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Defying Gravity

25,000 miles per hour is fast - really fast. But that speed is necessary to defy the gravitational pull of the earth and reach space. At 75 times the speed of the fastest car and 33 times the speed of sound, defying gravity is hard - really hard. But not impossible.

Similarly, driving innovation and change in a large organization - let alone the largest organization on the planet, the Department of Defense - is hard, really hard. But not impossible. There are any number of forces at work in a large organization: friction, sand in the gears, the frozen middle, bureaucracy, tradition, culture, stovepipes, analysis paralysis, risk aversion, programming and budgeting, and so on. The System is generally set up to pull everyone and every idea down to the status quo. Driving change requires defying gravity.

Defying gravity can feel uncomfortable. There's fire, there's smoke, the ground shakes, airwaves ripple, and a million things happening simultaneously. To the untrained eye, it can look and feel like chaos, but it's controlled. And the results become nothing short of astonishing as the previously unimaginable becomes the possible.

I've spent the last 3 years defying gravity... and not just by launching satellites! It's been my honor to help our nation get desperately needed technology into the hands of our service members who place their lives on the line every day. Some of that technology was previously unimaginable before we developed new capabilities, and at other times it was previously unattainable – available commercially, yet beyond DoD's grasp. In every case, my team and I achieved meaningful change in defiance of a constant, powerful pull to the status quo.

Overcoming the impossible and making a real difference is in my DNA. I inherited this drive for innovation from my grandfather, now 101 years old, who showed his agility and ingenuity on the front lines of World War II by making planes without wings fly again. After being part of 2 tech start-ups, serving 5 Secretaries of Defense, and as a Johns Hopkins University Applied Physics Laboratory Executive, I got the call from DoD leadership in 2019 asking me to return to government and start a new office with a bold mission. I was moved and humbled by the opportunity to start what could become a revolution of innovation. So, I signed on for a 2-year journey and last year agreed to extend that journey for a 3rd year. The time has now come to pass the baton.

It's been an honor to serve as the first Department-level Chief Architect Officer in the Federal Government and as the founding Chief Architect Officer of the Department of the U.S. Space Force and U.S. Air Force. Over the last 3 years it's been my privilege to oversee the architecture of over $70 billion of Space Force and Air Force research, development, and acquisition programs, sit at the nexus of Force Design and Capability Acquisition, grow teams of supremely talented individuals, and accelerate innovation, adaptability, and commercial practices across the Department for our operators. Nothing is more satisfying to me than delivering much needed technology into our operators' hands.

All this seemed impossible, however, when I arrived on Day 1. Not unsurprisingly to anyone who has worked for or with the Government before, I arrived to find no budget, no authority, no alignment of vision, no people, no computers, no networks, a leaky ceiling, even a broken curtain. You get the picture. Sadly, I was probably better off than most who show up to serve. I at least wasn't surprised; I'd been here before. Intentions and aspirations often masquerade as reality. So, on top of solving extensive technology problems across the Department, it was clear that I'd also have to overcome a number of institutional problems, both for the team and coalition I would build and for the Space Force and Air Force as a whole. Ironically as I'm writing this, I received notification that the phone lines are down at the Pentagon IT help desk. Phone lines are down? It's 2022, folks.

Some have asked what my playbook for success has been over these last 3 years. I've been a bit coy on that because I knew that if I revealed the plays ahead of time, the bureaucratic forces of nature would be energized to reject the potential of innovation at every turn. But I believe in passing the baton. So, as I move on to new adventures, I leave you with my Four Key Steps to defying gravity in DoD – and examples of how I applied each - to fight the beast of bureaucracy. The steps aren't necessarily earth-shattering, but the execution and impact of them are: 1) Shock the System, 2) Flip the Acquisition Script, 3) Just Deliver Already, and 4) Slay the Valley of Death and Scale.

