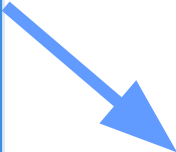


CEDAR Distinguished Lecture

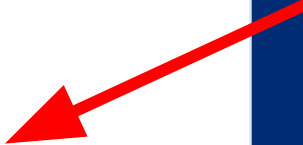
Choose your own adventure

Larry J. Paxton

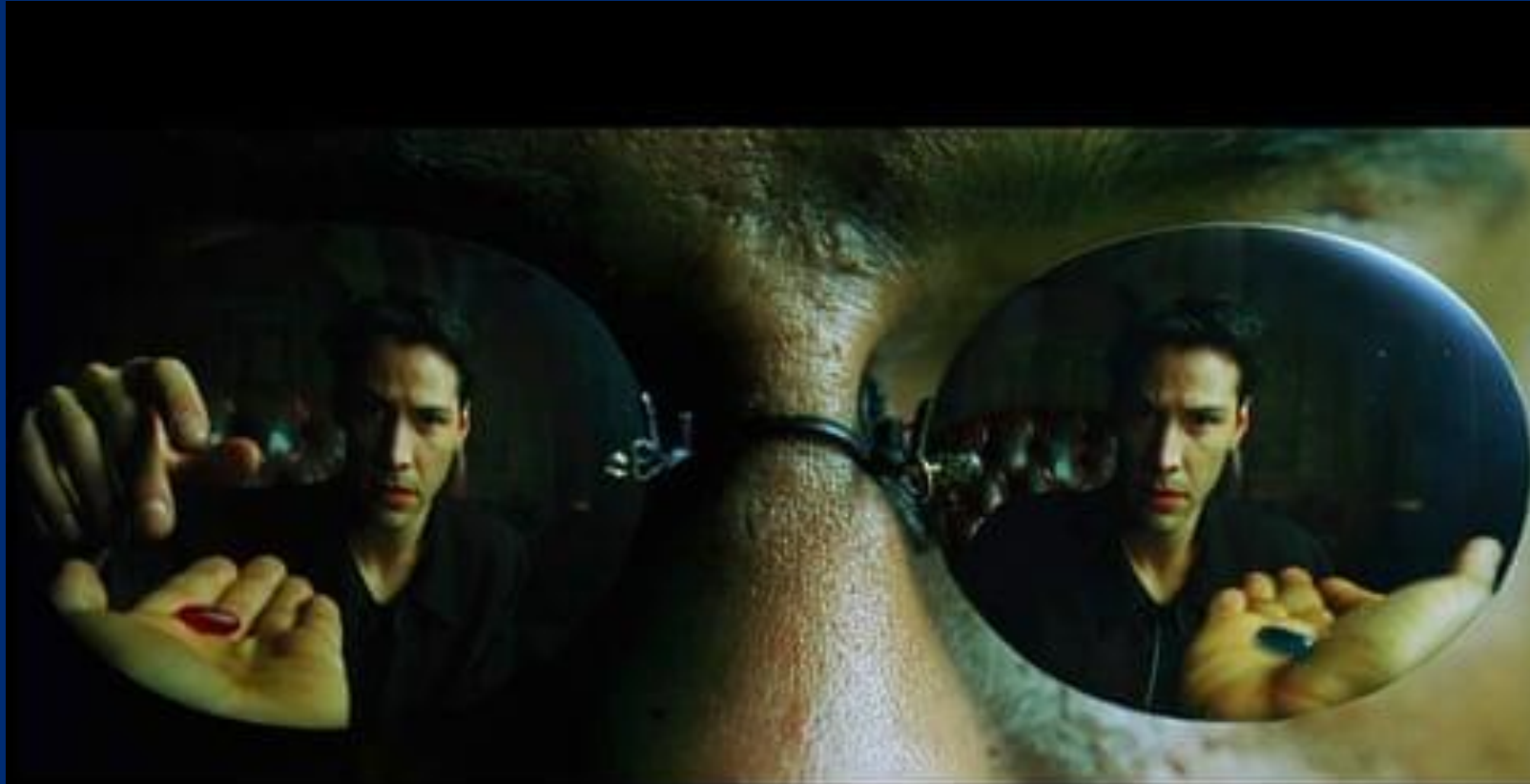
Your nomination letter highlighted your seminal and sustained contributions to CEDAR science through pioneering ultraviolet remote sensing of the ionosphere–thermosphere system, transformative space-based instrumentation, and the development of observational datasets and models that have fundamentally advanced our understanding of thermospheric composition, auroral energy input, and equatorial plasma structures.



It also emphasized your exceptional leadership and service to the community, your role in enabling major scientific advances through experimental innovation, and your long-standing commitment to mentoring and workforce development



Red Pill or Blue Pill?



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.

Morpheus [The Matrix](#)

DISCLAIMER:

- This is meant in the context of the 1999 movie *The Matrix*
 - First appeared in *Total Recall* (1990) with the red pill meaning a return to reality.
 - https://en.wikipedia.org/wiki/Red_pill_and_blue_pill
 - see also Philip K. Dick's story "We Can Remember It for You Wholesale"
 - https://en.wikipedia.org/wiki/We_Can_Remember_It_for_You_Wholesale
 - Taking the 'red pill' means becoming aware of a truth about reality that can be upsetting
 - Taking the 'blue pill' is choosing to continue along your current path without looking beyond it.
 - In this context, it does not mean or imply a shift from liberal/progressive beliefs to extremist viewpoints.
 - See 'pill' description at the ADL website or wikipedia
- Most importantly: be genuine, be true to yourself, believe in your intrinsic worth

Transforming CEDAR and your career

Some thoughts on my own career, life as a human, and the realities of the world

Larry J. Paxton

Experience is the best teacher (not quite)

- PhD at University of Colorado Boulder with a thesis on observations of atomic carbon in the Venus thermosphere, hot atoms, the exosphere and the nightside Venus aurora.
- As a postdoc/civil servant at Naval Research Laboratory doing Venus, Earth and Mars remote sensing, the post nuclear environment, and the development of extremely complex data management systems.
- Joined APL to develop and fly the DMSP Special Sensor Ultraviolet Spectrographic Imager; 5 were built and four were flown. In 1994 SSUSI was updated to create TIMED's Global Ultraviolet Imager (GUVI).
- Chief Scientist for the Midcourse Space Experiment's UVISI instrument suite (4 imagers, 5 hyperspectral imagers) spanning 115nm to 900nm. Worked with Delta 180, 181, and 183 programs.
- Worked with Congress to develop messaging for dual-use applications.
- Sounding rocket and Space Shuttle observations.
- VLEO flight, hypersonics, and (many) missions.

Variety is the best teacher (still not quite)

- 1 patent and 16+ provisional patents/invention disclosures.
- APL has recognized with the APL Spin-off Award for transitioning innovation to funded programs; National Security Space & Civil Space Development Synergy Award; as well as being nominated for APL Invention of the Year several times; nominated for Tech Transfer paper of the Year, and being named Innovation of the Year.
 - APL has nearly 10,000 employees.
 - 3 Publication of the Year Awards from APL.
- PI for two NASA Institute for Advanced Concepts (NAIC) awards; a study of new modalities for data and sensor design for geosynchronous Earth Observing satellites and another for AI-enable robotic exploration of the Moon, with a focus on location of water in permanently shadowed regions.

Other people are the best teacher

- Elected Member of the **International Academy of Astronautics**. The **International Astronautical Federation** Distinguished Service Award.
 - Developed the Small Satellites for Earth Observation, Knowledge Management and Integrated Applications programs at the **International Astronautical Congress**.
- Aeronomy Secretary, Vice President and President of the **AGU Space Physics and Aeronomy Section**, member of the **National Academies Space Studies Board**, and on over 20 National Academies panels and working groups.
 - 40+ AGU sessions
- Served on the **CEDAR CSSP**.
- Member of an AIAA Technical Committee and has been an invited participant in DoD and commercial innovation symposia.
- Many other sessions COSPAR, AOGS, etc.
- Session at Fall 2026 AGU

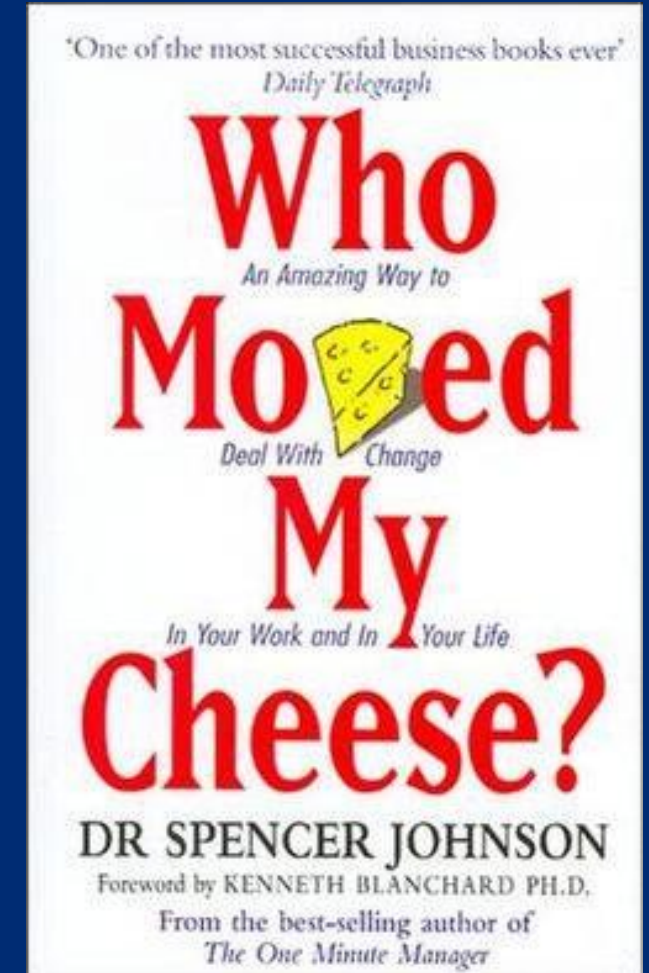
I will be telling you stories that I find relevant to my life and that might be useful to you

- I believe we, as a community, need to change how we think about what we do, how we convey value, and how we grow in our scope and impact.
- Success is not guaranteed – accepting that is hard
- There are always exogenous factors that affect what happens to you.
 - It is not what happens to you that defines you, it is how you react – Epictetus *The Enchiridion*.
 - Act with justice, kindness, and integrity, regardless of how others behave. - Marcus Aurelius *Meditations*
 - Remember that all things change, fade, and are ultimately forgotten. - Marcus Aurelius *Meditations*
 - Success is as dangerous as failure. *The Tao Te Ching*

Where do you want to go?

- **Remember, you are not alone.** For thousands of years, people have lived in turbulent times.
- People have developed ways to cope with the world and find meaning in a life that was marked by tragedy, danger, privation and the the lack of security in their person, their possessions, as well as food and water.
 - Remember where you came from
- **You are not what you did for your thesis; you are not what you are doing today.** Everyone of you has achieved extraordinary things. Everyone here can do extraordinary things.

Overcoming doubt and fear, accepting risk, living with uncertainty – heroic, stoic virtues.



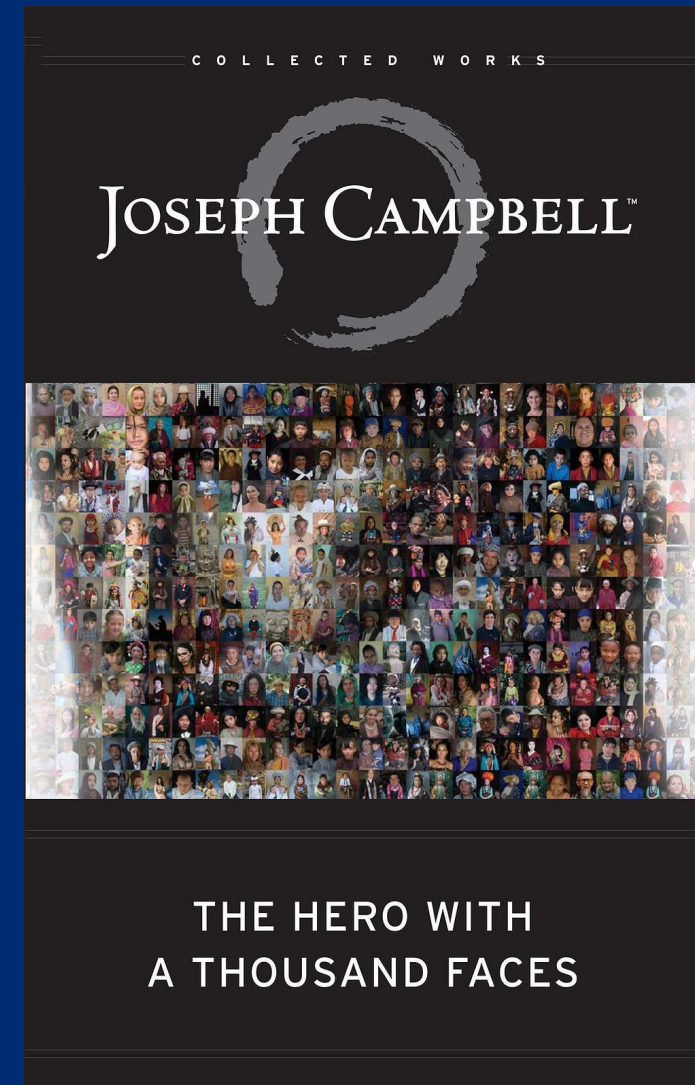
https://en.wikipedia.org/wiki/Who_Moved_My_Cheese%3F

There are lessons to be learned from “The Hero’s Journey”

- Joseph Campbell (1949) introduced the concept of the Hero’s Journey in *The Hero With a Thousand Faces* :
<https://www.jcf.org/learn/joseph-campbell-heros-journey>
- Myths show a common structure:
 - an inciting incident
 - crisis
 - transformation and a new life
- Today we are all faced with the Hero’s Journey
 - The hero is pulled from the usual world into the unknown
 - The hero faces a series of trials, meets the new challenges and achieves a real transformation
 - The hero takes their place in the world, bringing new hope, wisdom and meaning

“Whether I shall turn out to be the hero of my own life, or whether that station will be held by anybody else, these pages must show.”

Charles Dickens (1812-1870), *David Copperfield* (1848-1850)



There are lessons to be learned from “The Hero’s Journey”

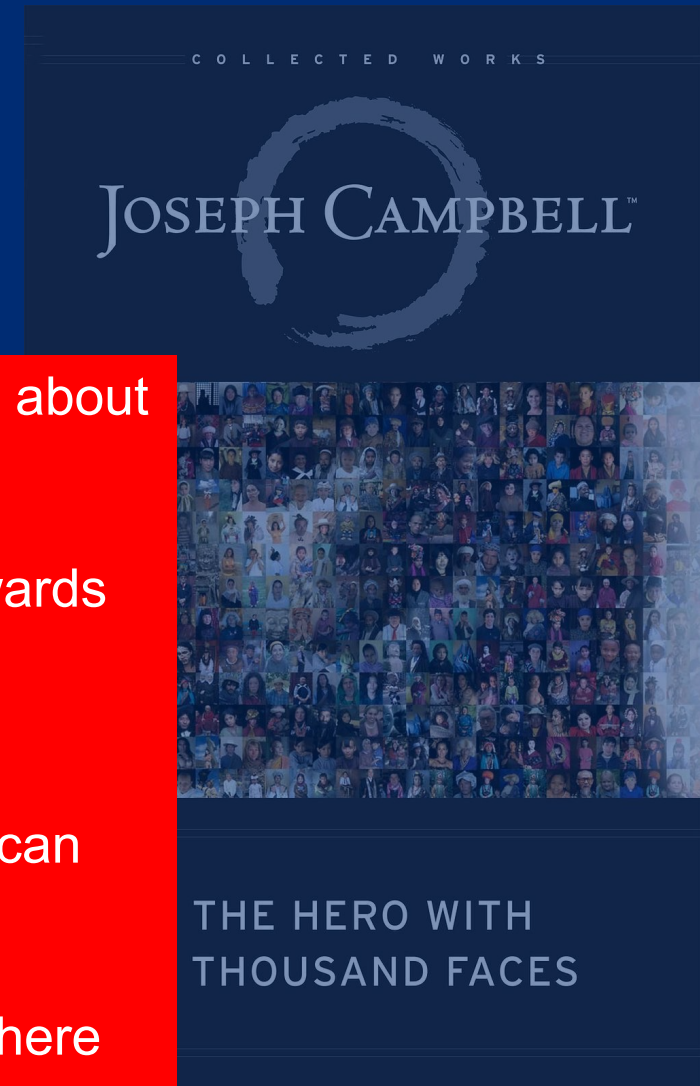
- Joseph Campbell (1949) introduced the concept of the Hero’s Journey in *The Hero With a Thousand Faces* : <http://www.josephcampbell.org/>

Myths and stories survive because they convey universal truths about the human experience.

