There is No Spoon:

_The New Digital Acquisition Reality

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"Dicula Nulla Est."

"This is your last chance. After this, there is no turning back. You take the blue pill - the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill - you stay in Wonderland, and I show you how deep the rabbit hole goes. Remember, all I'm offering is the truth - nothing more."
_Morpheus, *The Matrix* (1999)

I. INTRODUCTION. This is indeed your last chance. Should you continue reading, your defense acquisition training — no matter what lifecycle facet, function, or operational domain — becomes a dream from which to wake up…to something new. Digital Engineering and Management, combined with Agile Software and Open Architecture, truly is the rabbit hole to escape traditional defense acquisition. I am excited to share more about this trinity of digital design technologies, why their digital Wonderland excites me, and how they foretell a faster, agiler, and more competitive weapons-buying process our nation needs to succeed long term.

This *Matrix*-inspired guide for Air Force and Space Force Digital Acquisition is designed to "disrupt your input/output carrier signals" of analog thinking. It will illuminate terms and provide insights, best practices, and litmus tests for success (as best we know them) from some commercial industry and bellwether Air Force programs. But digital transformation, writ large, is still in flux. Only 44 "lighthouses" of excellence are recognized worldwide in industries like automotive and microelectronics; only 3 defense programs — the T-7A RedHawk, Ground Based Strategic Deterrent (GBSD), and Next Generation Air Dominance (NGAD) — are radically digital; and only 1 program, NGAD, is positioned to transform its lifecycle through a fully digital acquisition.

So digital acquisition is still very new. Your journey will increase our collective knowledge until past practices are shed, and we become **truly digital Forces**. Be bold. Blaze new digital trails. And inspire the Pentagon to wake up and follow.

But do not delay. This "digital trinity" — digital engineering and management, agile software, and open architecture — is the true successor to stealth: the next big paradigm shift for military tech dominance. **Rather than just building better systems, it builds systems better** — opening doors to faster design, seamless assembly, and easier upgrades — and not a moment too soon! With platform programs now decades apart — and defense industry merging into mega-primes to ferry the sparse competitions — the performance of our next system does not matter. We do not currently own the acquisition OODA[1] loop. If this remains status quo, we lose the competition with China and Russia.

Thankfully, digital acquisition foretells a "status next" if we free our minds of physical world restrictions. The digital world is now a primal acquisition battlefield; let's see how deep this rabbit hole goes!

II. WHAT IS THE DIGITAL TRINITY? *(Major spoilers for The Matrix — go watch it!)*

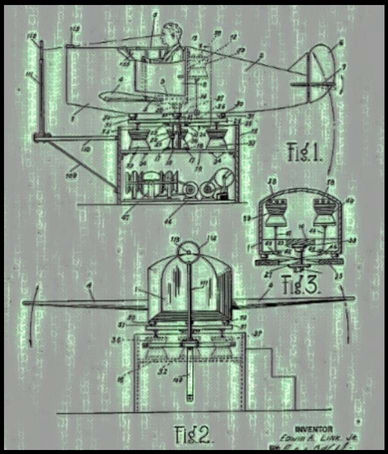
"Have you ever had a dream, Neo, that you were so sure was real? What if you were unable to wake from that dream? How would you know the difference between the dream world and the real world?"
_Morpheus, *The Matrix* (1999)

In the sci-fi future *The Matrix* portends, reality is modeled nearly-perfectly, creating a massive multi-player, virtual reality (VR) experience that, unfortunately, enslaves humanity to artificial intelligence and its enforcement Agents, including the dreaded Agent Smith. (Bummer, right?) Most people grow up, learn, work, and even die entirely in the sim, except a handful who wake up in the real world. Their eyes and muscles have to be retrained (because they've never used them!) but they still know how to walk, talk, and read. All the skills and learning they acquired in the virtual world convey to the real one.

The movie pushes the philosophical boundary of simulation versus reality as far as we must in digital acquisition. If you've read this far without watching *The Matrix*, please consider it official professional development. Like the movie, we must decide **when a model becomes so realistic we accept it as a full substitute for reality**.

[1] Observe, Orient, Decide, Act.

All good simulations capture reality, at least in part, in hopes their use improves real world operations. This idea goes way back in military history. The first flight simulators entered service in 1934 after U.S. Army Air Corps pilots were killed flying postal mail through bad weather. The Air Corps purchased six Link "Blue Box" Trainers (pictured) and the use of simulators for military flight training was born.