Step 1: Shock the System

Resuscitating the World's Largest Bureaucracy with Silicon Valley Mentality and Capability

A Congressional Staff Member once told me: "You're like the SpaceX of DoD." By the time the Government manages to produce something, it's too often obsolete; no business would ever survive this way, nor should it. Following a commercial approach, just like SpaceX, allowed me to accomplish a number of "firsts" in DoD in under 2 years; some unclassified examples include:

- First dramatic reduction in kill chain timelines for a critical defense mission, from 16 minutes to 16 seconds.
- First shoot-down of a cruise missile by a ground-based gun, using a new lower cost ground-based hypervelocity projectile in concert with 5G networks and AI.
- First seamless integration of data from 10 commercial satellite companies, creating insights as if one integrated commercial constellation.
- First secure, low probability of intercept communications capability for our 2 premier 5th generation fighters (F-22 and F-35), solving a decades-old embarrassing interoperability black-eye that they couldn't directly talk to each other in their native languages.
- First use of proliferated low earth orbit (LEO) commercial satellite communications (SATCOM) into a DoD-wide operational experiment with secure, classified data.
- First deployment (outside the Special Operations Community) of Artificial Intelligence algorithms into military operational tool chains in Europe and U.S. Cyber Command.
- First and largest joint force experiment that directly catalyzed the #1 DoD modernization prioritization, Joint All-Domain Command and Control (JADC2); with 70 commercial

teams, 65 government units, 40 types of platforms, 30 geographic locations, 6 Services, 4 national test ranges, and 2 Combatant Commanders.

- First employment of U.S. Space Command as the supported Commander (rather than supporting) in a joint exercise, proactively preparing the military for the changing landscape in space which sadly has proven prescient in recent events: Russia's anti-satellite test in 2021 and jamming during their unprovoked invasion of Ukraine in 2022.
- First autonomous cross-cuing algorithm that automated tasking directly across sensors in space, in the air, and on the ground.
- First development and employment of commercial cloud hosted software for operational and tactical Command and Control of a complex multi-domain fight.
- First integration of 4 Combatant Commanders across the globe into a single Common Operating Picture.
- First transformation of an airborne tanker from a single mission platform into a triple-threat platform: refueler, communications relay and translation node, and airborne edge battle management center –a 3x potential return on investment.
- First real-time DoD Command and Control of a commercial launch to replenish satellites in space.
- First scaled, secure deployment of Enterprise Zero Trust for mobile computing that enabled 1000s of employees to safely conduct classified work – while on the move - in locations around the globe.
- First integration of interoperable communications and employment of autonomous air vehicles alongside fighters, leading to the Next Generation Air Dominance (NGAD) family of systems concept.
- First collaborative continuous Authority-to-Operative DevSecOps software development environment in DoD, the All-Domain Common Environment, in partnership with the DAF Chief Software Officer and Cyber Authorizing Official.
- First deployment and fielding of operational SpaceX Starlink communications for secure, classified communications on the edge and on the move.

Step 2: Flip the Acquisition Script

Building a New DoD Acquisition Operating System: Forget Reforming, We Need Reformatting

I naively thought that resuscitating DoD with innovation and speed, solving decades-old unsolvable problems, and getting the warfighter tech they needed and loved would be enough. If I could just show that "it really can be done" and get enough operators and acquisition professionals energized and focused, then the rest of The System would fall into place. However, gravity is a powerful force; structural change is required. There have been many attempts at reforming DoD, and every Administration brings good ideas that improve the margins. However, to borrow an analogy from the Personal Computer world, DoD suffers from an acquisition "blue screen of death" that requires more of a repair of the proverbial DoD hard drive, not simply a rebooting. Here are a few structural changes that I made over the last 3 years. These only begin to flip the script. Much more must be done if DoD is going to regrow its thinning technological edge.

