

VFS Autonomy Panel

DELIVERING ON AUTONOMOUS VERTICAL FLIGHT - OEM PANEL

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April 26, 2022, Panel 1:00 – 2:30 pm





Manufacturer Panel Topics

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- Manufacturers Are Making Progress - Developing (Flying) Prototypes
- NASA & CAAs Serve Public Safety & Industry Needs – Partnering with Industry for Wildfire, AAM, and Other Efforts for Tech Maturation
- Automation Integration and Maturation Strategies - AIMS Towards the Future Target (FAA, NASA, Industry)
- Capability Maturity Model - New Capabilities Cannot Just be Envisioned Without A Development Path
- Supply Chain, Production, Lifecycle – Not Just Type Design



Supporting Slides



Notional Automation Capability Maturity Model

Capability

New ability, expertise, or proficiency

Functions/ Services

Task, role, and/or system effects which enable a *Capability*

Technology/ Human

Equipment including HW/SW which provide *Functions/ Services*

Human contributions to provide *functions/ services*

Data/ Knowledge

Information sources used by *Technology* and/or *Humans*

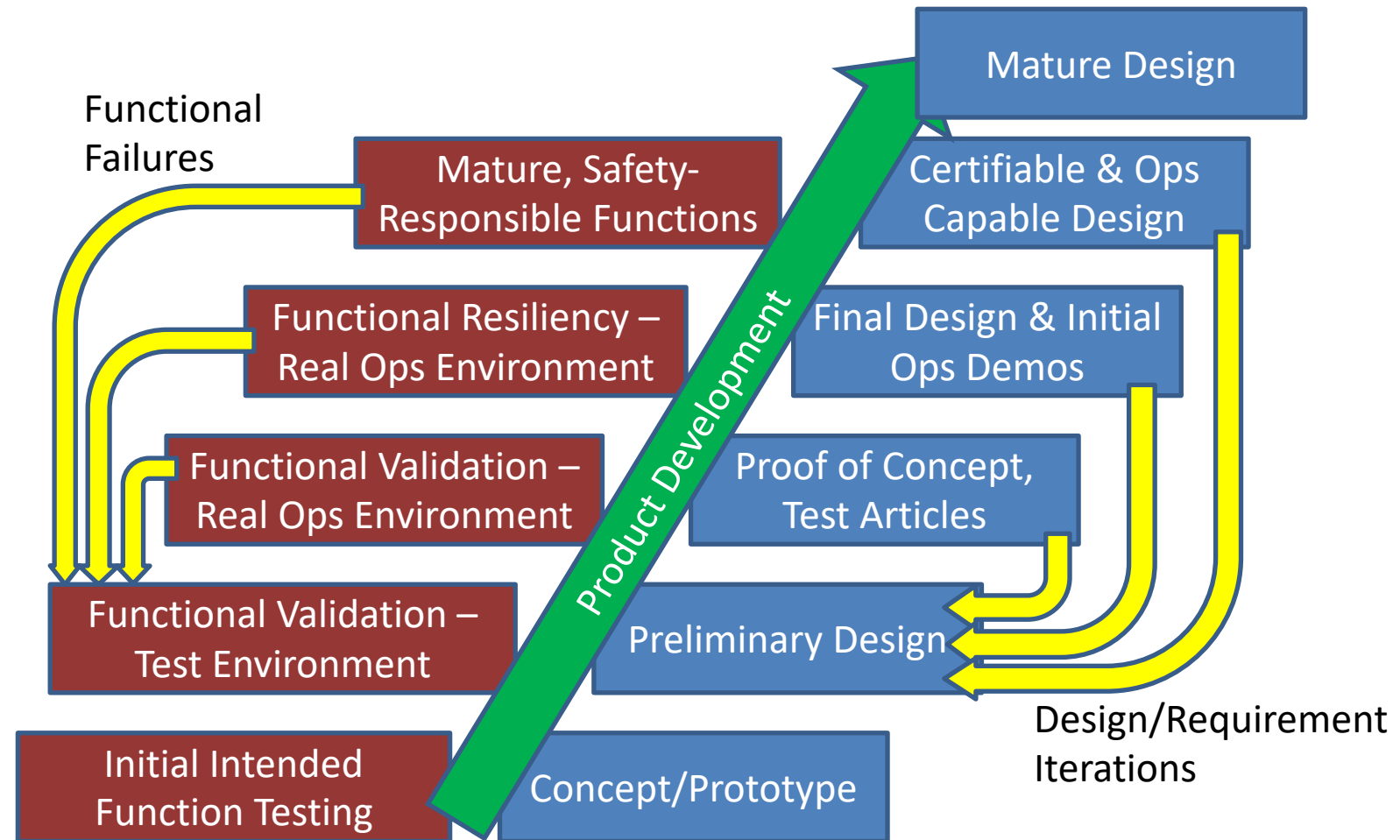
Human knowledge

Must assess maturity, integrity, reliability, availability, etc. of data sources & technology to implement an intended function in support of a new capability



Benefit of Using CMM Concept for Automation

- Methodical Progression from Prototype, to Initial Function with Human Monitoring/Backup, to Safety Responsible Function
- Common Framework for Analyzing Each Step Towards Proven Capability

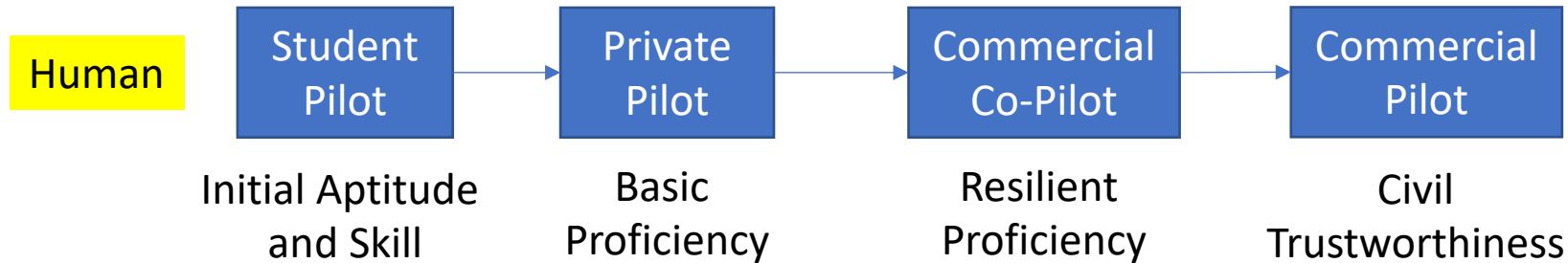


Building-in Robust Safety Assurance

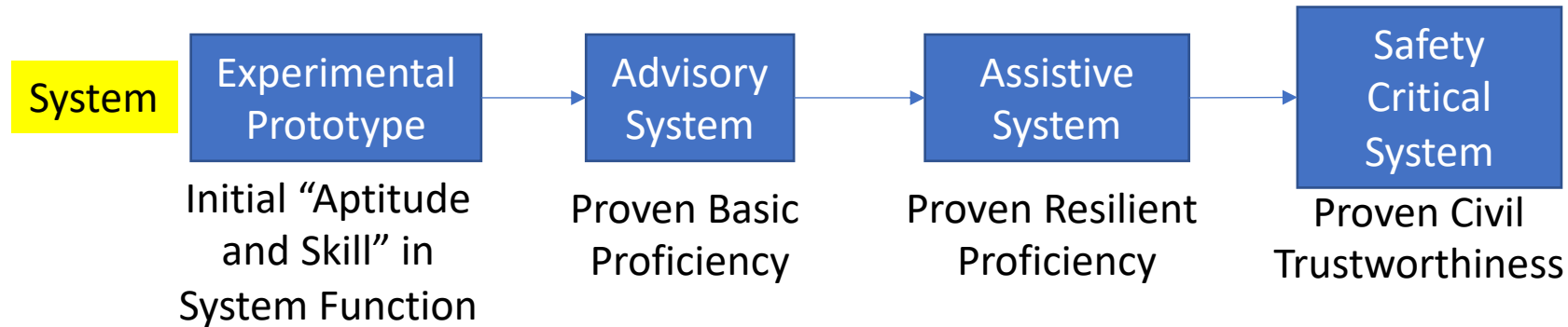


- Compare Risk-based, Model Based Automation Development to Pilot/Crew Development Process
- How Do We Build In Proficiency, Robust Function?