Link's simulator was so advanced for its time, the American Society of Mechanical Engineers designated it a historic landmark, and today's military simulators are no exception, as sophisticated as the planes they represent. End result: getting pilots, especially experienced ones, trained to fly new aircraft in record times. F-35 is a great example.

But simulators do not fully recreate reality; pulling Gs while fighting to maintain altitude — and other psychophysiological effects — will be difficult to recreate until we can connect our brains to the aviation equivalent of Morpheus' sparring program. (And yes, that would rock!) That's why we still build training aircraft like the T-7A.

But in design, engineering, software, manufacturing, testing, and sustainment, *Matrix*-like simulation realism is happening: components and processes rendered so realistically they become digital twins of reality. Like the movie, this means we can learn things in these virtual environments and transfer that learning to the real world. Implications are profound!

Imagine taking on the Agent Smiths of acquisition — Concurrency, Learning Curve, and Integration Risk, just to name a few — by designing, assembling, testing, even sustaining hundreds of systems digitally before the first parts are bought or metals bent. Concurrency and integration? Defeated by the Ju-Jitsu of fully-integrated models. Learning curve? Defeated by the Drunken Boxing of determinant assembly. Even "Fly Before You Buy," that time-honored Packard Principle, is now an Agent of the old acquisition system. Defeat it with a new line of acquisition scripture: "*e*Create Before You Aviate."

But to let our digital imaginations run wild, we need a common understanding of the digital trinity across the Air Force and the Space Force. Using computers for every lifecycle facet ***does not*** equal digital acquisition. It is important we understand terms at a technical level.

Your own research and continuous Department-level training will be required, but here are two definitions you should know before Section III: *Digital threads* are extensible analytic frameworks to ***connect*** models — and all associated data, software, and functional support — governing more than one system lifecycle phase with one-to-one real-word traceability. *Digital twins* are one-to-one system models, conjoined with their individual real-world systems in data feedback loops, which may or may not be governed by a full digital thread. As opposed to static baselines, these living, breathing models provide unprecedented power to create and troubleshoot. That is why the tech stack that instantiates them is of paramount importance in digital acquisition.

III. THREE PRINCIPLES OF DIGITAL ACQUISITION

1a. _OWN THE TECH STACK.

"Have you ever stood there and marveled at it, marveled at its beauty, its genius? … Some believed we lacked the programming language to describe your perfect world." **_Agent Smith, *The Matrix* (1999)**

The tech stack is your system's lifecycle "*Matrix*": a comprehensive environment capable of digitally modeling and massively iterating all its aspects without the shackles of real-world runtime, risk, or cost. Built correctly, your ideal eSystem "wakes up" from this digital reality with all designs, assembly and maintenance processes, testing, and even human learning intact.

Owning the tech stack is the modern-day successor to owning the tech baseline. Whereas a tech baseline is all data needed to support a system's lifecycle, a tech stack is all data, models, software, and associated infrastructure needed to create and optimize a system's lifecycle digitally. The power of having a lifecycle digital thread is the stuff of science fiction but fraught with potential missteps. Like the movie, if you don't own your tech stack and its reference architecture, it may end up owning you.

This is a paradigm shift for Air Force and Space Force Digital Acquisition. Aside from the digital lifecycle benefits — which are transformative by themselves — government tech stacks provide companies of all sizes cyber-secure infrastructure (especially when they cannot supply their own), cross-classification IT independent of hardware, and much faster capability generation leveraging automatic government certifications in the stack itself. A worthy second place would be company-owned tech stacks complying with our government reference architecture, but "they will never be as strong or as fast as you can be" with government-owned infrastructure, especially for software and AI.

These ideas are worth further discussion, so let's go deeper down this rabbit hole.

1b. _SHARE THE TECH STACK.

No team should create its own tech stack in the future. It should be available enterprise-wide, based on an enterprise reference architecture, with all tools necessary for program success. We are already on this path with Cloud One and Platform One, providing them as a Service (aaS) to programs like GBSD. But we have to go much further.

