/documents/2023SAF/Air_Force_Global_Futures_Report.pdf

Lin, A., Bull, D., DiLuca, E., & Kennedy, B. (2023). *Operation Kodiak Dawn*.

MacGregor, M., & Cuff, T. (2024, May 8–9). The acquisition game: Learning through play. *In Proceedings of the 21st Annual Acquisition Research Symposium.* Naval Postgraduate School, Monterey, CA. https://dair.nps.edu/bitstream/123456789/5168/1/SYM-AM-24-114.pdf

Murphy, C., & Bouffard, A. (2017). *Understanding defense acquisition.* MITRE Corporation. https://www.mitre.org/sites/default/files/publications/17-1585-understanding-defense-acquisition-workforce-challenges.pdf

Shala, R., Beto, J., Spreenberg, O., Bae, S., & Lin, A. (2024). *Acquisition wars*. https://www.linkedin.com/posts/activity-7194350773424590848-N0fR

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