- My

If you choose to change what you are doing there are great rewards possible but it can be difficult

- science is hard
- science is discovery not iteration
- science is a contact sport – and you can be bruised but you can survive and flourish
- trust in your skills and believe in yourself
- you have already completed one “hero’s journey” just to get here to CEDAR



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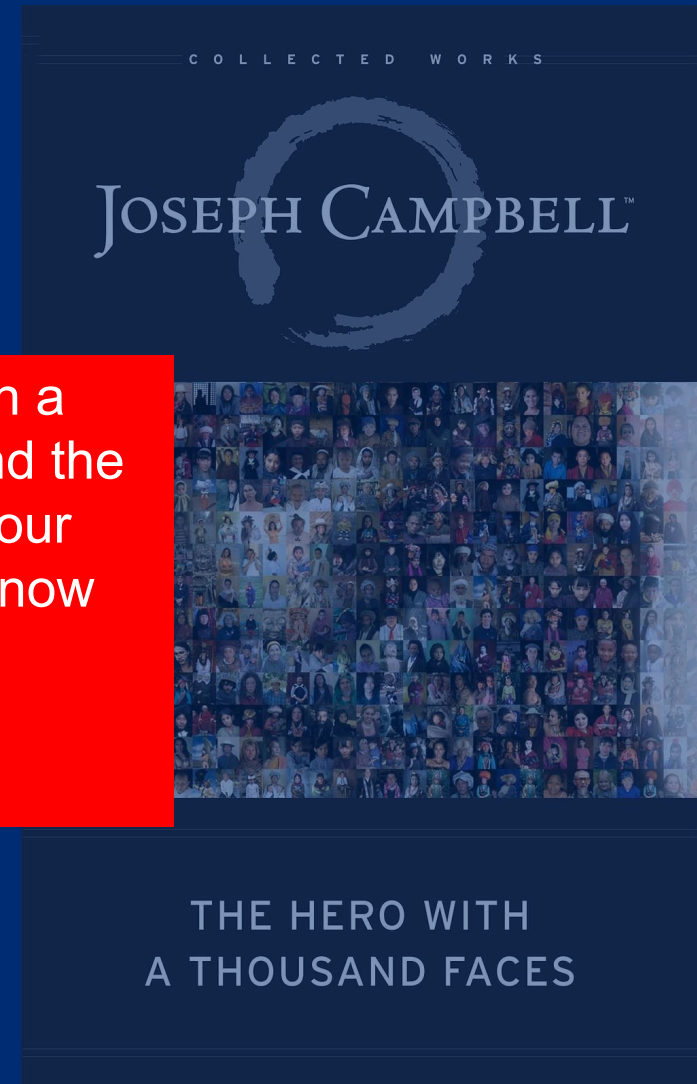
<http://www.jcf.org/>

- My bliss and don't be afraid, and doors will open where you didn't know they were going to be.”

Joseph Campbell

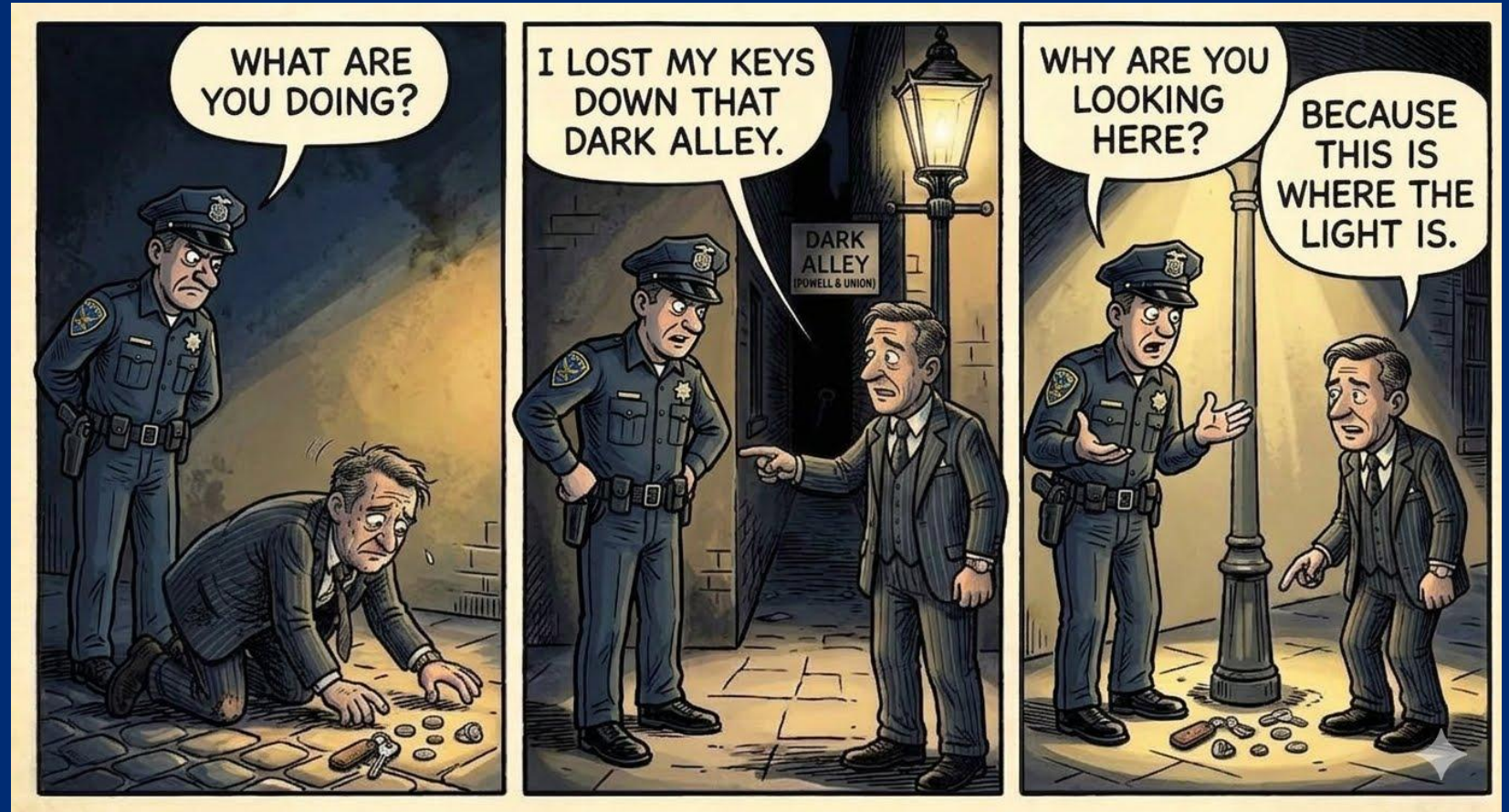
- To <https://www.jcf.org/learn/joseph-campbell-follow-your-bliss>

- The hero is pulled from the usual world into the unknown
- The hero faces a series of trials, meets the new challenges and achieves a real transformation
- The hero takes their place in the old world, bringing hope, wisdom and meaning



The first step in the hero's journey is to leave the 'Ordinary World'

- Our science is focused on small problems
- This is driven by small grants
- Which are driven by sponsor budgets
- Which are driven by politics
- Which is driven by 'value statements'



<https://quoteinvestigator.com/>

1989, Classic Tales of Mulla Nasreddin, Retold by Houman Farzad, Translated from Persian by Diane L. Wilcox, Looking for the Missing Ring, Quote Page v, Mazda Publishers, Costa Mesa, California -- might be over 800 years old.



CHALLENGE : Change from a ‘scarcity mindset’ to an ‘abundance mindset’

- An abundance mindset is the belief that there are always resources and opportunities if you open your acceptance criteria, while a scarcity mindset is the belief that life is a zero-sum game with limited resources
- Stephen Covey , *Seven Habits of Highly Effective People*

	Scarcity Mindset
Core Belief	Life is a zero-sum game
Central Question	What is missing, lost, or unavailable?
Others	Fear, envy, suspicion, and the belief that to succeed others must fail.
Time Horizon	Short-term survival and energy spent on restricting opportunities for others and gaining access to restricted opportunities

CHALLENGE : Change from a ‘scarcity mindset’ to an ‘abundance mindset’

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	Scarcity Mindset	Abundance Mindset
Core Belief	Life is a zero-sum game	Life is abundant in its possibilities
Central Question	What is missing, lost, or unavailable?	What is available, possible, and might be created?
Others	Fear, envy, suspicion, and the belief that to succeed others must fail.	Recognize that you are valuable as are others, collaboration succeeds, success comes in many forms and timescales
Time Horizon	Short-term survival and energy spent on restricting opportunities for others and gaining access to restricted opportunities	Long-term growth, learning, and investment in others by creating opportunities.

Abundance Mindset



Transformative Abundance Mindset and Practicing Gratitude



The person that has lost their keys has many options beyond looking where there is no hope:

Rideshares.

Asking for help.

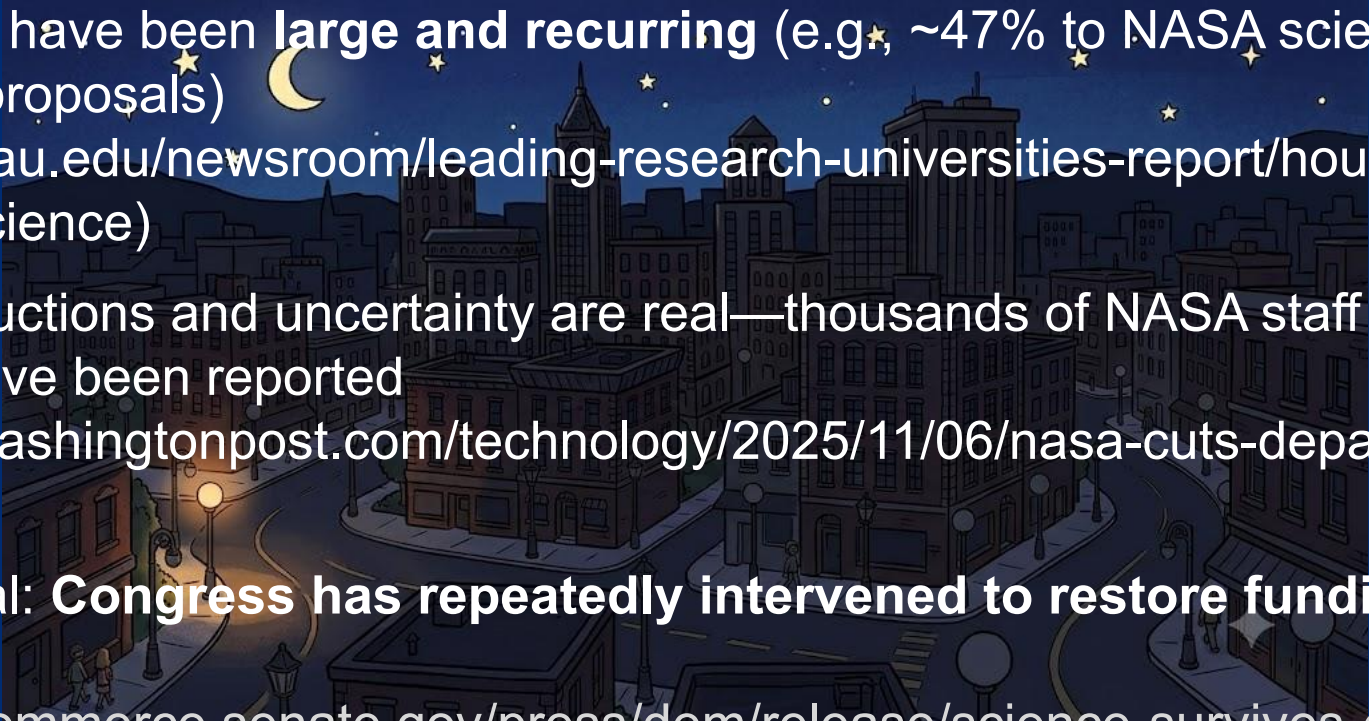
Finding another source of illumination

Wait for a new dawn.

How many can you think of?

I want you to think about how you can transform your life over the course of your career. Find your bliss through examining your life.

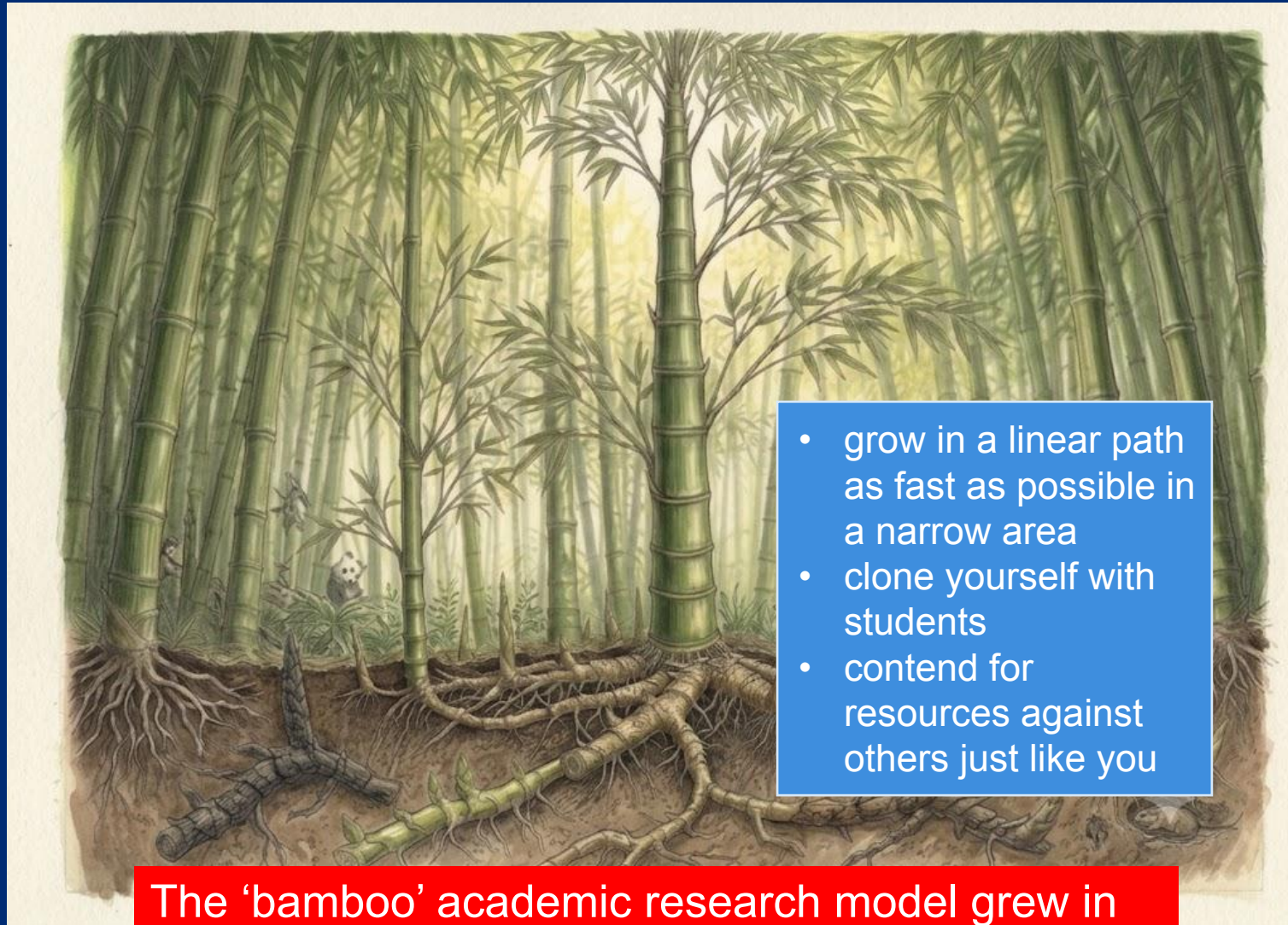
Scarcity is largely turbulence not a decline in opportunities

- Proposed cuts have been **large and recurring** (e.g., ~47% to NASA science, ~20% to NSF in some proposals) 
(<https://www.aau.edu/newsroom/leading-research-universities-report/house-bill-cuts-funding-nsf-nasa-science>)
- Workforce reductions and uncertainty are real—thousands of NASA staff departures and NSF layoffs have been reported
(<https://www.washingtonpost.com/technology/2025/11/06/nasa-cuts-departures-isaacman/>)
- But equally real: **Congress has repeatedly intervened to restore funding** and protect core science.
(<https://www.commerce.senate.gov/press/dem/release/science-survives-existential-threat-from-trump-budget-as-senate-rejects-gutting-nasa-nsf-nist/>)

Our ecosystem is being disrupted. We can take steps individually and collectively.

You own your life

- For the last 75 years, after Vannevar Bush's book *Science the Endless Frontier* (1945), science held a privileged place in American society
 - After 5 years of debate, NSF was founded in 1950.
- 'Basic research' defined to cover need for practical innovation and curiosity-driven science.
- V. Bush's book codified a national commitment to basic research for national security, health and prosperity.