Though layers of our tech stack will naturally evolve and grow as technology improves, at a minimum, we need the following layers enterprise-wide for acquisition: Cloud aaS (#cloudOne), Platform aaS (#platformOne), Model-Based System Engineering aaS (#mbseOne), Data aaS (#dataOne), Data Analytics aaS (#analyzeOne), and Artificial Intelligence aaS (#smartOne). Edge aaS (#deviceOne) would be a welcome addition. Note these are **the same** layers being leveraged by the Advanced Battle Management System (i.e., the internet of things (IoT).mil) which is adding more layers to take this integrated tech stack onto future battlefields.

As challenging as it may sound, we are on the precipice of creating "One" enterprise-wide infrastructure and IoT.mil — available to every program, platform, team, and operator — but we must free our minds and treat infrastructure and IT as warfighting systems. In the digital age, they **are** warfighting systems! Future development and operations must ride on one digitally — not physically — separated tech stack because the pace of digital warfare now demands it. That next digital bullet must be one real-time download away.

_NEO: ***"Can you fly that helicopter?"*** **_TRINITY:** ***"Not yet."***
_The Matrix **(1999)**

Achieving "One" unified infrastructure must ***not*** mean one option. In the future, each "One" tech stack layer should be a manageable portfolio of competing offerings, all certified to work together seamlessly, keeping digital threads and strings intact. In fact, tech stack evolution should foster our fiercest competition and innovation. For example, the evolution from DevOps to DevSecOps provided security as an enterprise-wide service, a major leap forward in software development. But why stop there or wait on commercial industry for the next move? Every function that humans currently perform — whether test, air worthiness, safety, nuclear surety, anything! — may be partially or even fully automated aaS. Serial steps and functions may be streamlined and converged, informed by a single source of authoritative truth. GBSD and B-21 are effecting this vision, dubbed "**Dev*Ops**," where "*" represents the string of automated layers. Join forces with these digital rock *s to end the tyranny of real-world serial processes. When you own your lifecycle *Matrix*, remake it as you see fit. Enjoy the power of the "One."

1c. _FURNISH THE TECH STACK

Furnishing government infrastructure and tools to industry may seem counterintuitive at first (especially to industry) but the potential windfall is as huge as it is esoteric: continuum. When using the same government-approved tech stack, it becomes your evolving baseline, design review, cost basis, workflow manager, test point anchor, even authority to operate — allowing once-discrete activities to happen **continuously** without paper or human impediments. Sound like science fiction? GBSD is there today. If this is "science fact" for this mega, must-succeed nuclear program, it can be for anything else too, no matter its risk profile. But getting started is easier than you think. MBSE tools have lots of UX/UI baked in, and GBSD's entire toolset will be available enterprise wide — like a white rabbit for you to follow.

> ***"There's way too much information to decode the Matrix."***
> **_Cypher, *The Matrix* (1999)**

This will place a big burden on government teams to maintain large-scale infrastructure, data, certification processes, and training to enable these continuous design and cost reviews, manufacturing improvements, modernizations…continuous everything! However, the payoff of having a continuum of lifecycle activities — without the formerly-dreaded acquisition Agents Concurrency, Integration Risk, and Learning Curve (and others) rebooting our systems — is well worth undertaking the paradigm shift. Air Force Materiel Command and Air Force and Space Force writ large are already gearing up for the challenge!

To achieve the first principle of digital acquisition, we can no longer be great for government at IT: we must be just plain great.

2. _WARP FROM TECH STACK TO EDGE EFFORTLESSLY.

> ***"Tank, I need a pilot program for a B-212 helicopter."***
> **_Trinity, *The Matrix* (1999)**

Setting aside the ultimate cool factor of downloading martial arts or pilot skills directly to their brains, characters of *The Matrix* clearly trust remote code will run as advertised once downloaded. Looking around legacy military systems, this is a big trust!

Until recently, successfully running code in a remote development environment did not indicate it would run successfully on a jet or satellite (much less our brains!). B-2 Defense Management System is a poignant example of why lengthy regression testing and validation and verification were needed to operate safely at the edge. Containerization and Kubernetes (K8s) flips this script.

Containerization and Kubernetes enable the software components of your design "*Matrix*", providing a predictable coding environment that virtualizes everything your software needs to run: (i) compute, memory, storage, and networking required from operating systems; and (ii) runtimes and libraries required from applications. **The net result is *Matrix*-like "downloadability" at the edge!** If a container runs on your laptop, it runs on your jet, satellite, or weapon the exact same way: no regression testing, no serial validation and verification, nada. Both F-16 and B-21 have demonstrated precisely this!