Scenario-based Training With Instructor + Repetition + With Expected Outcomes/Behavior



Simulation & Flight Test to Demonstrate Readiness for Intended Use, Type of Operation, Task Criticality



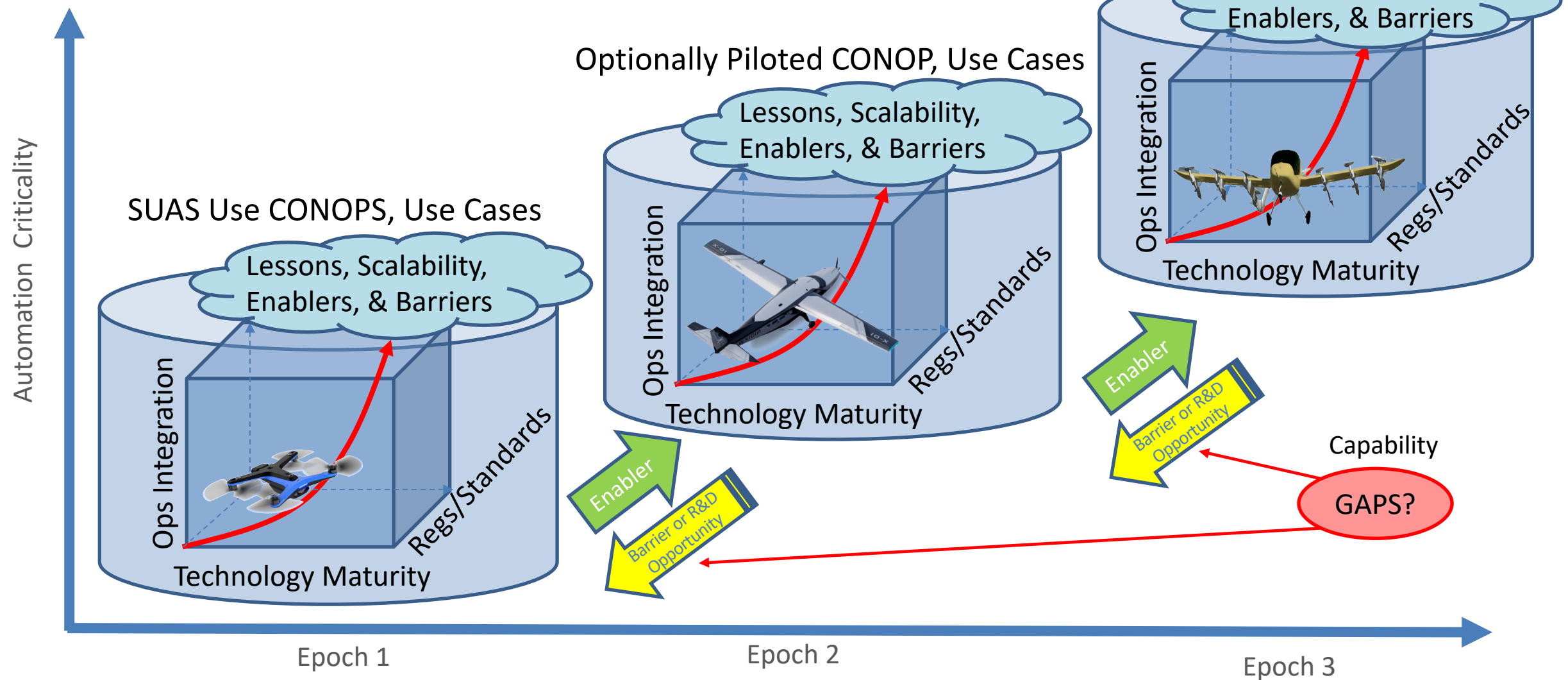
Must Work-up to Resilient/Robust Assurance in Automation Designs