- grow in a linear path as fast as possible in a narrow area
- clone yourself with students
- contend for resources against others just like you

The 'bamboo' academic research model grew in response to a new enriched environment and the enormous influx of WW2 veterans who were able to attend college

We benefit from a fundamental change in society wrought by World War 2 and the Cold War

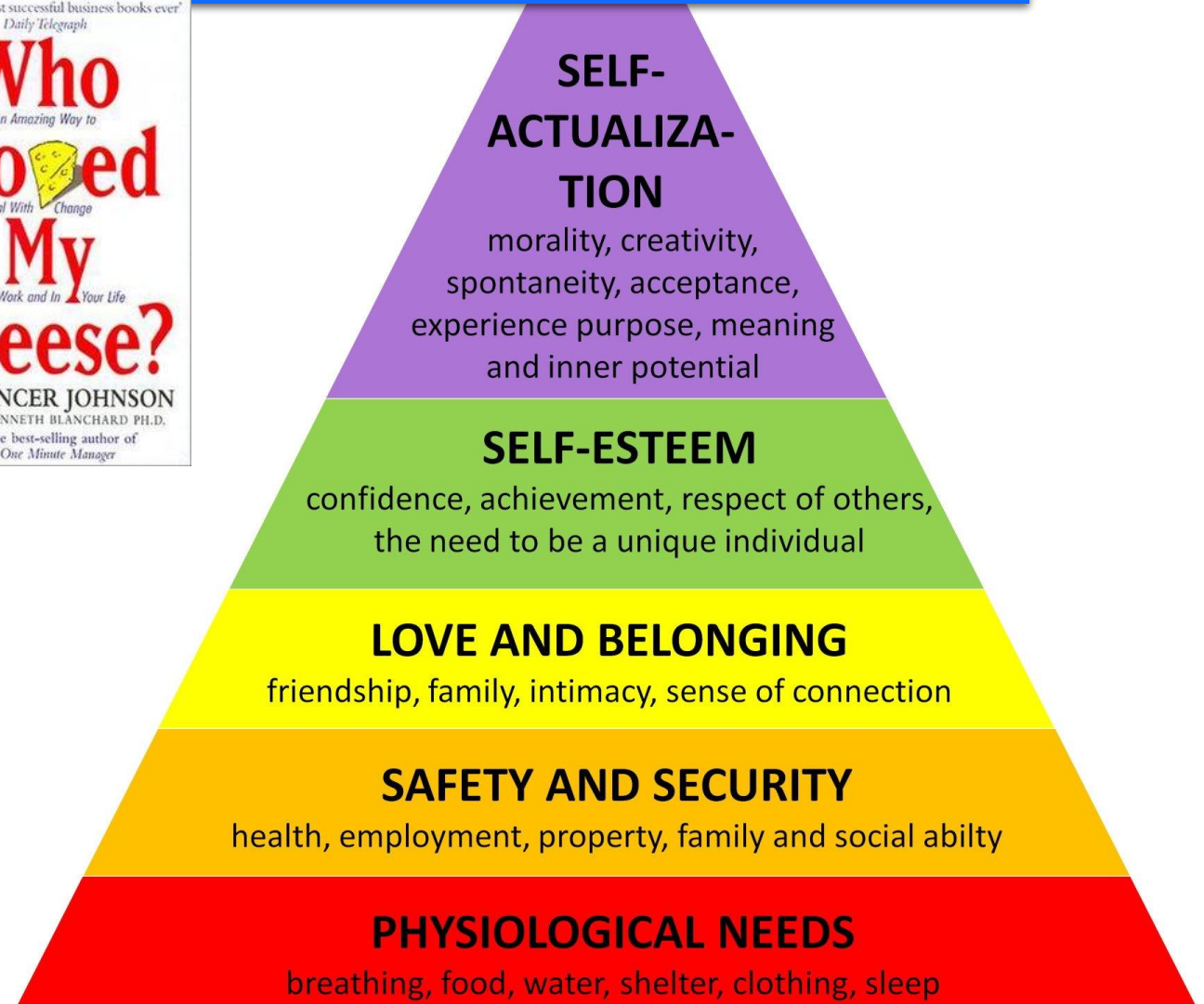
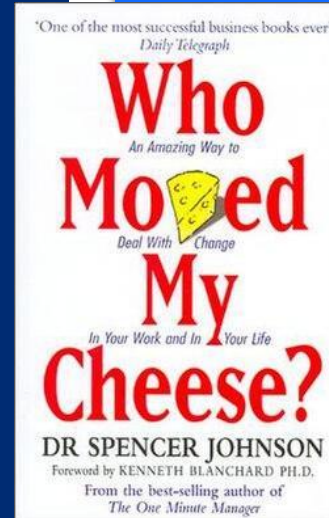
- Realizing it needed a massive pipeline of technical talent to compete with the Soviets, the U.S. government passed the **National Defense Education Act (NDEA)** in 1958.
- Hundreds of millions of dollars were funneled into rewriting science and math curricula (such as the "New Math" and updated physics textbooks).
- The federal government actively bankrolled college educations for a generation of young scientists, transforming STEM fields from elite institutions into career paths for a redefined middle class.
 - Science education began with a few elite, private institutions offering "natural philosophy." (Ph.D.!!!!)
 - Public land-grant universities, establishing dozens of dedicated agricultural and engineering programs arose in the early 20th and late 19th century
- Post World War 2 GI Bill or Rights and the Cold War led to rapid growth in the number of universities and the depth of their science departments, **funded heavily by the federal government to win the geopolitical tech race.**

Medicine and public health, fundamental/basic science, military and defense research, the education and cultivation of scientific talent, research that supports economic growth, new industries, and employment – were the recognized values of science investment.

Has the cheese moved? **NO...**

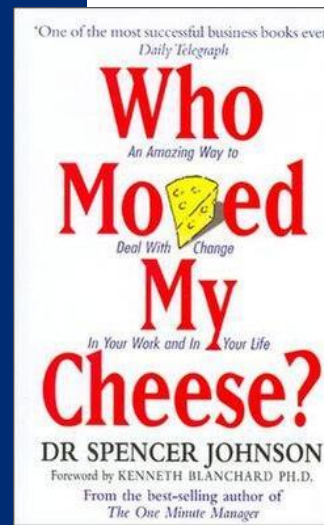
Curiosity-driven research requires that all other needs are addressed

- Nations stand or fall on their ability to address the people's basic needs
 - Economic benefits
 - Food and water security
 - Physical security
 - Security via 'soft power'
 - 'creating a wonder'
- ITM science connects to more than just the highest goal of self-actualization ... which is what we are lucky enough to experience in our professional lives.



https://en.wikipedia.org/wiki/File:Maslow's_Hierarchy_of_Needs.svg

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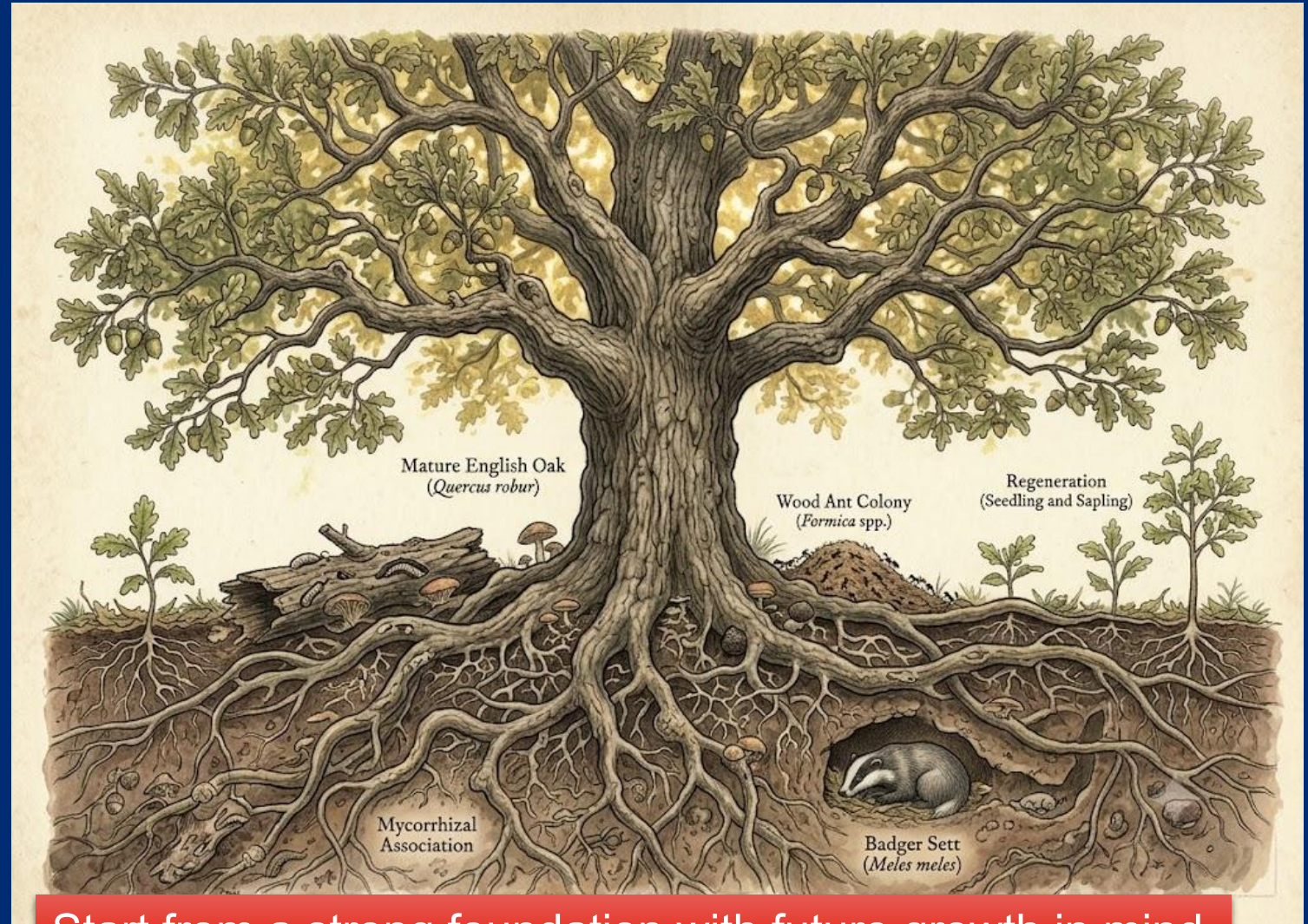
https://en.wikipedia.org/wiki/File:Maslow's_Hierarchy_of_Needs.svg



Maslow, A.H. (1943). A theory of human motivation. *Psychological Review* 50 (4) 370–96

Think about life as an oak tree rather than bamboo

- Oaks start out from a seed and grow from seedling to sapling.
- The initial focus is on rapid growth to assure viability.
- Over time, they branch out and build an extensive root system that anchors them against storms, and a broad canopy that ensures access to life-sustaining resources
- An oak is part of a diverse ecosystem and adapts to many niches.
- Oaks often challenging to identify in the wild because they readily hybridize



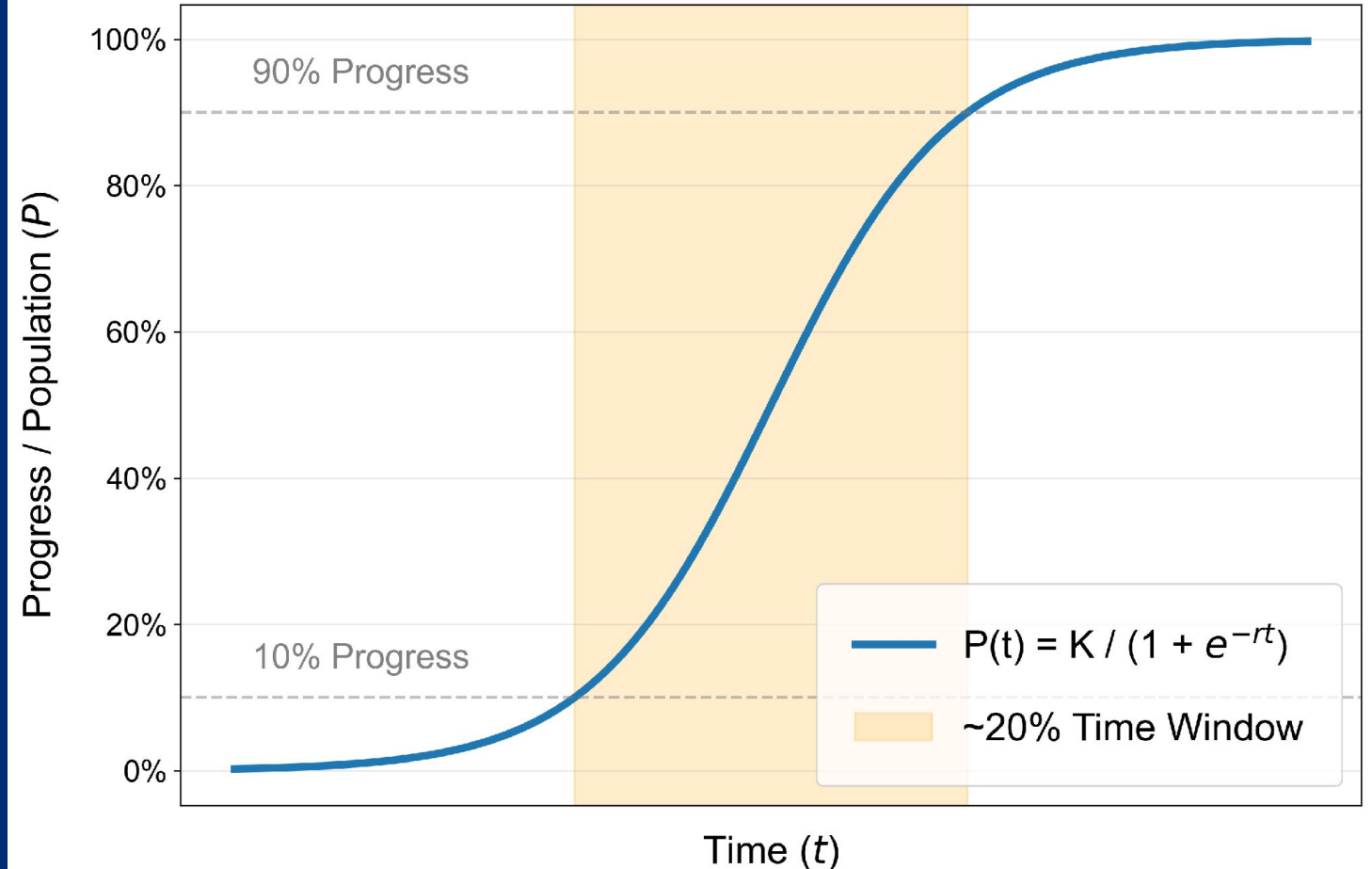
Start from a strong foundation with future growth in mind

Change is hard...

But you have acquired the skills that enable growth

- You have already made the investment in learning basic science – something few people do.
- The empirically demonstrated Logistics Curve or Pareto Distribution shows that in something like 20% of the time that it takes to achieve totally mastery you can get up to 90% of the way to total mastery.
- **OR... that you are capable of learning applications and extensions of your existing skill set.**

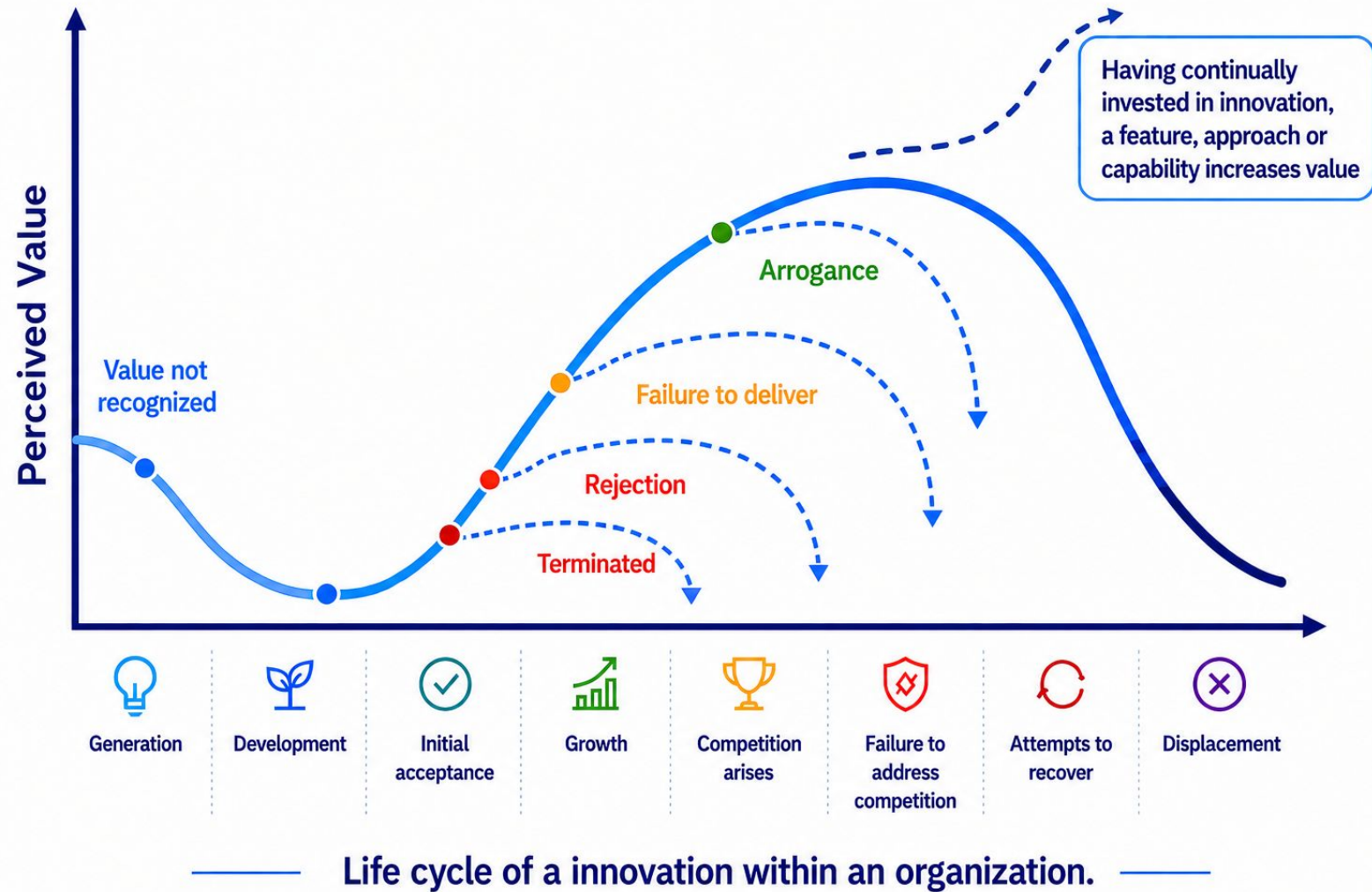
The 80/20 Rule in the Sigmoid Curve



Getting organizations to change/innovate is hard

- Paxton, L.J., Chapter 21 Systemic Engineering and Systemic Innovation, in Infusing Innovation Into Organizations: A Systems Engineering Approach,
- Larry Paxton and Shannon Rodri Organizations: A Systems Engine

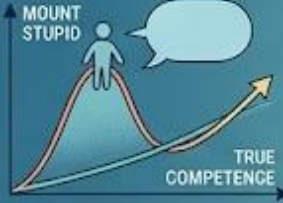
This applies to
science &
research
programs as well
as commerce



The Journey Begins... dealing with management is one of the trials of the Hero's Journey

THE 5 LAWS EVERYONE SHOULD KNOW

1



THE DUNNING-KRUGER EFFECT
People with limited knowledge greatly overestimate their competence, while experts may underestimate theirs.
Acknowledge your knowledge gaps.