The isolation and independence benefits of K8s open the door to a sci-fi future where we push code directly, and frequently, from developers to users at paces modern warfare will almost certainly demand. How long can code remain relevant against an AI-enabled adversary, anyway? Speaking of that, combining K8s with other technologies like secure service mesh, data threading, and zero trust finally opens the door to ubiquitous microservices and AI at our military's edge *at scale*.

AI may have enslaved humanity in *The Matrix*, but its real-world power and present Achilles heel — adversarial tactics — highly motivate battlefield implementation, but smartly, with risks warfighters understand. Otherwise, human-to-human OODA loops will be frozen and *pwned* by machine-to-machine adversaries capable of "dodging bullets" or worse.

_NEO: *"What are you trying to tell me, that I can dodge bullets?"* _MORPHEUS: *"No, Neo. …when you're ready, you won't have to."* _*The Matrix* (1999)

With OODA loops now tightening to knots beyond human involvement, streaming data management, algorithm training, and software design become all-important safeties and triggers for auto-firing our own digital magazine. Fortunately, K8s allows us to isolate safety-critical functions from mission-critical — making when, where, and how we use AI an operational choice unlimited by design. But to keep our digital magazine full, we must understand — and keep up with — these rapidly-evolving software technologies. We can get everything right in the base layers of the tech stack — cloudOne and platformOne — and still fail to get useable data, code, analytics, and AI to the edge — **where it matters** — if (i) our software development and deployment environments are not container-native now, and whatever comes after it in future; (ii) our data architecture, not designed for data streams and stream processing applications; (iii) our functions, applications, and services, not in scalable, enterprise-wide architectures rather than stovepipes; (iv) our networks and radios, not software-defined; and (v) our edge, not optimized for generalized compute and storage. There's a lot to get right for an IoT.mil!

But once we do, applying good DevSecOps principles — and innovating towards Dev*Ops — will warp software- and data-enabled "Kung Fu" right into our warfighters' hands.

To achieve the second principle of digital acquisition, "**Crawl. Run. Warp!**" is our new software motto — *crawl-to-run* via Dev*Ops and *run-to-warp* via the IoT.mil.

3. _*e*CREATE BEFORE YOU AVIATE

_NEO: *"This isn't real?"* _MORPHEUS: *"What is 'real'? How do you define 'real'? If you're talking about what you can feel…what you can taste and see, then 'real' is simply electrical signals interpreted by your brain."* _*The Matrix* (1999)

Now that you own your tech stack — ***shared*** across our Department, ***furnished*** to industry, with ***edge-warping*** software — it is finally time to build *e*Planes, *e*Satellites, *e*Weapons — *e*Anything! Done correctly, these electrical signals can be the true digital equivalent of your future physical system and its lifecycle: its digital twin and thread, respectively. But what does this look like in practice?

Let's use a real-life example where real lives depend on the answer: Formula 1 Racing. Highly competitive, this sport seeks every opportunity to gain even the slightest performance edge. What makes a car design fast enough to win is not simply answered. Aerodynamics, mass, engine torque, turn handling, even tire interaction with the road, all contribute as functions of speed and acceleration. Then there are driver preferences to consider, and the list goes on. You can see why teams historically do not know their true performance until their prototypes hit the track.

Today, there are no prototypes in Formula 1, not physical ones anyway. Every aspect of future cars — from parts and assembly; to the complicated physics of material interactions, engine combustion, and even tire deformation; to maintenance across a grueling racing season — is meticulously modeled. These models, interconnected from upfront supplier specs to backend logistics, form one digital thread. And this digital thread is used to *e*Create millions of *e*Cars in pursuit of a winning design.

Only one physical racecar is ever built — the final car — which hits the track only two weeks later. "Fly before you Buy" no longer exists in Formula 1: digital acquisition made it completely obsolete. Taking the hint from Morpheus, "…speed is still based on a world that is built on rules." Digitally recreate that world, and you can create, iterate, and eventually dominate its speed, as real-world checkered flags attest.

But the complexity of creating a *Matrix*-like digital thread for a high-performance military system is a daunting task; not all cutting-edge systems will be equal. For instance, integrating a new weapon on a well-understood digital jet will be much different from a hypersonic weapon with little real-world data to anchor its models. Following the simple catechism below can help you work through major considerations. Otherwise your digital labors might wake up to disappointing real world results (but hopefully not AI overlords!). A great example is the Department's first *e*Plane, the T-7A RedHawk, that demonstrated an unprecedented real-world learning-curve reduction — T1=T100! — using digital threads to both simplify and learn assembly digitally. I'll answer the catechism questions using T-7A for illustrative purposes.