Potential Reference mission Capability Maturity Path (Epochs)

Consider Technical & Regulatory Maturity + Aircraft/Ops

Remotely Piloted CONOP, Use Cases





Automation Example – Technology Maturation

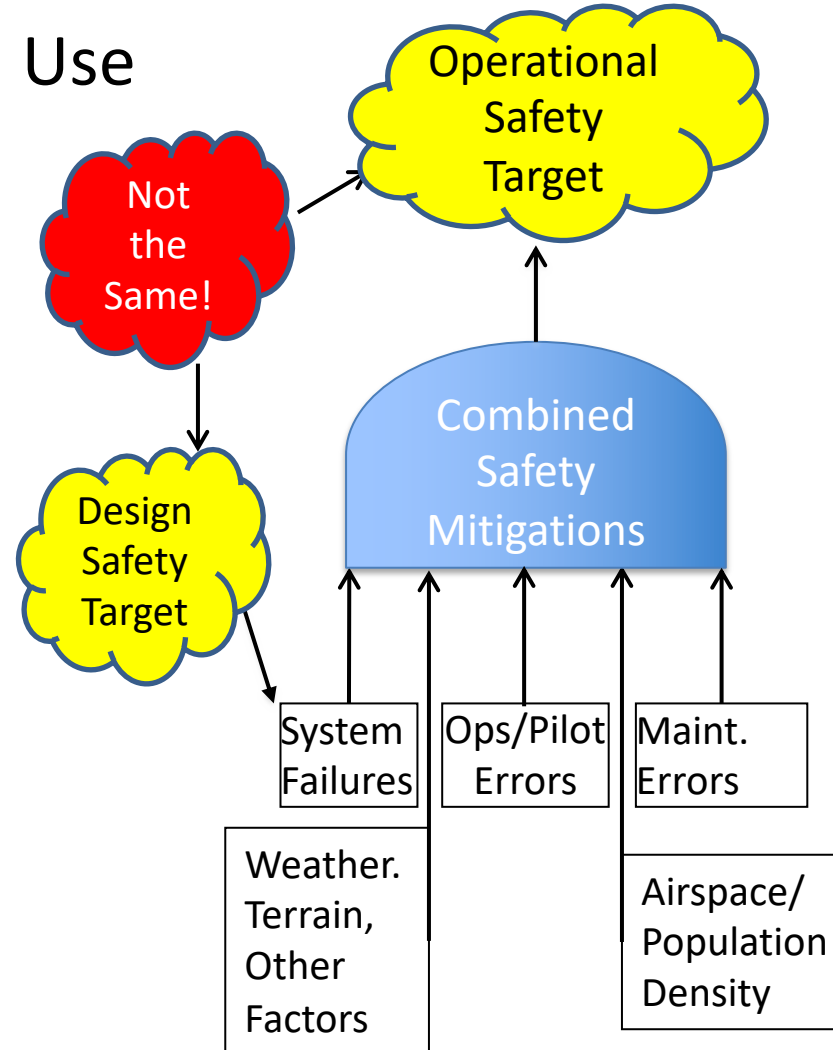
NASA Paper: [Visual advantage of enhanced flight vision system during NextGen flight test evaluation](#)





What Is Safety Assurance?

- The Process By Which A Product is Deemed Safe for Repeatable, Reliable, Civil Use
 - Not Just Development Assurance
 - System safety, airspace, ops, maintenance, & pilot performance all feed into operational safety
 - Cannot try to fix ops safety target with increasing $10E^{-X}$ for system failures
 - Must Account For Other Factors





Technology Hype – Lessons Learned

- History Reflects Typical Hype Cycle
- Technology Triggers of Electric Propulsion and Automation
- Reaching a Peak of Expectations – Large Investment
- The Level of Rigor and Diligence Dictates How Deep The “Trough of Disillusionment” Will Be
- Accidents Early Will Deepen the Trough and Delay the Rise to a Plateau of Successful/Safe Ops
- VLJ Lessons Are Applicable – Autonomy Represents a Challenge to eVTOL AAM Departing from the VLJ Path