- **Commercial First**. DoD loves to build things from scratch. This makes sense if there's no commercial market. But if a commercial technology is available that could meet the need, why reinvent the wheel and risk delays or even failure? Pushing the system to flip this mentality and go commercial first meant I integrated capability faster and rode the wave of massive commercial investment, commercial "modernization," and lower costs due to amortization. I've achieved significant gains the last 3 years by flipping this equation, and if others do the same, this is one of the largest relatively untapped levers of our time.
- **Enterprise Contracting**. I created a macro enterprise Joint All-Domain Command and Control (JADC2) contract approach with 130+ companies and counting, broad scope, and a ceiling of $1 billion each, allowing rapid, flexible task awards – slashing months off award timelines, baking in contract agility more closely aligned to the speed of technology and learning, and avoiding countless wasted efforts that would normally have been spent on 100s of siloed contracts. If leveraged effectively, this will have a massive impact on DoD's ability to move at speed and scale.
- **Product Focus.** I developed 2 new (for government) roles, Product Lead and Product Portfolio Lead. Normally our programs are run by highly talented Program Managers or "Materiel Leaders" that are trained to laser in on the acquisition process and critical elements like cost, schedule, and performance. Missing was a Product Lead with the operational (customer) and technical (developer) understanding who wakes up every morning ready to make the product even better. The Product Portfolio Lead does the same thing for an ecosystem of capabilities and sets up new pipelines of Research and Development or new commercial partnerships to prepare the next version of a Product or a new Product altogether. The result is a proper ordering: Outcome moves to the foreground and Process to the background as a critical enabler.
- **Finding Talent.** Typically, the government assigns new programs based on organizational titles. If the talent is there then this works, but that's not always the case. As we acquire more families of systems and less single systems, this is increasingly an issue. I created a better approach. When I had a problem with no clear fit for the solution, I ran a "contest" open to everyone in the Department where they would present how they would solve specific operational and technical problems. This contest was open to acquisition and research professionals as well as operators from the Commands. Tactically, I got some amazing ideas from the process, but the real motivation was to find talent trapped in the woodwork that could be matrixed into "virtual program offices." It was highly successful. Now the approach needs to scale.
- **Leveraged Investment**. I helped flip the thinking from simply acquiring widgets to investing in outcomes. An investment approach means that you can directly buy or build systems toward your investment thesis, but you can also leverage your resources to get outside capital for even greater return. Leveraging someone else's money is not a new idea, even in government. But it was a new idea to leverage private and venture capital. When I helped the Assistant Secretary stand up what has become AFWERX, AFVentures, and SPACEWERX, we achieved 5x or more investment for every dollar we put in. Not only is this financially game-changing it also means we are strengthening our fragile innovation base.

- **Relentless Focus.** Too often it takes a crisis to move the mountain of large bureaucracies. When there's a crisis we focus, set aside differences, have a common goal, cut out the noise, have time urgency, etc. When there's a crisis we have a window of innovation, but what about when there's not a crisis? To focus the bureaucracy and large numbers of commercial partners on iterative development and delivery at scale and speed, I created a new concept - large-scale experiments led by a Combatant Commander with complex operations conducted at a fixed, stressing cadence that required constant delivery and drive. Every military and commercial team pushed hard, and every bureaucratic obstacle or red tape became a target to knock down because everyone knew the eyes of all the Department of Defense would be watching the execution and seeing bold bets and creative approaches. No one wanted to fail because they weren't prepared or they weren't leaning forward. Instead, everyone was motivated by a common goal, noise was cut out, and time was of the essence, and we defied gravity, achieving breakthrough after breakthrough. This strategy alone accounted for more progress and innovation breakthroughs in 1 year than has happened in a long time. If DoD adopts and scales this approach, watch and be amazed at what can happen.

Step 3: Just Deliver Already
Fielding Increasingly Capable Solutions Now, Not Failed or Irrelevant Programs Later

Once I had extensive pipelines into a broad commercial innovation base (Step 1) of demonstrated technology and new structural approaches (Step 2) in place, I needed to show how to quickly procure and field authorized and operationally-ready capabilities that could evolve as technology and adversaries progress – and break the mold of the 10+ year acquisition horizon that gravity pulls everyone toward. The following are a few examples.