2



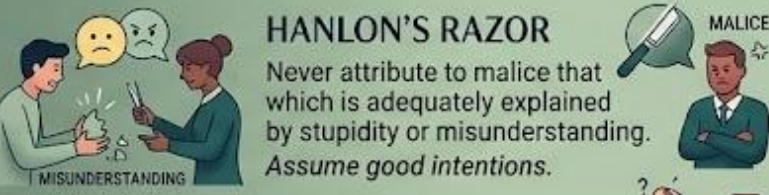
PARKINSON'S LAW
Work expands to fill the time available for its completion.
Set firm deadlines to improve efficiency.

3



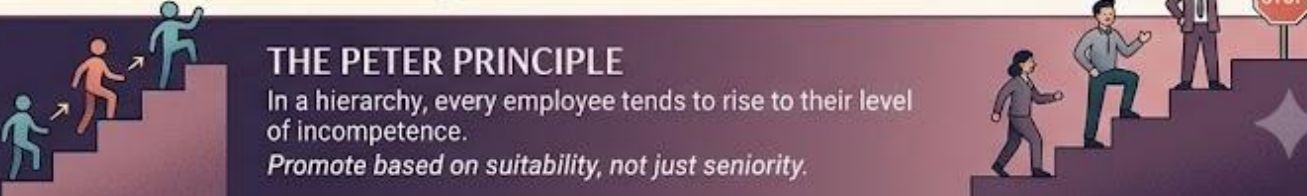
THE PARETO PRINCIPLE
Roughly 80% of consequences come from 20% of causes.
Focus on the high-impact few.

4



HANLON'S RAZOR
Never attribute to malice that which is adequately explained by stupidity or misunderstanding.
Assume good intentions.

5



THE PETER PRINCIPLE
In a hierarchy, every employee tends to rise to their level of incompetence.
Promote based on suitability, not just seniority.

Changing how we operate requires management buy-in

Reason Managers Struggle to Commit to Change	You must consider this in presenting your idea
Fear of Negative Outcomes	Change can disrupt operations, reduce short-term performance, or fail, creating risk for the manager.
Loss of Control	New processes and structures may reduce a manager's sense of predictability and influence. It may run counter to 'institutional culture' (e.g. 'not the NASA way')
Unclear Benefits	Managers may not see a convincing case that the benefits (especially to them) outweigh the costs and effort.
Competing Priorities	Daily responsibilities leave limited time and resources to focus on longer term efforts required to produce change.
Organizational Incentives	Organizations often reward maintaining current performance more than taking risks on change (success has many parents – failure is an orphan.
Previous Failed Efforts	Past unsuccessful changes can create skepticism and "change fatigue."
Human Psychology	Natural biases, such as preferring the status quo and avoiding losses, make change harder to embrace.
Stakeholder Resistance	Managers may anticipate pushback from employees, peers, customers, or leadership.
Identity and Success	Changing established practices can feel like questioning methods that previously led to success.

Change is hard, necessary and must consider other factors

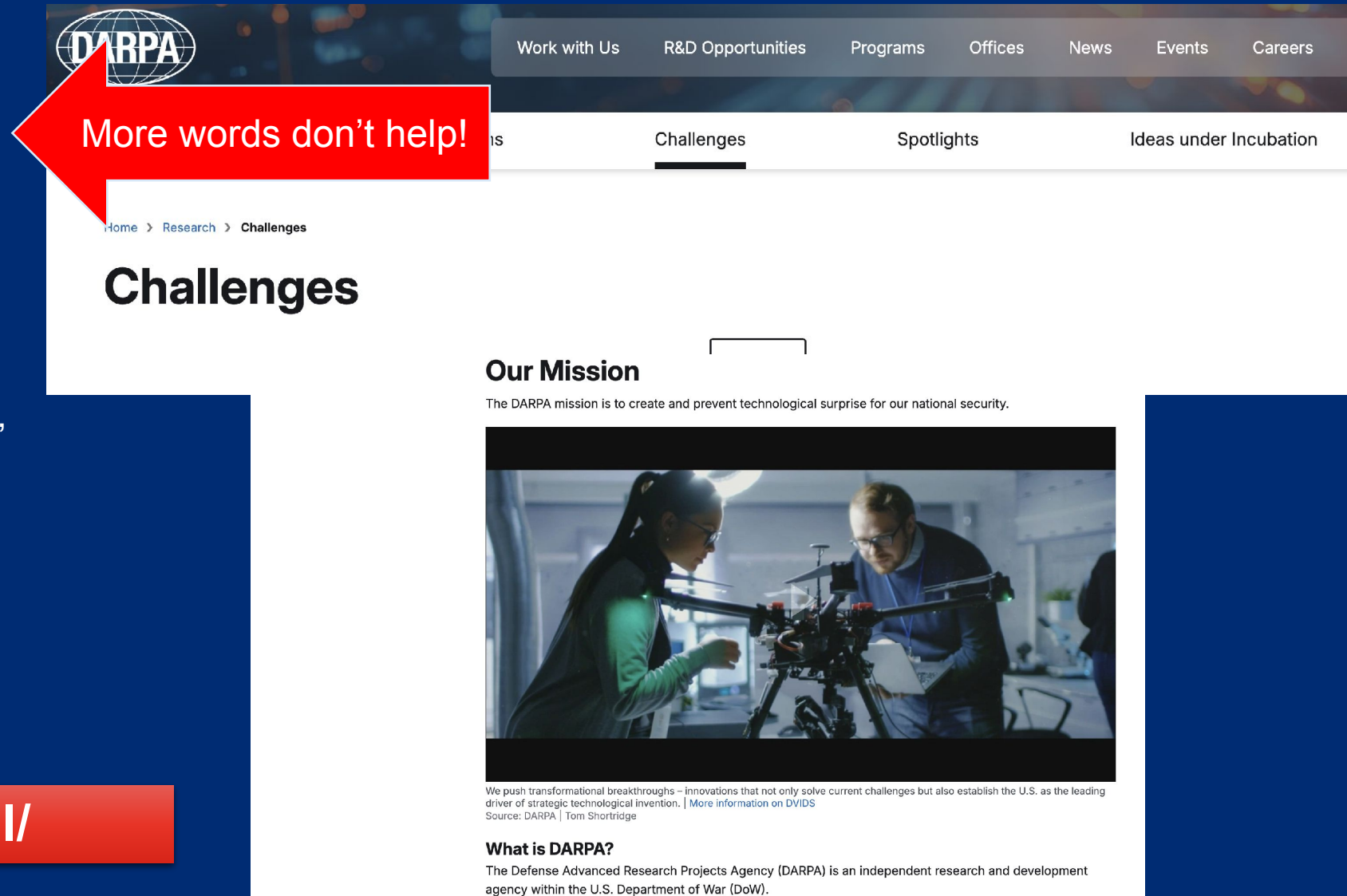
These considerations apply wherever you are in your journey

Factor	Why It Helps
Clear Need for Change	Creates urgency and understanding of why action is necessary.
Defined Success Measures	Helps managers understand what success looks like and how progress will be evaluated.
Leadership Support	Reduces perceived risk and signals organizational commitment.
Risk Mitigation	Gives managers confidence that potential problems have been considered.
Early Wins	Demonstrates tangible benefits and builds momentum.
Involvement in the Process	Increases ownership, buy-in, and commitment to implementation.

Heielsemeier Catechism – A Useful Heuristic

- **What are you trying to do?**
Articulate your objectives using absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What is new in your approach and why do you think it will be successful?
- Who cares? If you are successful, what difference will it make?
- What are the risks?
- How much will it cost?
- How long will it take?
- What are the mid-term and final “exams” to check for success?

<https://www.darpa.mil/>



How do you improve your life and that of the people you deal with?

- Learn patience
 - Some can learn and some cannot and some will not
- Cultivate beginner's mind
 - Share the excitement of what you do
 - Be open to and enthusiastic about new experiences – not afraid
- Do not focus on the details in talking about your expertise – that is your story not your listener's story
 - You may only feel comfortable because you have been taught that your value is in your expertise
 - It is not! It is in your ability to use that expertise to help others achieve their goals.
- If you cannot explain why you do what you do, then develop that story.
- Practice your story.
- Build more than one story so that you can connect with different audiences with different needs and backgrounds, taking into account their priorities.

Learn to tell your story

THE 5 LAWS EVERYONE SHOULD KNOW

1

don't let negative emotions drive you to maladaptive behaviors
perfect your story every time you tell it

EFFECT

2



PARKINSON'S LAW

Work expands to fill the time available for its completion.
Set firm deadlines to improve efficiency.



3



THE PARETO PRINCIPLE

Roughly 80% of consequences come from 20% of causes.
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Promote based on suitability, not just seniority.



Academic writing - unlearning an unfortunate mindset

- As a community we fail at the craft of building compelling narratives
- We have been taught that our primary communication mode is through written scientific articles.
- Written documents 'document' practices and procedures but do not create a compelling story.
 - electronic publications are little more than electronic representations of what could be achieved with physical paper
- Written scientific communications presume reader:
 - interest
 - knowledge
 - commitment to learn as a life motivation

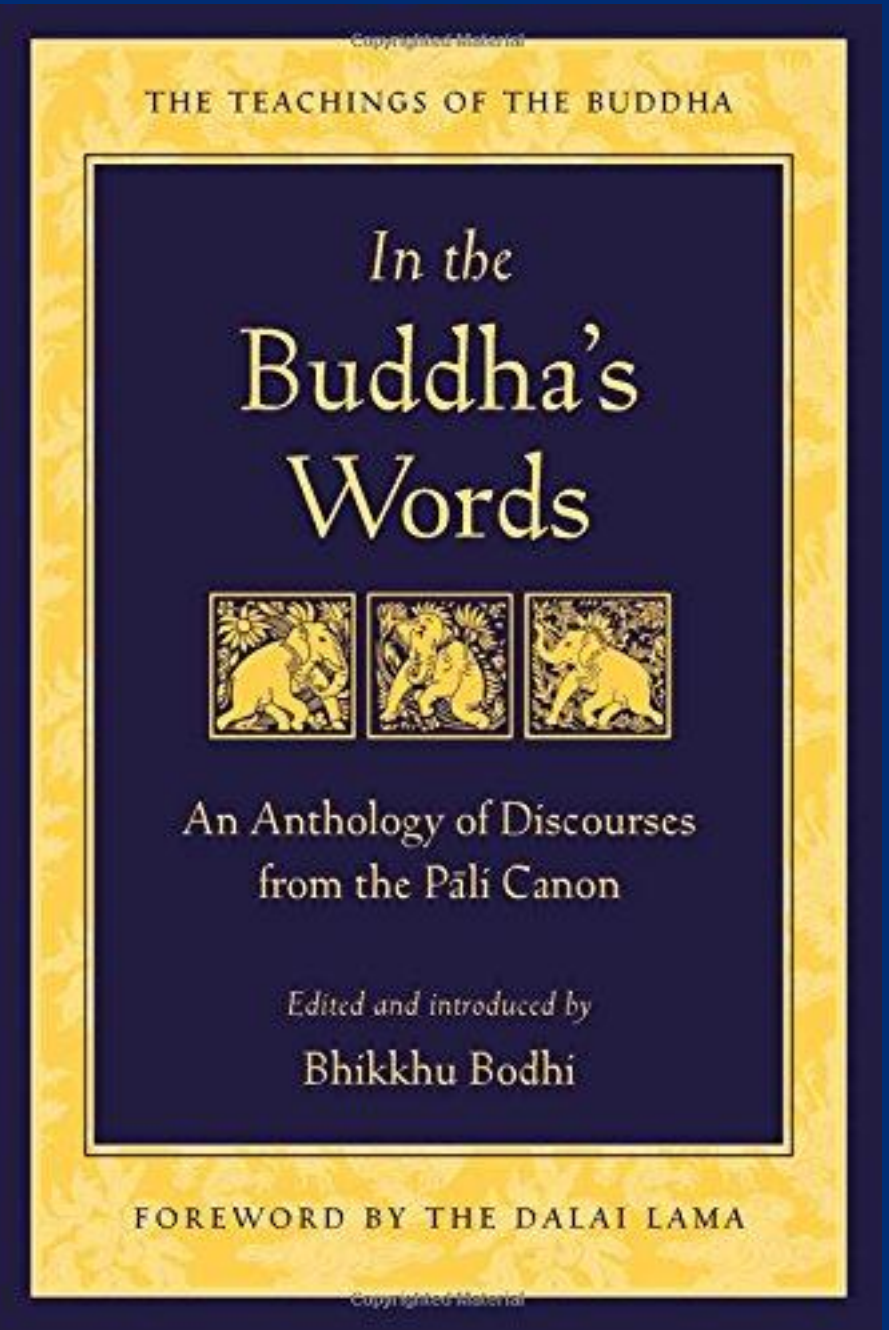
Written 'scientific communications' are not the primary way that value is established within your organization or community nor is it an effective mechanism for creating new opportunities.

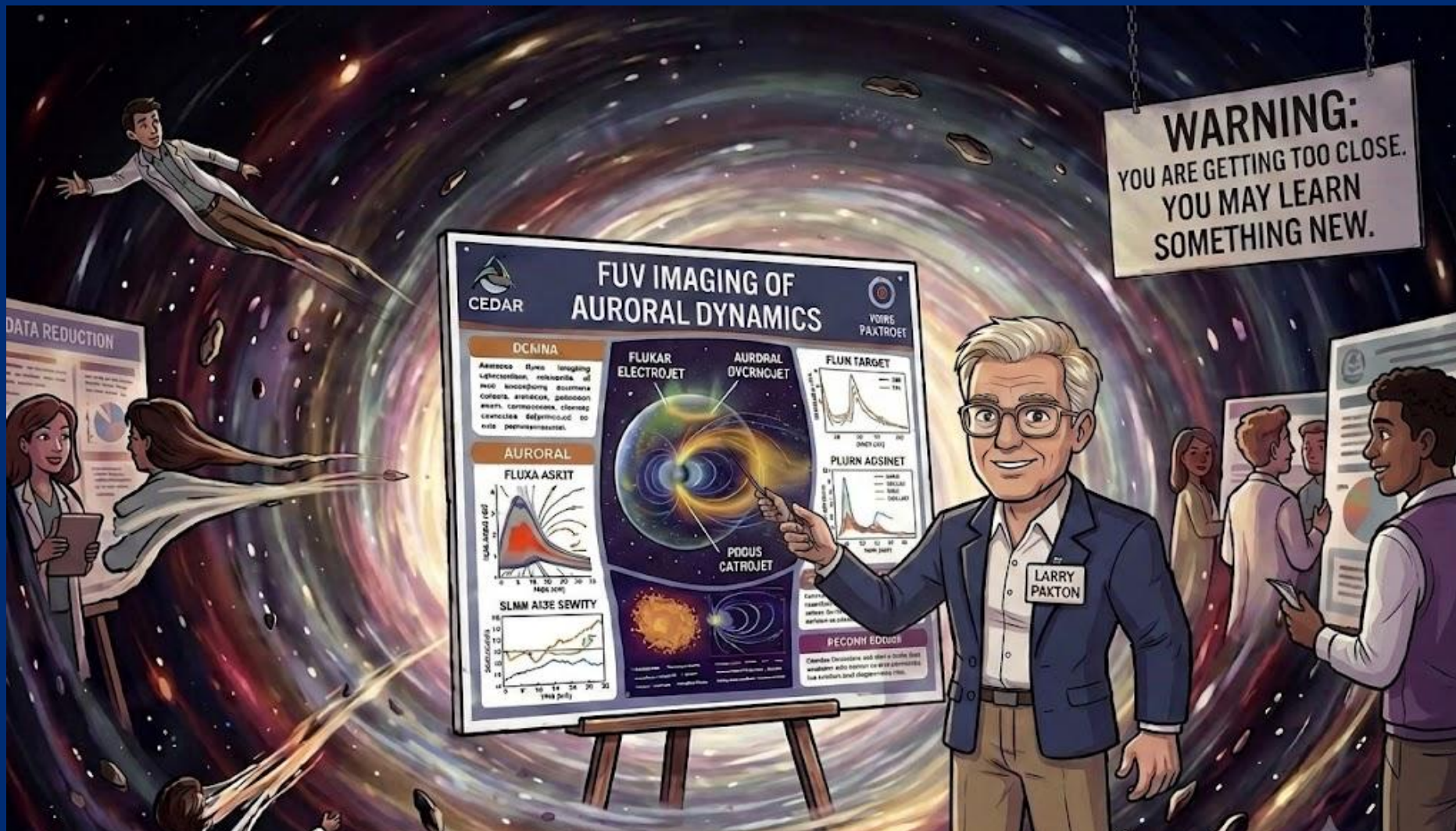


Parable of the Poisoned Arrow



https://en.wikipedia.org/wiki/Parable_of_the_Poisoned_Arrow





see e.g. Olson, R. *Don't Be Such a Scientist: Talking Substance in an Age of Style*. Washington, DC: Island Press, 2009

Can I figure out if this is worth looking at without having to listen and pretend that I care?

