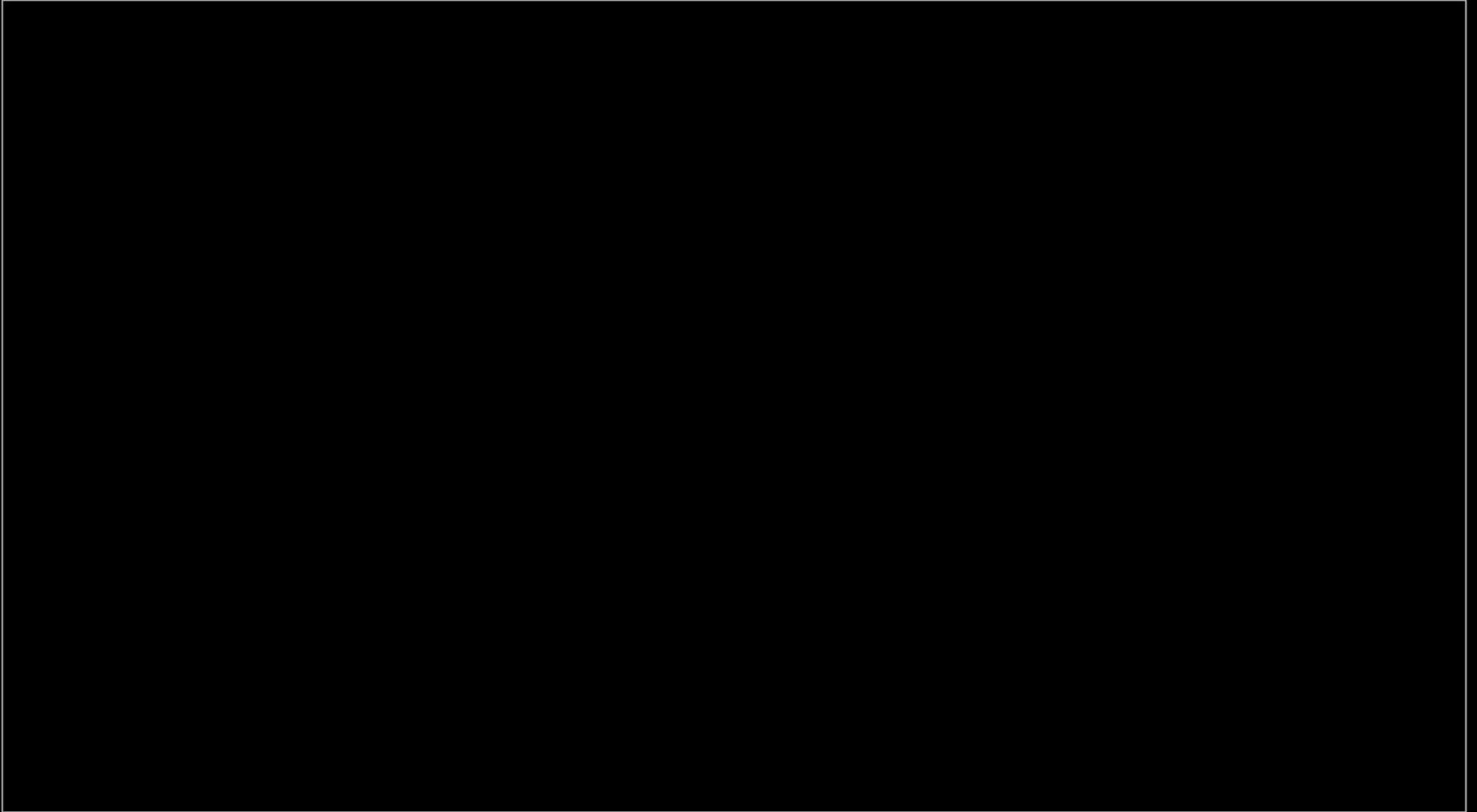


# It Really *is* Rocket Science

Dr. Edward Hoffman & Dr. Jon Boyle  
NASA Chief Knowledge Office

# ISS View



# I. Knowledge at NASA

- Generational Knowledge
- The Changing Landscape
- Products, Projects, Entrepreneurship
- Complexity
- Stakeholder Messages