- **Global Pandemic Emergency.** As DoD surged to support the national response to COVID-19 with medical professionals, the situation on the ground at COVID hot spots was changing so rapidly that the traditional approach of phone calls, echelon unit reporting, and powerpoint was too slow to keep up. The uncertainty also created health risks for our troops on the ground without the ability to track each individual and the state of who was being treated and their own personal protective gear. The government also found itself in reactive mode against the virus' spread and desperately needed to be proactive to save lives. So, in partnership with U.S. Northern Command I worked to deploy mobile devices for the first time to all our personnel on the front lines of the COVID fight and pushed software over-the-air to aggregate data from commercial sources as well as multiple government agencies. Ultimately, we built perhaps the most comprehensive data environment in the country at the time. This kept our forces safe and ready and enabled real-time reporting, but we also leveraged that data to develop Artificial Intelligence algorithms to judge where new "hotspots" might occur to preposition forces to augment hospitals. And, we did this in under 60 days, not years.
- **The Future of Work**. When COVID-19 hit and much of the national security community became paralyzed without the ability to perform daily functions from home, I didn't skip a beat nor wait for direction. I pulled a team together across the globe and across DoD

as well as in industry to develop, accredit, and deploy the first Zero Trust, secure, scalable solution to enable the workforce to perform classified operations and processing from anywhere (even on the move!) over commercial pathways like cellular and WIFI with as much capability as in the office. I led the team to accomplish this in just four weeks, not years, and scaled to 1000s of sustained users and now multiple data centers across the globe

- **Distributed Basing and Agile Combat Employment.** When Russia invaded Ukraine this year, public reporting stated Russian forces almost immediately lost their ability to communicate securely, forcing them to choose to either call on open lines or stop talking altogether. The U.S. must not place our forces in the same predicament. We have to operate on the edge in disrupted and disadvantaged locations, yet our capabilities are too low rate, fragile, and tied to fixed locations that are vulnerable to attacks. Instead, we need mobile, global, resilient, reliable communications that securely provide voice, video, and data as needed over a software-defined cyber-secure network. So, I built an architecture called the Integrated Warfighting Network (IWN) Edge Connect, that solves these problems. IWN Edge Connect Tranche 1 is on track to for delivery to Indo-Pacific Command this summer - in 6 months, not years – with an immediate path to scale across the entire Space Force and Air Force and integrate all Space, Airborne, and Terrestrial transport into a ubiquitous all-domain fabric.

Step 4: Slay the Valley of Death and Scale

Incubating Mission-Driven Programs that Create Pathways to Transition Technologies at Scale

One might think fielding needed technology is enough, but in DoD to have impact at scale under current policies and authorities, you must reshape "Big A Acquisition" and move technology, even fielded technology, across the so-called "valley of death" into what DoD calls programs. So, I fostered cross-cutting approaches that enabled scale and efficiency and incubated ideas into programs, securing billion-dollar budgets and buy-in across DoD, the White House, and Congress. Along the path to the following "wins," I and my team suffered many bureaucratic battle scars, but we defeated gravity and that means our warfighters won.

- **Open Architecture.** I created the first Department-level Space Force and Air Force integrated architecture. Previously, there had been no Department- or Service-wide technical architecture nor technical plan for how platforms could and should work together as an integrated ecosystem. I found that absence scary. After all, we certainly don't want to wait until we're in combat to find out how things work together when it's too late. The paradigm shift to an Open and Integrated Architecture allows platforms to be increasingly interoperable and internally modular and adaptable and inherently designed to scale up more quickly.
- **Open Standards**. I reversed the long government tradition of developing DoD-unique interfaces without common standards, and instead required in priority: (1) commercial standards that allow flexibility, adaptability, and faster adoption of capabilities; (2) Government Open Standards or modified standards; (3) development of new Government Standards that benefit the enterprise; (4) unique solutions. This change is

essential to keep and/or reclaim America's technology edge. It's common sense yet feels more like a tectonic shift in DoD to simply leverage what's out there.