Why do I care?

What will I be able to do that I couldn't do before?

What is new and exciting?

What is in it for me?

Transform the Hazard of the Black Hole into a Feature



‘Maladaptive behavior’ and you

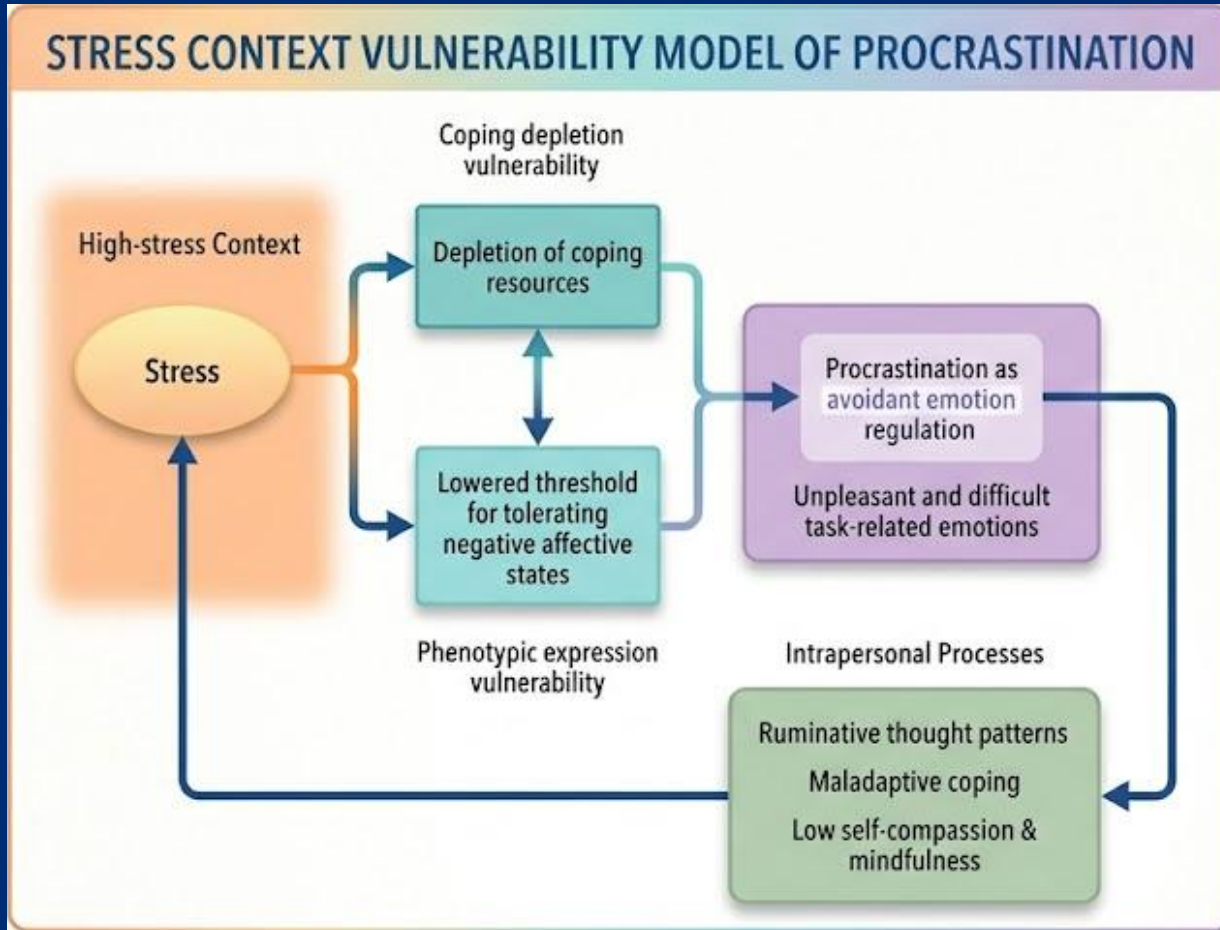
- A personality trait, behavior or coping mechanism that is ineffective, unhelpful, or fails to achieve the intended goal.
- **EXAMPLE: Starting a proposal or presentation at the last minute. Not wanting to let it go; re-editing text, tweaking figures, adjusting format, etc. Working until the last minute.**
- This does NOT make it better.
- These learned behaviors can arise from:
 - What seems like success (the normalization of deviance)
 - Neurodivergence
 - Inability to escape perfectionism
 - Escaping other social interactions or responsibilities
 - Self identification as doing something heroic (e.g. ignoring relationships, not sleeping, doing it all yourself)

e.g. Janis and Mann, Coping with Decisional Conflict (1976)
<https://www.jstor.org/stable/27847557>
Janis, I. L., & Mann, L. (1977). *Decision Making: A Psychological Analysis of Conflict, Choice, and Commitment*. New York: Free Press

Instead of aiding in coping with or managing stress, these behaviors create further stress, sabotage success, and interfere with your personal life.

Parkinson's Law: "Work expands to fill the available time..." C.N. Parkinson (1955)

Avoidance-procrastination leading to forced choice

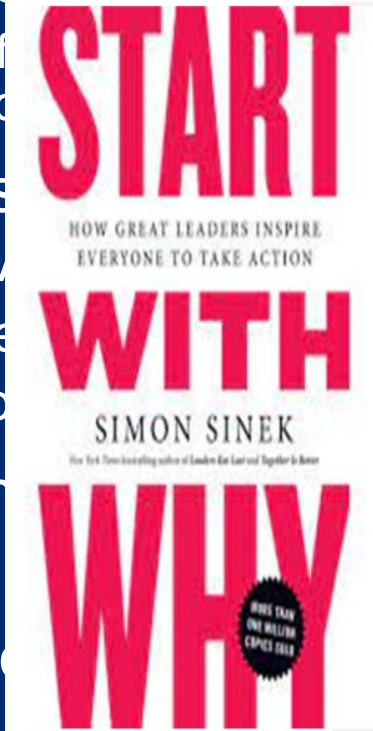


- In psychology, a "phenotype" is the observable expression of a trait (how you actually behave) resulting from the interaction between your "genotype" (your genetic predispositions) and your environment.
- **In a high stress environment, you may be more likely to retreat to comforting patterns.**
 - **Everyday tasks can feel overwhelming.**
 - **Cost to your personal life and your efficacy.**
- Your brain seeks immediate relief from heightened discomfort. Avoidance can become a habitual short-term mood regulation strategy.

This figure redrawn based on Sirois FM. Procrastination and Stress: A Conceptual Review of Why Context Matters. Int J Environ Res Public Health. 2023 Mar 13;20(6):5031. doi: 10.3390/ijerph20065031. PMID: 36981941; PMCID: PMC10049005.

Academic writing - unlearning a maladaptive mindset

- We think the details matter – but they rarely if ever do to many people
 - Certainly not in terms of crafting a compelling global message
- We value correctness and always want to get everything right
 - This does not prepare us for the real world
 - Or trusting the work of others
- Always start with “Why” – that engages more people
- Practice messaging to people you haven’t met from ideas you know nothing about.



Think, Act & Communicate from INSIDE OUT !

Clarity of WHY

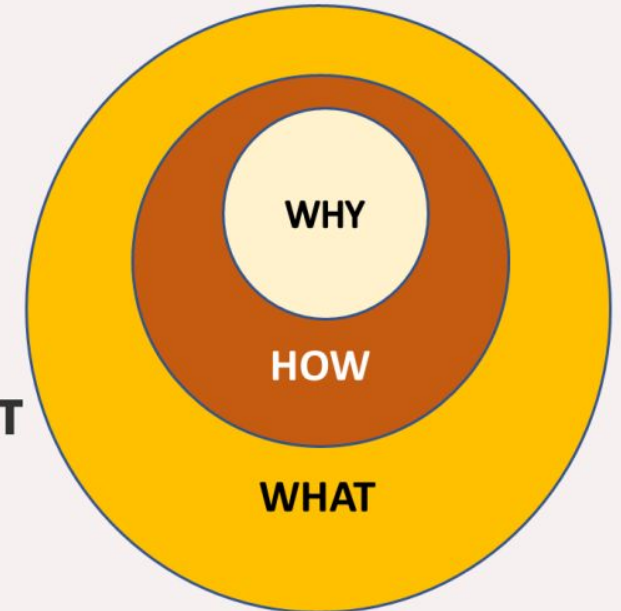
Your purpose, cause or belief.

Discipline of HOW

Your strengths, values or guiding principles.

Consistency of WHAT

Products sold, services offered or your role at work.



© Simon Sinek

No message is universal - every audience has a value system – and it is likely different than yours
Tailor your message to your target audience – not the people who already know your work.

Let's think about NASA and NSF a little differently

- When we look at NASA and NSF as one organism we can see threats and signs of contraction.
- Society itself is rewriting norms of political behavior
- Where is contraction actually occurring?
 - Institutional area (budgets, programs, civil servants)
 - a real decline (cuts, DRP/firings, reorganization, changing institutional norms of behavior)
 - focused and directed research rather than supporting curiosity driven research
 - Mission, science and technology (fundamental research, applied research and technology development)
 - space weather, heliophysics new starts
 - fundamental questions remain in play – with additional means to address them
 - The ecosystem (who does work based on the foundations laid by science)
 - commercial space, AI-driven science, international partners, national security space, philanthropy
- Advocacy coalitions have reversed cuts
(<https://www.planetary.org/planetary-radio/2026-nasa-science-saved>)
- Shift toward partnerships with industry, academia, government labs, international organizations creates more ways to create and execute opportunities

The Abundance Mindset is not “magical thinking”

The Abundance Mindset is **NOT** predicated on more money everywhere.

The Abundance Mindset means that you recognize that there are more pathways for YOU to do meaningful work. (Look elsewhere in the maze for the new cheese)

You may find that you can “Follow your bliss”

The American Geophysical Union Must Act as a Labor Union not an Affinity Group

- Why?
 - Collective bargaining
 - salaries, benefits, overtime, promotions, working conditions
 - Grievance Representation
 - Protection against arbitrary actions
 - Working conditions
 - Benefits and retirement
 - Advocacy
 - Professional Development
- Why now?
 - Employment stability
 - Protection during reorganizations or layoffs
 - Transparent promotion and evaluation processes
 - Intellectual freedom and professional autonomy
 - Workload and staffing concerns
 - Benefits and retirement security

People need time to adapt

[EXT] Ten thousand scientists fired, but we can still fight for science in the U.S.



Elizabeth Landau <elandau@agu.quorumoutbox.com>

Today at 1:

To: Paxton, Larry



From firings to visa changes to funding restrictions, students and scientists need our support today.

18 months of funding uncertainty, firings, and policy changes have diminished opportunities for scientists and students in the U.S., weakening the U.S. STEM education pipeline and the scientific workforce.

Help support the future of science in America by garnering support for bills that would:

- Address graduate student financial instability.
- Make it easier for skilled international students to stay in the U.S.
- Safeguard scientific integrity in federal research.



[Send an Email](#)

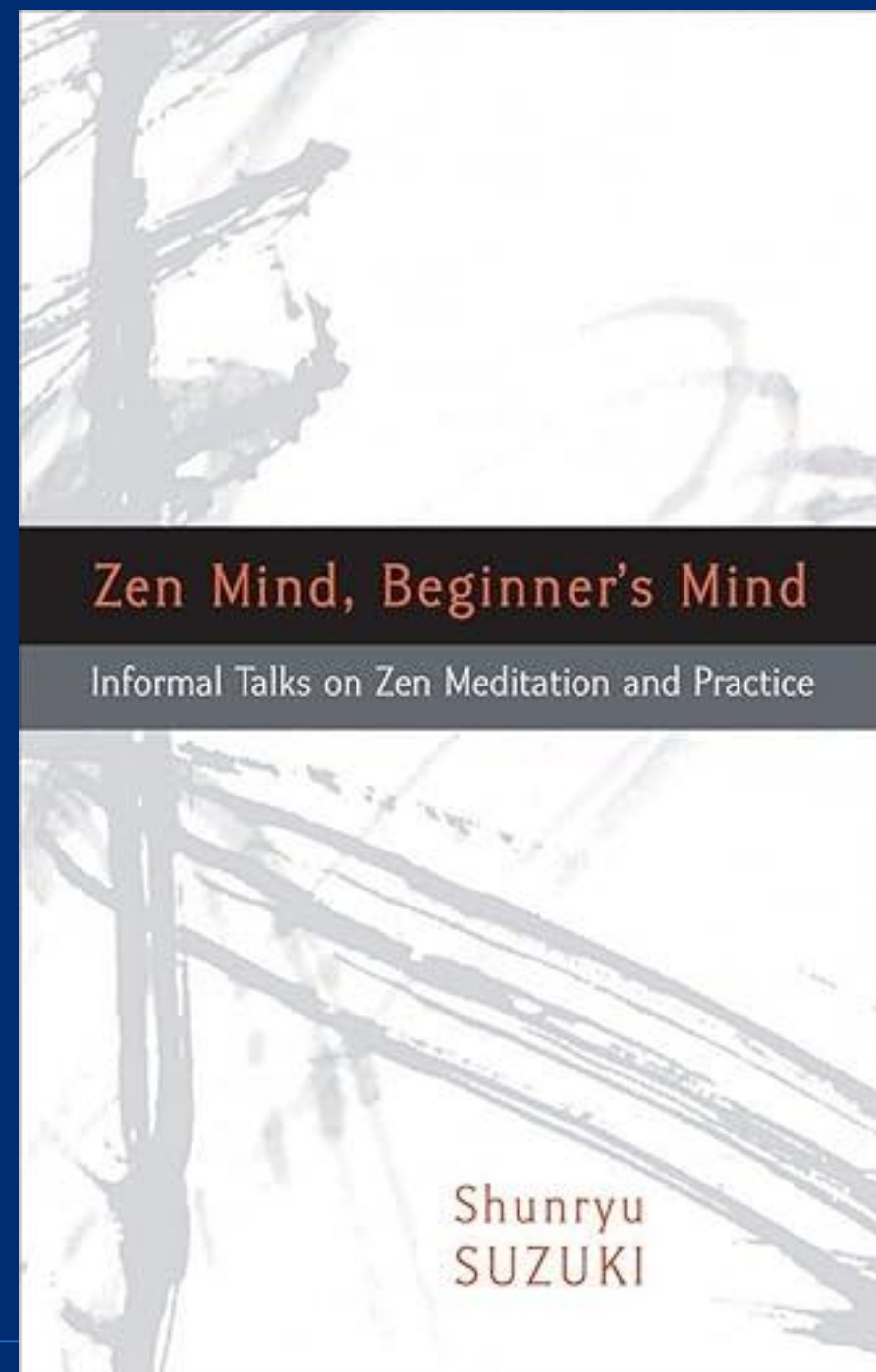
AGU's new Voices for Science cohort is on Capitol Hill today speaking to policymakers in support of these critical bills.

It's up to the scientific community to show the value of science to policymakers. You have the best stories and examples of how these bills

Beginner's mind and exploration

- The challenge is to accept and act on: “I don't know and that is okay”
- "In the beginner's mind there are many possibilities, but in the expert's there are few." – Shunryu Suzuki
- **Beginner's mind, or *Shoshin* (初心)**
 - children begin with beginner's mind
 - open, eager, accepting
- The expert's mind can be challenged by differences
- Learn to be humble and open to new experiences

Remind yourself “I am where I am because I can learn, I can do that hard work of learning. I can eat bitter. I have proved this many, many times. I am worthy of the opportunity to learn, grow, succeed and be happy.”