(i) Have I represented all relevant design, performance, mission, production, test, cost, and sustainment aspects in a consistent digital thread with requisite digital program management functions?

- *T-7A: Yes. (If not, leverage future tools from MBSEaaS (courtesy of GBSD!) or add new ones if you require them. Accepting analog or disconnected models will cut your digital thread, glitch conclusions, and result in acquisition-as-usual déjà vu. Completing the digital thread should be the first phase of new programs. Subsequently using it for continuous activity and reviews is where the real magic happens.)*

(ii) What aspects should be optimized, leaned, or automated?

- *T-7A: Assembly time, cost, and design optimization.*

(iii) **What real-world changes does this require?**

- *T-7A: Better supplier tolerances and assembly practices for determinant assembly.*

(iv) **Can I first model and derisk them digitally?**

- *T-7A: Yes. ("Dodge this!" Learning Curve!)*

(v) **Can I then replicate the model in the real world without impactful artifacts?**

- *T-7A: Yes, once supplier tolerances match the model.*

(vi) **Is my software fully agile and environment independent?**

- *T-7A: Agile processes but not full containerization. (Cancel Ju Jitsu downloads for T-7A. ☹)*

(vii) **Thinking ahead, what architecture components should be open for future system modernization and sustainment competitions?**

- *T-7A: Training subsystems and other components.*

(viii) **What data rights ensure this?**

- *T-7A: Training system interfaces. (If you forget data rights, you're still a prisoner, "Coppertop". ☺)*

The first five questions cover digital engineering and management; the sixth, agile software; and the seventh and eighth, open architecture, all the members of the digital trinity. There is obviously significant decomposition work to turn these high-level answers into subsequent work breakdown structures, but starting here will help you understand your digital gaps and strategies to close them.

T-7A is not perfect across the board, neither must your program in order to reap huge benefits. Even a partial digital thread, alone, can be a game-changer if encapsulating major risks. Containerized software, alone, can give legacy systems new digital dominance. Open architecture, alone, can turn modernizing weapons systems into competition ecosystems. But the more members of the digital trinity you combine, the more power of digital acquisition you unlock. Like Neo, following Trinity (the digital one in our case) will eventually lead to superhero abilities.

Consequently, if it's traditionally difficult, expensive, or time-consuming, your digital acquisition strategy should seek to replace it altogether with a digitally-derisked alternative. In digital acquisition's overclocked reality, "Fail fast. Fail often." is on steroids: there is no reason not to attempt the impossible. Over 6 billion GBSD variants were digitally designed prior to selecting the one destined for the silos! This is the "*e*Create before you Aviate" paradigm crossing into Defense.

So the question is: "What's next?"

To achieve the third principle of digital acquisition, the digital lifecycle must become as real as the physical one, and then eventually, even more real. One day we should design particular eSystems and view "printing" them in reality as unnecessary, even wasteful, as printing electronic documents today.

IV. NGAD eSERIES EXAMPLE

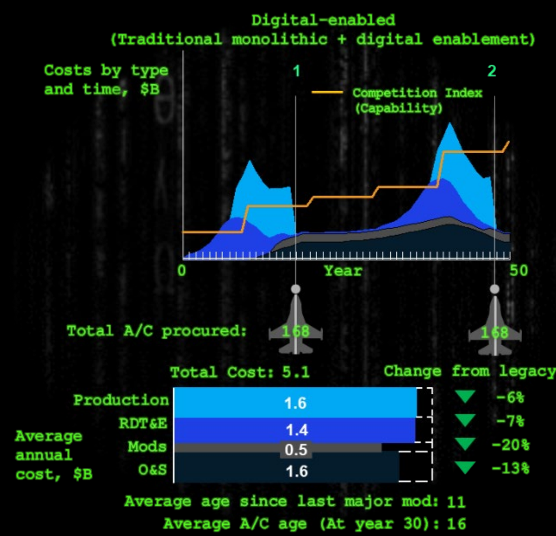
_BOY: *"Do not try to bend the spoon. That's impossible. Instead only try to realize the truth."* _NEO: *"What truth?"* _BOY: *"There is no spoon."* _*The Matrix* (1999)