- **Space.** I propelled increasing recognition and investments in space, leveraging key insights learned when I co-led a National Space Exercise for the Vice President of the United States and Cabinet Secretaries on the future challenges and opportunities that were at our doorstep in light of the growing nexus of national security, civil, and commercial space capabilities. These insights, on top of technical analysis and architectural opportunities, helped push our space investments up by 40% this coming year, from $18B to $25B in order to begin to scale-up the potential of space. It's a start, but not enough.
- **Next Generation Air Dominance (NGAD):** I helped the Assistant Secretary of the Air Force transform the NGAD strategy from simply buying yet-a-new-fighter jet into an Open Architecture approach that can enable technology adaptability over time as well as the opportunity for the pilot to act as quarterback of a team of autonomous aircraft. If done right, this family of systems enabled by communications, autonomy, and AI would bring a dramatic and necessary paradigm shift to air combat – just like the shift I led in Long Range Strike when I started the B-21 program and its Family of Systems for Secretary of Defense Bob Gates. This approach is moving the Department from buying another program to investing in an integrated portfolio.
- **Joint All-Domain Command Control (JADC2) and Advanced Battle Management System (ABMS)**: I co-founded the JADC2 concept and incubated ABMS from an initial idea to a $4 billion program in under 12 months, with exponential increases in annual resources but without the multi-year delay that plagues every other new program. I and my team delivered and transitioned numerous operational warfighting capabilities from the commercial and national security sectors. I drove focus, speed, and fielding through Operational Commander-led experiments that pushed more technology into the defense ecosystem faster than any other recent approach. I worked with the Assistant Secretary for Acquisition to transition to a long-term approach by setting up a Program Executive Office to execute ABMS at scale when most programs would only be halfway through an analysis phase in that same amount of time. My JADC2 Architecture continues to drive development of capabilities across DoD in technology areas such as: (1) Connectivity and Communications, (2) Secure Processing and Digital Infrastructure, (3) Data Orchestration and Streaming, (4) DevSecOps and Artificial Intelligence, and (5) Sensor and Weapon Integration. This architecture quickly became the basis of the U.S. Army's approach to JADC2 and later the Department of Defense JADC2 Architecture.
- **Commercial Scale**. Over the last 3 years I made significant progress in partnering with start-ups and venture firms, onboarding 100s of companies that wanted to contribute to national security; many never had before. This is great news; however, a word of caution. To ensure these successes don't die on the vine, DoD has to remember that all the "WERX" initiatives across DoD are built on a promise of trust that there's actually something of consequence at the end of the rainbow other than just more innovation initiatives. I believe if DoD gets this one wrong and loses the heart of America's booming innovation base, it will result in some of the most devastating long-term strategic consequences we've seen in a long time.

I would not have been able to achieve those 4 Steps without steadfast trust, partnership, and leadership from the very top over the last 3 years: Deputy Secretary of Defense David Norquist and Kathleen Hicks; Vice Chairman of the Joint Chiefs John Hyten; Secretary of the Air Force Heather Wilson, Barbara Barrett, and Frank Kendall; Chief of Space Operations General Raymond; Chief of Staff of the Air Force General David Goldfein and General CQ Brown; and Assistant Secretary of the Air Force for Acquisition, Technology and Logistics, Will Roper and Andrew Hunter. I – and many others - are grateful to each of them for their dedication to our nation, for making the delivery of desperately needed capabilities to our people a critical priority, and for their trust in me and my team to allow the freedom of maneuver to accelerate at speed and scale.

Ultimately, my team and I proved that we can defy gravity and change can happen – even at the largest employer in the galaxy and even with small but highly capable teams. But, we shouldn't be satisfied. We need this kind of progress at scale. And we need it now, not tomorrow. Or it will be too late. So let's be careful to not:

- Lull ourselves into complacency, when we should be running on all cylinders.
- Distract ourselves with process, when we should be focused on delivering product.
- Compete with each other, when we should be competing with China.
- Defend our turf, when we should be defending our country.
- Focus on input metrics, when we should be focused on output metrics.
- Reinvent the wheel, when we should be leveraging each other.
- Blame someone else, when we should be working on the same team.
- Do things the same way, when we should be doing things better.
- Buy the same things, when we should be buying what we need.
- Be comfortable with the way things are, when we should be fighting for the way things should be.

Don't let it happen.

Thank you to the amazing Chief Architect Office Team. You are truly an inspiring and talented cross-disciplinary team of warfighters, engineers, and acquisition professionals - the best in the business. Thank you to everyone across the Department that partnered to make all of this happen; you should be very proud. I may have helped set vision, create opportunities, and bust down barriers, but you defied gravity and unlocked untapped creativity and potential. Our nation is grateful to each of you, and I am grateful for you.

Keep on defying gravity and accelerating needed change!

Preston Dunlap
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