Being a successful PI, leader, and team member

- PI core responsibilities (NASA but with my refinements)
 - PI has absolute accountability NOT sole responsibility
 - PI cultivates the project vision NOT dictates 'good' or 'bad' science
 - PI is accountable for mission finance NOT micromanaged but delegated to Program Manager
 - PI defines schedule and technical milestones NOT dictated but developed with the Team
 - PI leads the Team by working with their strengths NOT by micromanaging
 - PI serves as principal external spokesperson NOT by working alone but by faithfully promoting the Team
- The PI makes sure important decisions are made by the Team NOT by making all decisions but by having the team embrace what must be done

If you wish to cultivate Heroes, be a Hero yourself – take care of your team first, make them feel safe and valued, ensure that they see the value *for them* in what you, as the Leader, are doing.

Being a successful PI, leader, and team member

- Bad PI traits:
 - Not trusting the Team
 - Saying “I am playing the PI card – we will do this....”
 - Being responsible for the details rather than assuring that someone else is responsible
- The more you appeal to your authority – the less you have and the less secure your team feels
- Good PI traits:
 - cultivate emotional stability (believe in yourself and your team)
 - always evaluate what is important and what, though correctable, is not worth the effort.
 - sharing credit with the Team
 - take care of the Team first and yourselves last

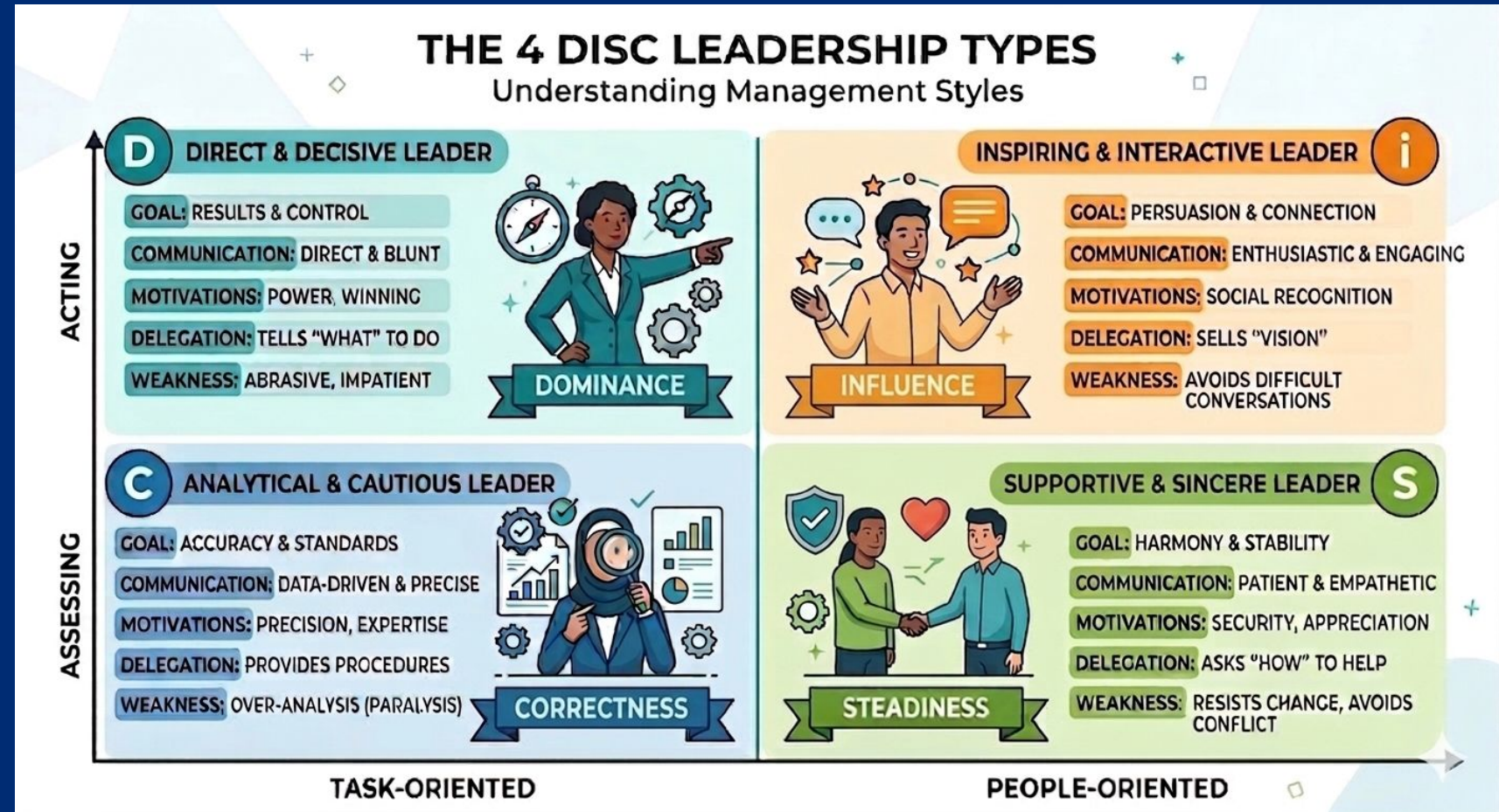


Leaders Eat Last by Simon Sinek

If you wish to cultivate Heroes, be a Hero yourself – take care of your team first, make them feel safe and valued, ensure that they see the value *for them* in what you, as the Leader, are doing.

What kind of leadership role do you play?

- If you are serious about increasing the scope of your professional life, go on the Hero's journey to find a mentor.
- A mentor does not have to be a person or just one person.
- There are many resources available to you
 - Remember, one of your cores strengths is scholarship
 - Another is persistence
 - And you have a solid technical base that very few others have.



An effective leader adjusts their interaction style to the type of the person they are dealing with

What kind of leader are you?

- If you are serious about increasing the scope of your professional life, go on the Hero's journey to find a mentor.
- A mentor does not have to be a person or just one person.
- There are many resources available to you
 - Remember, one of your cores strengths is scholarship
 - Another is persistence
 - And you have a solid technical base that very few others have.



In my experience, scientists and engineers have a happy place in the lower left corner
Plenty of time to think and not a lot of pressure to make decisions or produce a result and not a lot of people required
An effective leader adjusts their style.

We live in challenging times

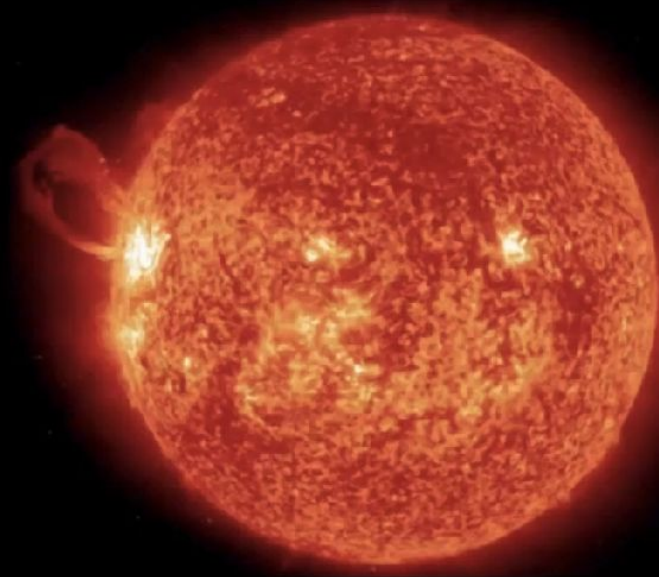
All of human history has been ‘challenging times’

No one writes stories that began “Once upon a time nothing happened. The end.”

You can make a difference

You can make the hero’s journey

The way we talk about the cheese has changed



The Shift

From vision to implementation

Our traditional focus has been curiosity driven investigations.

Traditional Focus	2026 Strategic Focus	Benefit
Disciplinary & Mission Silos	Strategic Purpose Themes	Alignment with NASA and National Priorities
Curiosity-Driven Investigations	Outcome-Driven Research	Actionable "Environmental Intelligence"
Fragmented Theory, Knowledge Building, Operations	Integrated Knowledge Chain	Faster Transition to Application

SMD, AVSupportTwo (HQ-...)



Miller, M...



Hill, Deni...



WESTLA...



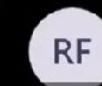
Mahonie...



Marshall, ...



Vladimir ...



Filwett, ...



Greeley, ...



Cheney, ...



Pietro Be...



Aleksand...



+331

<https://assets.science.nasa.gov/content/dam/science/hpd/key-documents/2026/HPD-Community-Meeting-Captions.mp4>

Map your 'bliss' into these goals

NASA HELIOPHYSICS33

Heliophysics R&A Themes

1**Preparation for Spaceflight**
Develop the scientific foundation for future spaceflight activities and explore future scientific directions.

2**Focused Science Objectives & Foundational Research**
Achieve priority science with existing data and capabilities.

3**Strategic Capabilities**
Advance capabilities needed for priority heliophysics science.

4**Rapid Access to Space**
Advance capabilities needed for priority heliophysics science.

5**Space Weather Applications**
Apply heliophysics science to improve space weather forecasting and decision-making capabilities.

6**Workforce Development**
Foster and support a healthy pipeline of heliophysics scientists and future leaders.

with the existing data and capabilities that we already have in hand.



SMD, AVSupportTwo (HQ-...



Miller, M...



DH
Hill, Deni...



WESTLA...



Mahone...



Marshall,...



VT
Vladimir ...



RF
Filwell, ...



Greeley, ...



Cheney, ...



PB
Pietro Be...



YN
Yuta Not...



+345

Mahoney, Erin (HQ-DJ000)[BOOZ ALLEN HAMILTON INC]



24 June 2026 | 51

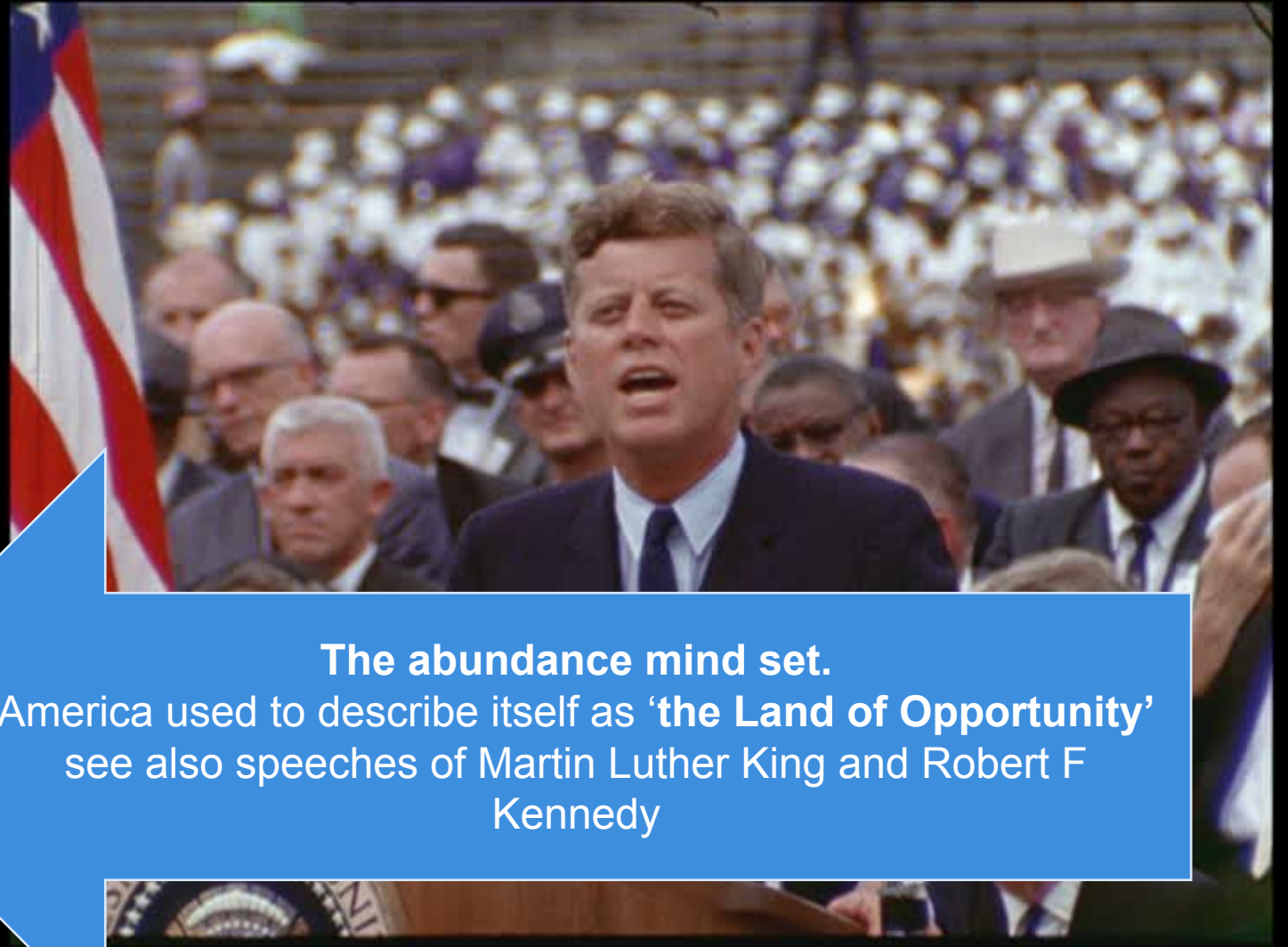
*“We choose to go to the moon.
We choose to go to the moon
in this decade and do the
other things, not because
they are easy, but because
they are hard, because that
goal will serve to organize
and measure the best of our
energies and skills, because
that challenge is one that we
are willing to accept, one we
are unwilling to postpone,
and one which we intend to
win, and the others, too.”*

President John F. Kennedy
Rice University
12 September 1963



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President John F. Kennedy
Rice University
12 September 1963



The abundance mind set.

America used to describe itself as ‘**the Land of Opportunity**’
see also speeches of Martin Luther King and Robert F
Kennedy

Vision then: the future would be different and better

Vision now: the future is more of the same

Mars Excursion Module 1964 - NASA

Two months after the Rice University speech, President Kennedy was assassinated. Less than 6 years later, humans were on the Moon.

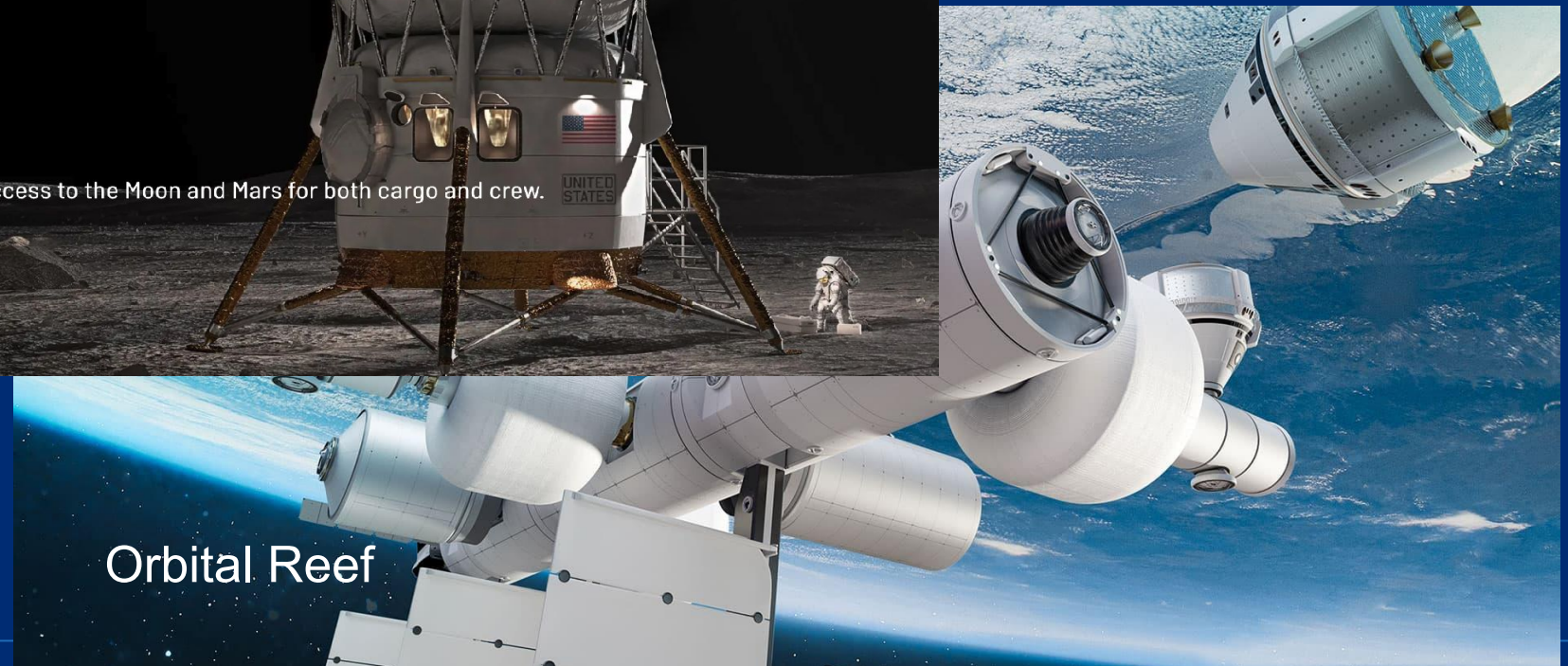
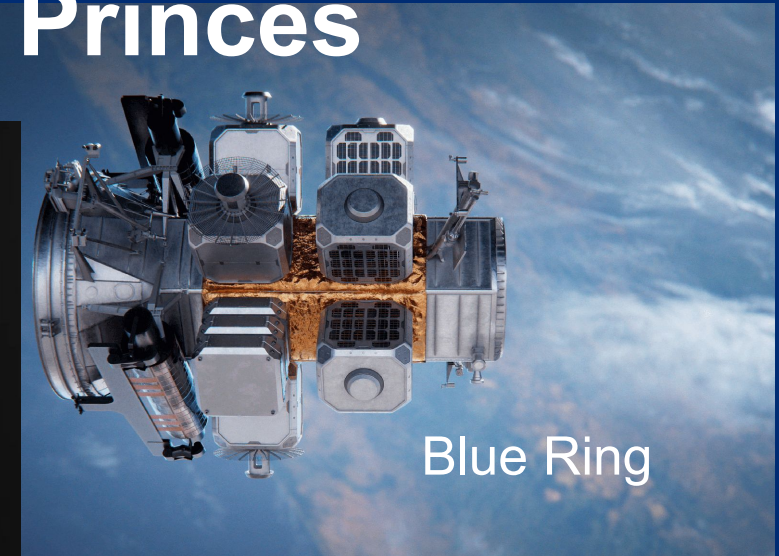
2001: A Space Odyssey – released 1968

Trade has driven history and shaped society

- ***Power and Plenty: Trade, War, and the World Economy in the Second Millennium*** by Ronald Findlay and Kevin H. O'Rourke (2007)
 - Traces how the drive for commercial advantage funded centuries of global exploration, mapping, and conquest.
 - The authors argue that the expansion of physical horizons was fundamentally bound to the "plenty" of trade and the "power" of the military state structures that backed merchants.
- ***The Corporation That Changed the World: How the East India Company Shaped the Modern Multinational*** by Nick Robins (2006)
 - Explorers like Vasco da Gama charted the initial path.
 - Joint-stock corporate giants systematically mapped and dominated the globe.
 - The English East India Company used institutionalized commerce to drive geographical exploration, cartography, and military-backed trade expansion.
 - It was the underpinning of the British Empire.