Since generalities only go so far, let's consider a specific example of daring the impossible with digital acquisition: the **NGAD "Digital Century Series"** (or "**eSeries**" for short) attempt to increase the frequency of new military aircraft competitions. Taking on the Cold-War-era aircraft procurement system is a worthy showdown for this *Matrix* guide with many daunting Agent Smiths like Infrequent Competition, Industry "Buy-in-to-Win," and Sustainment-Dominated Costs. I hope other once-invincible acquisition Agents seem equally vulnerable to your digital skills once honed. Be bold!

As background, we're all aware U.S. military aviation has been collapsing for nearly 40 years. In the 1950s, over a dozen companies built spiraling supersonic fighters every 2-4 years, called the "Century Series," during a fiercely competitive period with the Soviet Union. In the 1970s, we still enjoyed 10 companies building fighters every 4 years. Today, we're down to 3 primes with innovation cycles now decades apart. A vicious circle, comprised of multiple locked-arm acquisition Agents, still drives this alarming trend (as shown).

The circle's origin (i.e., early computerization and integrated system-of-systems aircraft designs) was arguably unavoidable, even necessary, to win the Cold War, but it is a crippling millstone in the current competition with China.

Taking inspiration from the previous T-7A example, applying digital engineering and management would drop the cost of a notional fighter aircraft by 10 percent over a 30-year-lifecycle acquisition, with savings spread across production; research, development, test, and evaluation (RDT&E); and operations and sustainment (O&S) as shown.[2]



This digitally-enabled, but still legacy, approach would significantly lower average procurement unit cost (APUC) via mass production economies of scale. But it would not halt the vicious circle. And looking at the profile, there is still significant funding trapped in modernization and O&S, just waiting to become "new-new" warfighting capabilities instead of "new-old".[3] But to free it, **we must care more about Total Cost of Ownership than APUC**, which begs a broader question: when did optimizing for one color of money become more important than universally optimizing for all of them? Maybe we are in the *Matrix*…. ☺

Introducing smaller, iterative aircraft lots would lower bulk purchasing power (the con) while producing a higher Competitive Index[4] and healthier industrial base (the pro). Digital acquisition cannot defeat the laws of economics, so we must generate more modernization and sustainment savings than we lose RDT&E and procurement efficiencies. This is where the full power of applying the digital trinity must come into play.

[2] Notional example assumes a Primary Aircraft Available of 150.
[3] Conservatively assumes no sustainment costs until lots are operational.
[4] Combination of system and industry base capability, capacity, and readiness.

Digital Engineering and Management Strategy: Because smaller more-frequent aircraft lots are our stated objective, full digital threading is foundational — and non-negotiable — for all platform providers: (i) enabling continuous eDesign contracts for three vendors across awarded lots, (ii) lowering cost and time for production via determinant assembly, (iii) derisking government (vice industry) subsystem selections, and (iv) derisking component commonality required for easier fleet-wide sustainment.

What an apropos script flip for this movie-themed guide! Because of limited platform and mission system providers, eSeries cannot afford locked teaming relationships between primes and suppliers. Leveraging a shared tech stack, mission systems must be developed separately, with government teams selecting optimal system-platform pairs for all lots — making each platform a continuous competitive ecosystem where the latest tech can go on the latest jet (balancing cost and training impacts, of course). **Unlike the old paradigm, mission systems, vice platforms, now independently drive capability evolution**. Without the government owning and furnishing its digital tech stack, derisking integration and assembly would be virtually impossible (quite literally).

Agile Software Strategy: The *eSeries* software tech stack layers must be fully containerized to simplify integration challenges across vendors, share code across platforms, and compete mission apps separately from safety-critical code. No matter how fast eSeries spiral, *Matrix*-like "downloadability" is foundational for NGAD operational relevance in a future AI fight.

Open Architecture Strategy: To enable the "pilot's seat" role the government must play, the entire *eSeries* reference architecture, including all major interfaces, must be government-owned. Without this critical — though less-hyped — component, the other two elements of the trinity lose much of their power.

And NGAD is not alone, nor the first, with this digital trinity strategy: **GBSD takes that title**. But that program's impossible feat of overcoming unprecedented complexity procuring 634 ICBMs, 538 launch facilities, and 1,720 miles of cabling, etc., is harder to illuminate in a short guide. **NGAD already digitally engineering and flying a real-world, full-scale flight demonstrator** packs a pithier punch.