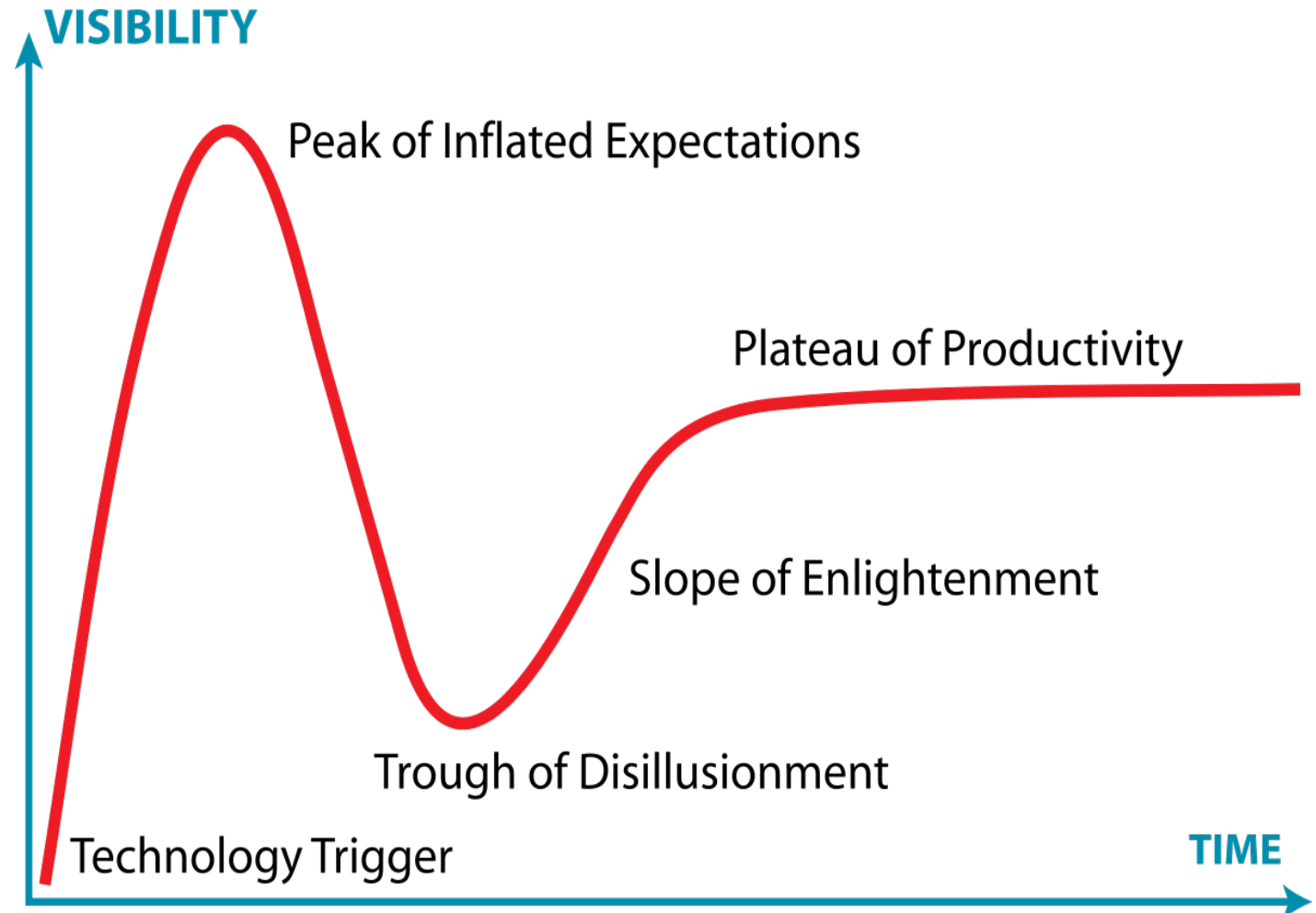


Image: Wikipedia Hype Cycle

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