Exploration was rarely a speculative venture funded out of scientific curiosity alone. Exploration required massive capital outlay, and those investments were only made when there was a promise of a shorter route to market, a monopoly on a scarce commodity, or fresh territory for corporate wealth extraction.

Exploration led by the Merchant Princes



SpaceX Return to the Moon (...”and the other things”)

SPACEX

VEHICLES

HUMAN SPACEFLIGHT

STARLINK

STARSHIELD

xAI

TERAFAB

COMPANY

SHOP

MOON MISSIONS

Starship cargo flights to the lunar surface for research, development, and exploratory missions start no earlier than 2028, at a rate of \$100 million per metric ton.

Join a Starship human spaceflight mission now, flying around the Moon or landing on the lunar surface.

For additional information on human spaceflight seat or full mission availability, payload masses, pricing details, and timeframes, please contact sales@spacex.com.



The Kardashev Scale

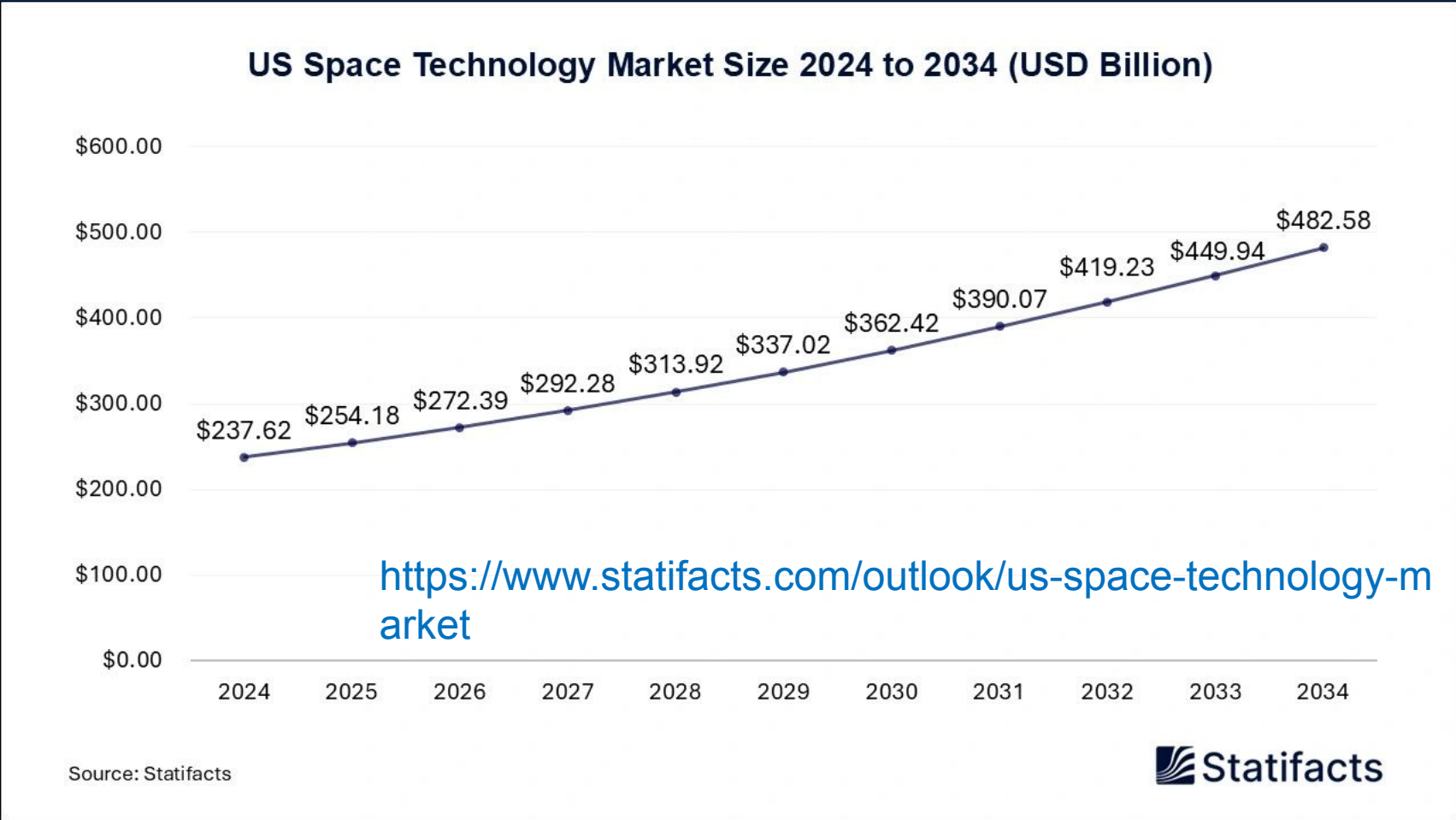
We aspire to be a galactic civilization

Type I

Harness all the energy on a planet

US Space Technology Market Size to Attain USD 482.58 Billion by 2034

US Space Technology Market (By Type: Space Vehicles, Space Stations, Orbital Launch Vehicles, Deep-space Communication, In-space Propulsion, Others (Support Infrastructure, Procedures, etc.); By End-use: Government, Military, Commercial; By Application: Navigation & Mapping, Meteorology, Disaster Management, Satellite Communication, Satellite Television, Remote Sensing, Science & Engineering, Earth Observation, Military & National Security, Data & Analytics, Information Technology, Internet Services, Manufacturing, Others (Space Medicine, Tele-Education, etc.)) Industry Size, Share, Growth, Trends 2025 to 2034



ACHIEVING THE VISION MOON BASE



SYSTEMS



TRANSPORTATION



AUTONOMY &
ROBOTICS



LOGISTICS



COMMUNICATIONS
& POSITIONING,
NAVIGATION, AND
TIMING



HABITATION



POWER



MOBILITY

PHASE
01

PHASE
02

PHASE
03

NASA Concept – 2026

The plans look similar to those of >65 years ago
Technology and Will are the enablers

There are interesting problems to be solved

NOW - 2029

SECURE RELIABLE ACCESS TO
LUNAR SURFACE AND EXPERIMENT

2029 - 2032

ESTABLISH INITIAL MOON BASE
OPERATING CAPABILITY

2032 - BEYOND

ACHIEVE SEMI-PERMANENT
CREW PRESENCE

PROGRESSION



LAUNCHES

● 25

● 27

● 29



LANDINGS

● 21

● 24

● 28



CARGO TO SURFACE

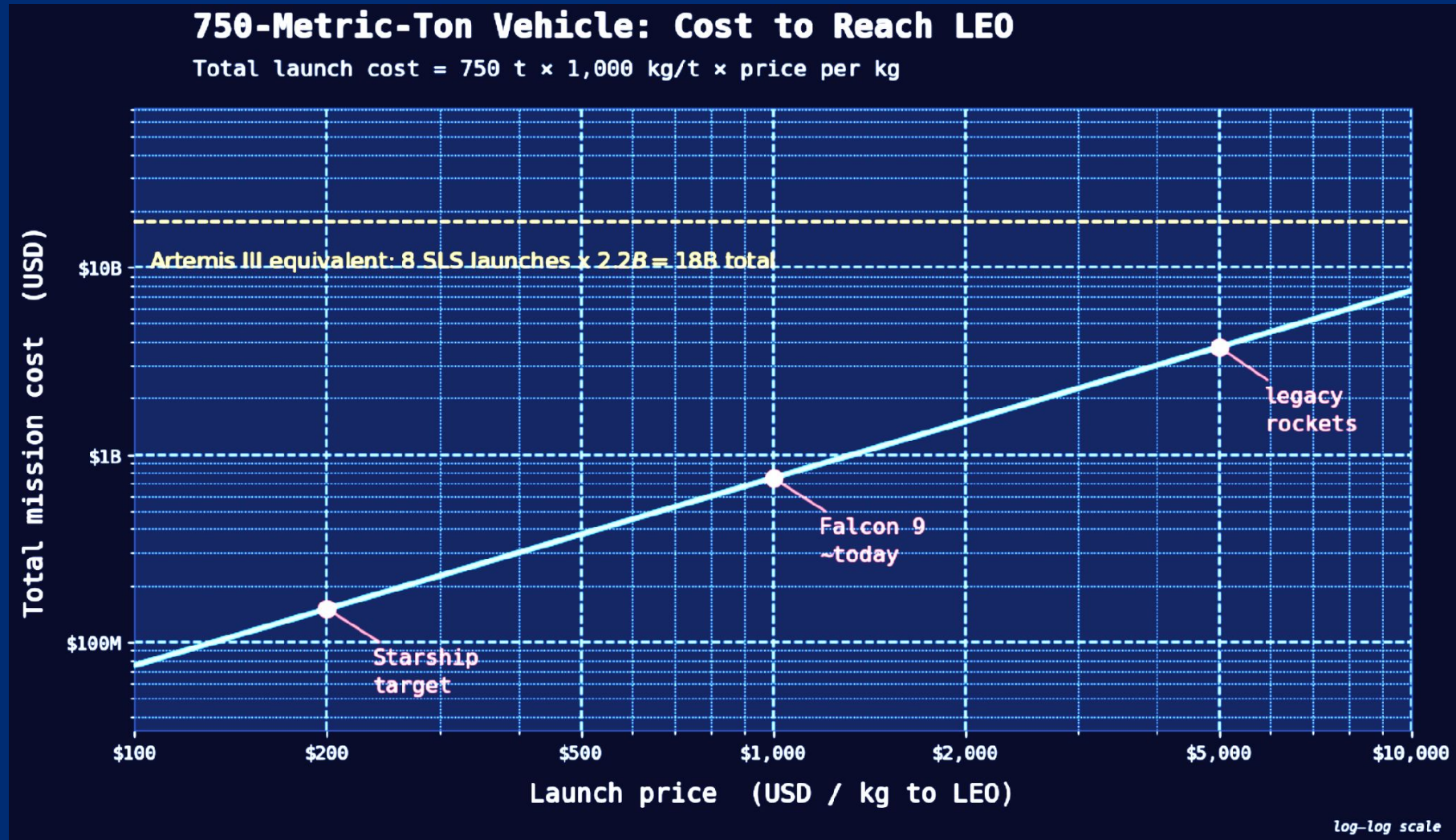
● ~4,000 KG

● ~60,000 KG

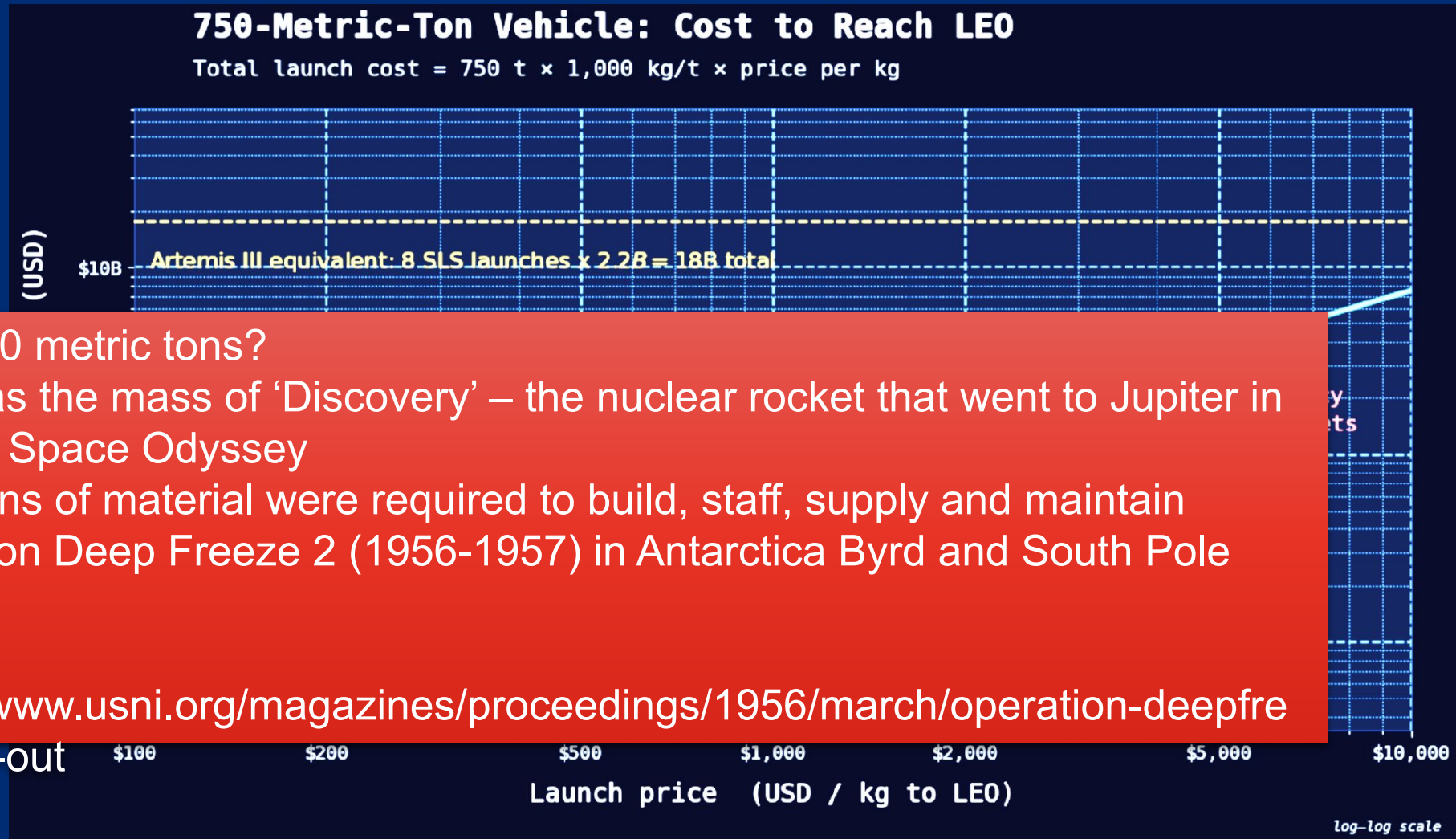
● ~150,000 KG

BUILDING AN ENDURING LUNAR PRESENCE

Trade has produced revolutionary capabilities



There are revolutionary developments



Why 750 metric tons?