Leveraging NGAD's digital trinity, numerous trades were conducted in pursuit of affordable eSeries: fleet trades like design cycle timeline, number of aircraft per procurement lot, and total aircraft service life; competition trades like number of competing vendors and sub-vendors, incentive structures, and business cases, especially for companies not selected for production lots; and affordability trades like required system commonality between vendors, allowed aircraft variability between awarded lots, and workforce, facilities, and tooling sizing. Take away: digital acquisition does ***not*** put critical thinking in a Dev*Ops autopilot; it raises its bar significantly!

Of all trades conducted, the most important was the retirement age of each eSeries. Across today's Air Force, compounding sustainment costs — between 3 to 7 percent annually for planes 15 years or older — consume Air Force budgets: a thing alien to our 1950 Century Series forebears. Though not a computer-generated reality, its *Matrix*-like control over budget flexibility is worse than a sci-fi villain. Equal to it is the material nature of out-year maintenance issues themselves. Like the laws of economics, digital acquisition cannot defeat entropy and make old airframes new. Retiring old planes from future inventories is needed generally, but especially to afford more-frequent competitions.

Percent Total Cost of DCSs Compared to Traditional but Digitally Enabled Acquisition

Aircraft Release Cycle Cadence, Years (columns) / **Aircraft Operational Life, Years** (rows)

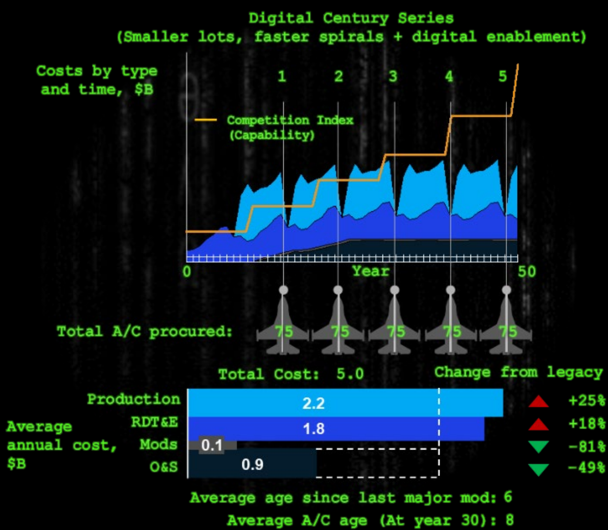
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
8	152	144	136	129																						
9	145	136	129	122	120																					
10	140	131	124	117	115	110																				
11	135	126	119	113	110	105	107																			
12	131	122	115	109	106	102	103	102																		
13	128	118	112	106	103	99	100	98	97																	
14	125	115	109	104	100	96	97	96	94	93																
15	122	112	106	101	97	94	94	93	92	91	92															
16	120	110	104	99	95	92	92	91	90	89	90	91														
17	117	108	102	97	93	90	90	89	89	88	88	89	90													
18	117	107	101	96	93	89	89	88	88	87	88	89	90	89												
19	116	106	100	96	92	89	89	88	88	87	87	88	89	89	88											
20	116	106	100	96	92	89	89	88	88	87	88	88	89	89	88	86										
21	116	106	100	95	92	89	89	88	88	87	87	88	88	89	88	86	85									
22	115	106	100	96	91	88	89	88	88	86	87	88	89	88	88	86	85	84								
23	115	105	100	95	91	89	89	87	88	86	87	87	88	88	87	86	85	84	84							
24	115	106	100	95	91	89	88	88	88	87	87	88	88	88	88	86	85	85	84	85						
25	115	106	100	96	92	89	89	88	88	87	87	87	88	88	88	87	85	85	85	85	86					
26	115	106	100	96	92	89	89	88	88	87	87	88	88	88	88	87	86	85	85	85	87	89				
27	115	105	100	96	92	89	89	88	88	87	87	88	88	89	88	87	86	86	86	86	87	89	91			
28	115	106	100	96	92	90	89	89	88	87	87	88	89	89	89	88	87	87	86	87	88	90	92	93		
29	116	106	100	96	93	90	89	88	89	88	88	88	89	90	89	88	87	87	87	87	89	91	92	94	96	
30	116	107	100	97	93	90	90	89	89	88	88	89	90	90	90	89	88	88	88	88	89	91	93	95	97	99