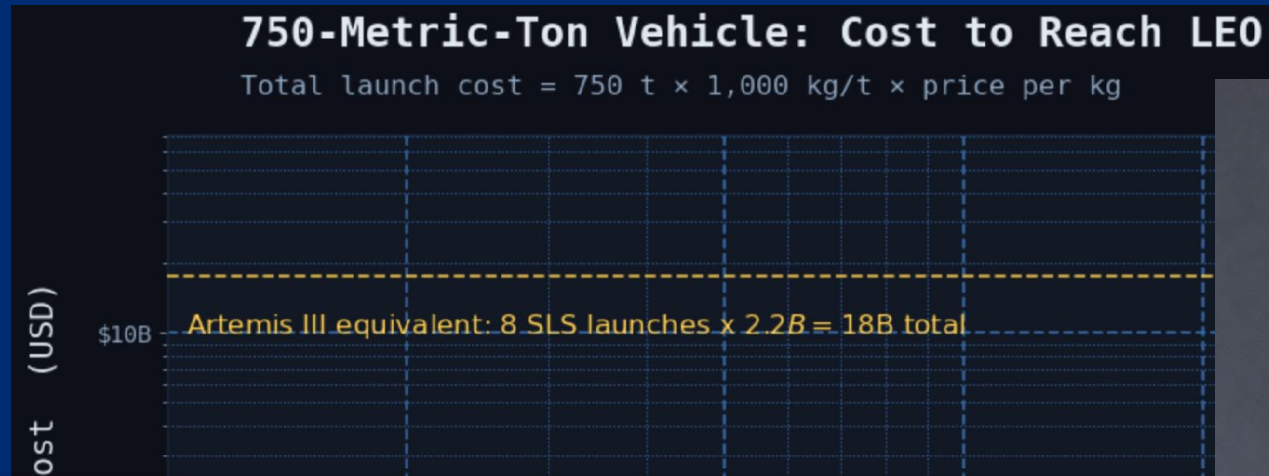
That was the mass of 'Discovery' – the nuclear rocket that went to Jupiter in 2001: A Space Odyssey

~500 tons of material were required to build, staff, supply and maintain Operation Deep Freeze 2 (1956-1957) in Antarctica Byrd and South Pole Station

See:

<https://www.usni.org/magazines/proceedings/1956/march/operation-deepfreeze-fits-out>

There are revolutionary developments



NSF CEDAR can redefine success because of:

- low cost to orbit
- use of industrial parts

by

- no longer attempting to build space/mass constrained solutions that demand sophisticated technologies (no more 'watchmakers' in space)
- establishing value for industry and academic partners
- test quickly, fail quickly – learn from failure

mapping to NASA, NOAA, DHS, DARPA, commercial and industry - not existing, constricting pipelines will create opportunities.

We Talk About Space Weather the Wrong Way

Our focus on extremes (e.g. Carrington) no longer works

- Why do people build homes in 100-year flood plains?

Bias	Effect
Temporal discounting	Future flood losses matter less than present housing benefits
Probability neglect	1% annual risk feels tiny
Availability heuristic	No recent flood leads perceived safety
Optimism bias	"My house won't be the one that floods"
Normalcy bias	Future assumed to resemble recent experience

- IF you can demonstrate via OSSE or OSE that a measurement can improve the performance of a system by reducing costs, increasing margins or provide some tangible benefit – RIGHT NOW! - you will be successful
- The value does NOT need to be revolutionary – you are not required to save the world!
- People discount rare future risks but they are attuned to profit margins

A Lesson on the Journey to the Abundance Mindset

- Once I saw this guy on a bridge about to jump. I said, "Don't do it!" He said, "Nobody loves me." I said, "God loves you. Do you believe in God?"



Emo Phillips

https://www.youtube.com/watch?v=X09_sw_vc6w

<https://www.theguardian.com/stage/2005/sep/29/comedy.religion>

A Lesson Along the Journey to the Abundance Mindset

- Once I saw this guy on a bridge about to jump. I said, "Don't do it!" He said, "Nobody loves me." I said, "God loves you. Do you believe in God?"
- He said, "Yes." I said, "Are you a Christian or a Jew?" He said, "A Christian." I said, "Me, too! Protestant or Catholic?" He said, "Protestant." I said, "Me, too! What franchise?" He said, "Baptist." I said, "Me, too! Northern Baptist or Southern Baptist?" He said, "Northern Baptist." I said, "Me, too! Northern Conservative Baptist or Northern Liberal Baptist?"
- He said, "Northern Conservative Baptist." I said, "Me, too! Northern Conservative Baptist Great Lakes Region, or Northern Conservative Baptist Eastern Region?" He said, "Northern Conservative Baptist Great Lakes Region." I said, "Me, too!"
- Northern Conservative Baptist Great Lakes Region Council of 1879, or Northern Conservative Baptist Great Lakes Region Council of 1912?"
- He said, "Northern Conservative Baptist Great Lakes Region Council of 1912."



Emo Phillips

https://www.youtube.com/watch?v=X09_sw_vc6w

<https://www.theguardian.com/stage/2005/sep/29/comedy.religion>

A Lesson Along the Journey to the Abundance Mindset

- I said, "Die, heretic!" And I pushed him over.



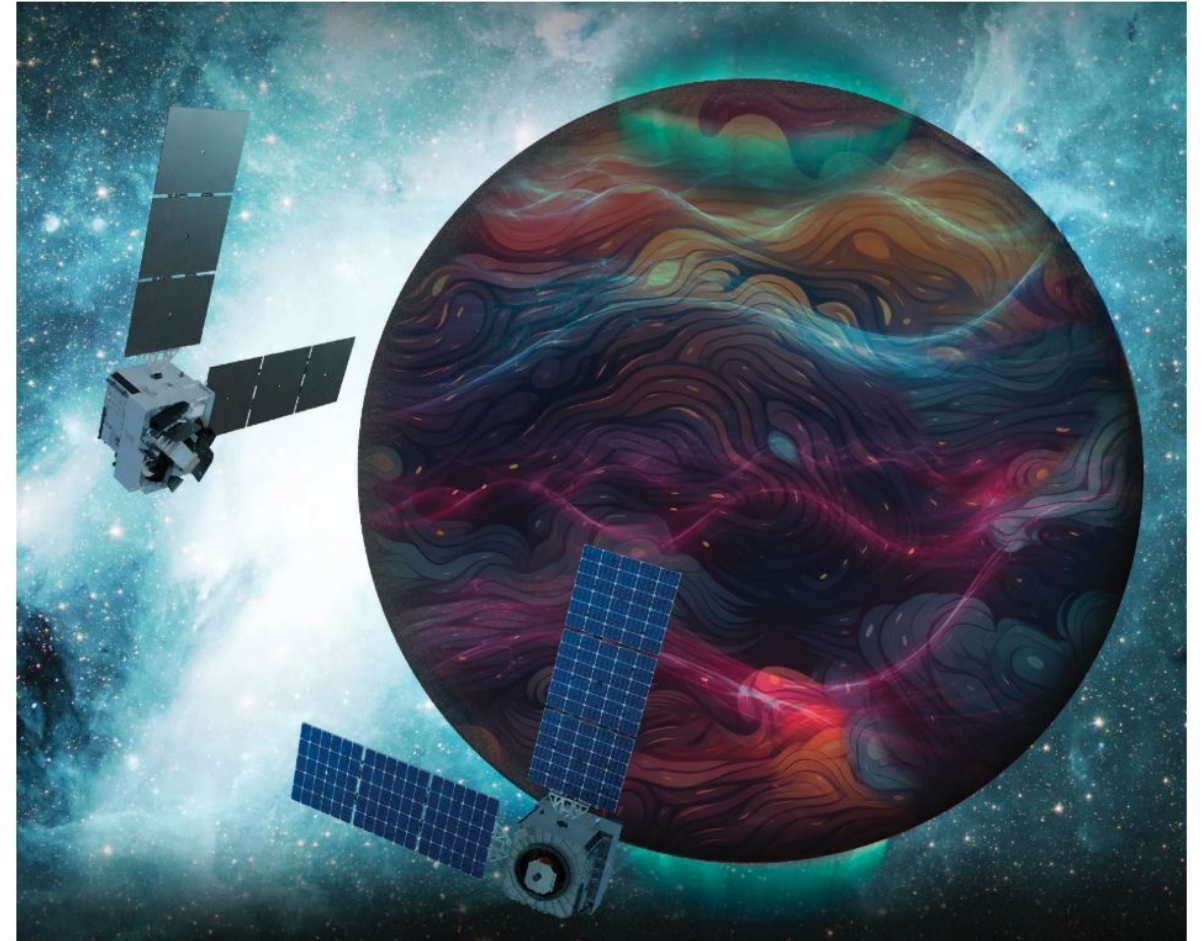
Emo Phillips https://www.youtube.com/watch?v=X09_sw_vc6w
<https://www.theguardian.com/stage/2005/sep/29/comedy.religion>

What do heroes look like? Everyone that made **DYNAMIC** happen is a hero

- Three groups just completed a journey that started 15 years ago
 - Two teams were not selected.
 - They are not 'losers' – they made the journey
 - Not every hero survives
- In 2011 a recommendation was made
 - CATE
- The 2013 Decadal Survey endorsed the DYNAMIC mission
- The fact that 4 teams were willing to commit Step 1 proposals indicated to NASA that the community was able to address the science called out in the previous Decadal and endorsed in the DS2024.

This is our opportunity to
practice the
Abundance Mindset

NASA Mission to Study Space Weather Impacts of Earth's Atmosphere



Artist's rendition of the DAPHNE (Dynamic Atmosphere-Ionosphere Explorer) mission concept. The coloring represents auroras and atmospheric waves in Earth's atmosphere.

Credit: Laboratory for Atmospheric and Space Physics/Mary Tostanoski

What do heroes look like?

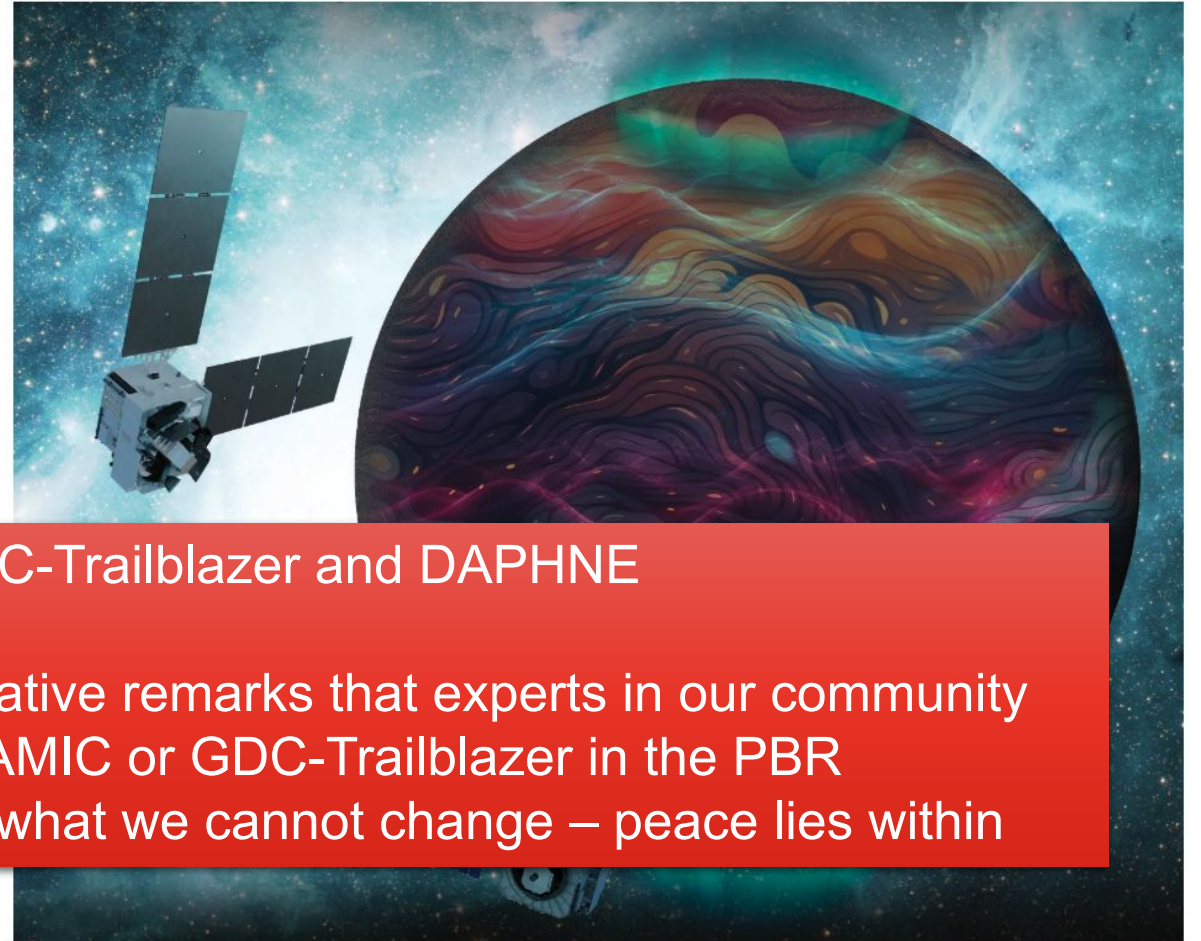
- Three groups just completed a journey that started 15 years ago
- In 2011 and 2012 the Decadal Survey recommended a 'DYNAMIC reference mission'
 - CATE cost \$480M (my recollection)
- The 2013 NASA Roadmap showed that DYNAMIC was not likely to happen under the Decadal assumptions.
- Two teams were not selected.
- One was.

This is our call to action – we need to support GDC-Trailblazer and DAPHNE

Whether we see an immediate return or not

There may be others that will seize upon any negative remarks that experts in our community make as reasons not to prioritize funding of DYNAMIC or GDC-Trailblazer in the PBR
Dao and Stoicism (many others) tell us to accept what we cannot change – peace lies within

NASA Mission to Study Space Weather Impacts of Earth's Atmosphere



Artist's rendition of the DAPHNE (Dynamic Atmosphere-Ionosphere Explorer) mission concept. The coloring represents auroras and atmospheric waves in Earth's atmosphere.

Credit: Laboratory for Atmospheric and Space Physics/Mary Tostanoski

Useful but necessary lesson

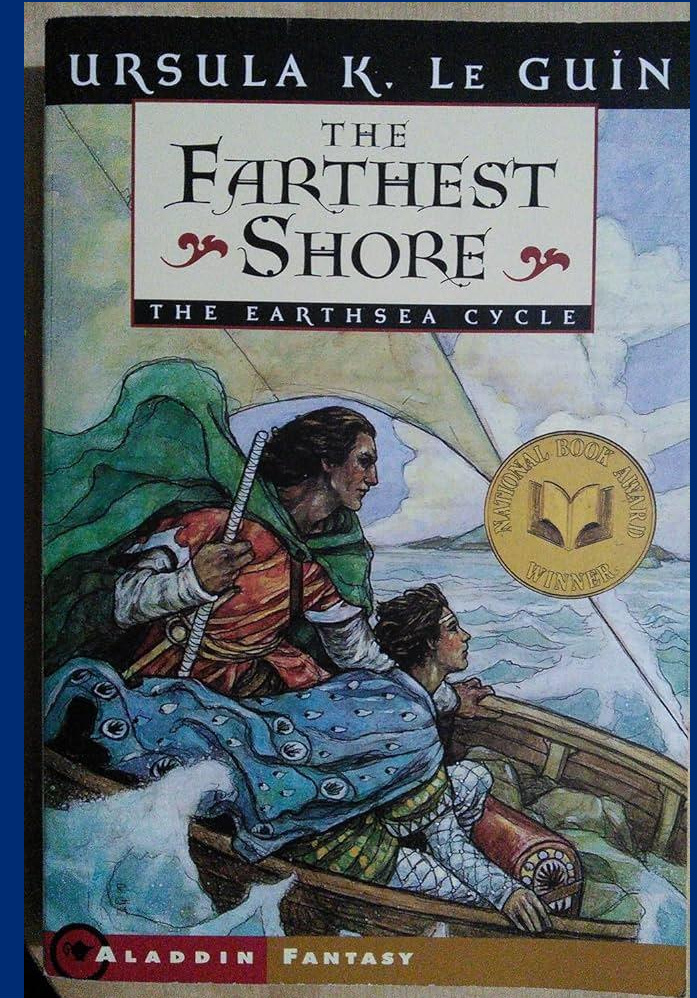
- If you stay focused on:
 - Why has my world changed?
 - Where is stable NASA/NSF funding?
- Then your mindset will focus on scarcity and react from fear
- If you shift to:
 - Where are the problems that *must* be solved, regardless of agency?
- Make the adjustment that
 - your academic work does not constrain you
 - your academic work prepares you
- Your work provides the foundation for new branches (“be the oak”)
- You can open your scope of possible action
 - more stakeholders
 - more pathways
 - more leverage
- Your institutions are all looking for new options, too. Use your ecosystem. Understand what they value. Shape their values. Provide that to them.

A sincere thank you to you all

- “When I was young, I had to choose between the life of being and the life of doing. And I leapt at the latter like a trout to a fly. But each deed you do, each act, binds you to itself and to its consequences, and makes you act again and yet again. Then very seldom do you come upon a space, a time like this, between act and act, when you may stop and simply be. **Or wonder who, after all, you are.**”



- — Ursula K. Le Guin, [*The Farthest Shore*](#)





JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Changing Your Mindset

- **Shifting your outlook requires moving away from automatic fear responses and consciously training your brain to see possibilities.**
- **Practice Active Gratitude:** Neurobiologically, your brain cannot experience deep anxiety and deep gratitude simultaneously. List three specific things you are grateful for daily to force your brain to look for what is working – this is not limited to your work. Remember: work is not everything
- **Reframe "Have To" into "Get To":** Change your internal language. Instead of telling yourself, *"I have to do this exhausting task,"* reframe it as, *"I get the opportunity to try this."*
- **Create Win-Win Situations:** Actively seek outcomes where both sides benefit. Share resources, introduce connections, and mentor others without fearing that their rise will cause your fall. It becomes easier with repetition as you learn good consequences outweigh bad.
- **Monitor Your Inputs:** Pay attention to your environment. Limit time spent consuming media designed to make you feel inadequate, and distance yourself from chronically cynical or competitive peers.
- **Ask Expansive Questions:** When faced with a limitation, avoid saying, *"We can't afford/do/propose that."* Instead, ask, *"How can we make that possible?"* or *"What options haven't we considered yet?"*