DCS more expensive
DCS close to parity
DCS less expensive

Trading aircraft operational life (rows) against *eSeries* frequency (columns) gives the trade space shown. The numbers in the array capture the percent cost of a particular eSeries when compared to those digitally-engineered but traditionally-acquired (e.g., a 30-year, T-7A-like acquisition). Most of the array is a better fiscal value than both legacy and digitally-enabled approaches — some as much as 25 percent! – indicating just how much twilight-year modernization and O&S really costs. But *eSeries* in the 7-8 year cycle range provide the rapid iterations needed to be more disruptive, rather than disrupted, against a capable adversary now that air power is again in flux, just like the original Century Series era.

Selecting the (16, 8) eSeries as an exemplar, spiraling nearly four times faster than traditional acquisitions, produces many interesting results, illustrated below.

Firstly, this notional eSeries awards lots of 75 aircraft every 8 years, as well as three ePlane design contracts for each future lot. This increases rate of competition, lowers the need for industry buy-in by maintaining steady design revenue; lowers the need for industry lock-ins by replacing, vice upgrading, aircraft; and provides a much healthier Competition Index.[5] It also cuts the average age of the fleet in half.



Secondly, it increases RDT&E and production costs by 25 and 18 percent, respectively, while annihilating modernization and sustainment costs by 79 and 49 percent but keeping total ownership cost equal to the previous (30,30) example. Assumptions obviously matter for these notional percentages. Assuming 2 unique plus 3 derivative aircraft lots (vice the 3 unique plus 2 derivative shown above) saves an additional 4 percent. Stretch those spirals to 10 years and the total cost drops another 6 percent.

<u>**But the bigger issue in question is which color of money should buy the next 50 years of air superiority**</u>. While lowering total ownership cost, digital acquisition ***also*** enables the choice of competition cadences that preference (i) development-heavy funding profiles, (ii) sustainment-heavy funding profiles, or (iii) somewhere in between. Which one is now a choice, afforded by today's digital technology.

[5] On average, planes are newer, more capable, and more maintainable with a more active industrial base. Primary Available Aircraft remains at 150 for comparison.

Norman Augustine, the American aerospace businessman and former Under Secretary of the Army, once quipped in his famous 1984 *Laws*: "In the year 2054, the entire defense budget will purchase just one aircraft." Based on the trend line through F-16, F-22, and F-35, he could be right. But the reason would not be the 2054 aircraft's sticker price per se, but all the dollars trapped in sustaining increasingly elderly fleets. Today's are the oldest on record.

Trying to stave off that future via mass production and low APUCs simply perpetuates the vicious circle and is just plain wrong given today's digital technology and threat imperative. Look at its effects on the past 50 years of aircraft procurement: infrequent but existential mega-programs; industrial "buy-in to win;" profit shift from platform "pediatrics" to "geriatrics," industrial lock-in to intellectual property; rise of the 70 percent modernization and sustainment profile; and, arguably, the driving force behind collapsing the defense industrial base into mega-primes. But we can prove Augustine wrong and break the vicious circle ***if*** we have the fortitude to pay more upfront until aircraft retirement savings kick in. The numbers speak for themselves. Long before smartphones, our military learned that cheaper device prices come coupled to longer locked-in service plans. "Pay for the device (red pill) or pay for the long-term plan (blue pill)" is now a strategic national security choice that will determine much about future military lethality, the industrial base that provides it, and which color of money primarily pays for it. Like *The Matrix*, which system of control is a choice left up to us.

Thankfully, digital acquisition ***finally*** gives us a true choice to wake up from the old system. We've been taking the blue pill for long enough!

VI. CONCLUSION.

I hope this Matrix-themed guide inspired you to enter the digital acquisition reality: **(1) own, share, and furnish the tech stack**; **(2) warp from tech stack to edge effortlessly**; and **(3) eCreate before you Aviate**.

This is what defense acquisition has been waiting for — a new paradigm, a digital one, that can wake up to a new reality for both taxpayers and warfighters. It's time to wake up!

***"I didn't come here to tell you how this is going to end. I came here to tell you how it's going to begin. … A world without rules and controls, without borders or boundaries. A world where anything is possible."* _Neo, *The Matrix* (1999)**