# Knowledge Spans Generations



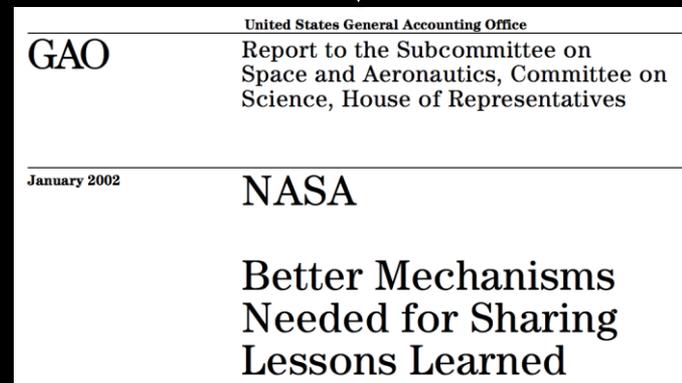
X-15  
Introduced: 1958

Space Shuttle  
Retired: 2010

One of the X-15's many knowledge legacies that it passed to the Shuttle was unpowered landing — both reentered the atmosphere as gliders.

# The Changing Knowledge Landscape

- Managing knowledge is nothing new at NASA.
- Many early efforts were in response to specific needs.
- In recent years, agency stakeholders have identified opportunities for greater coordination and collaboration across NASA.



# Products, Projects, Entrepreneurship

## *Complex Project-Based Organization*

## *Mass-Production Organization*

**Product**

One-and-only

Scalable manufacture

**Problems**

Novel

Routine

**Technology**

New/invented

Improved/more efficient

**Cost**

Life cycle

Unit

**Schedule**

Project completion

Productivity rate

**Customer**

Involved at inception

Involved at point of sale

**Knowledge**

Innovation

Continuous improvement

**Need**

# Complexity at NASA

Complexity works against mission success:

- Confusing, vague, and poorly defined priorities, strategies, lines of authority, governance, policies, roles, responsibilities & support.
- A proliferation of customers, stakeholders, & strategic partner interfaces at multiple levels of interest, involvement & responsibility.
- Technical complexity & system integration issues within & across multiple disciplines and multiple systems.
- Increased data & information amount & availability for process input, throughput, & output.
- Multiple overlapping, conflicting, outdated processes and procedures that involve multiple points of contact distributed across multiple organizational levels & across multiple oversight & advisory entities.

# Message from Stakeholders, 2002-2012

GAO 2002: “...fundamental weaknesses in the collection and sharing of lessons learned agency-wide.”

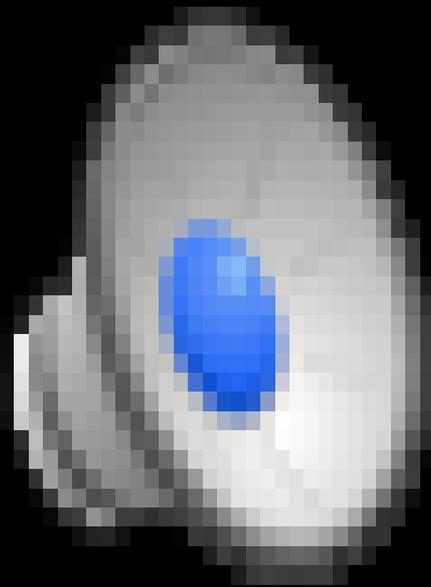
ASAP 2011: “...recommends NASA establish a single focal point (a Chief Knowledge Officer) within the Agency to develop the policy and requirements necessary to integrate knowledge capture...”

OIG 2012: “...inconsistent policy direction and implementation for the Agency’s overall lessons learned program.”

# **Critical Knowledge in Action: The ISS Water Intrusion Mishap**

**A Case In How Organizational Pressures  
Leads to Knowledge Services**

# Space Suit Water Problem





"I experienced what  
it's like to be a goldfish in a fish bowl"

- Astronaut Parmit

## II. Areas of Progress

- Policy and Governance
- NASA Imperatives
- Knowledge Community and Networks
- Knowledge Services Strategy
- CKO Roles and Responsibilities
  - Knowledge Transfer (Chris Scolese)
- The 4 As
  - Speaking up (Bryan O'Connor)
- Knowledge Map and [km.nasa.gov](http://km.nasa.gov)

# Policy and Governance

NASA collaboratively developed and adopted a new knowledge policy in November 2013. Key features:

- Federated approach to governance.
- CKOs appointed at Centers, Mission Directorates, Functional Offices, with Roles and Responsibilities.
- Tools such as the first NASA Knowledge Map based on 6 activity categories that form a common vocabulary and [km.nasa.gov](http://km.nasa.gov) to focus communications and distribution.

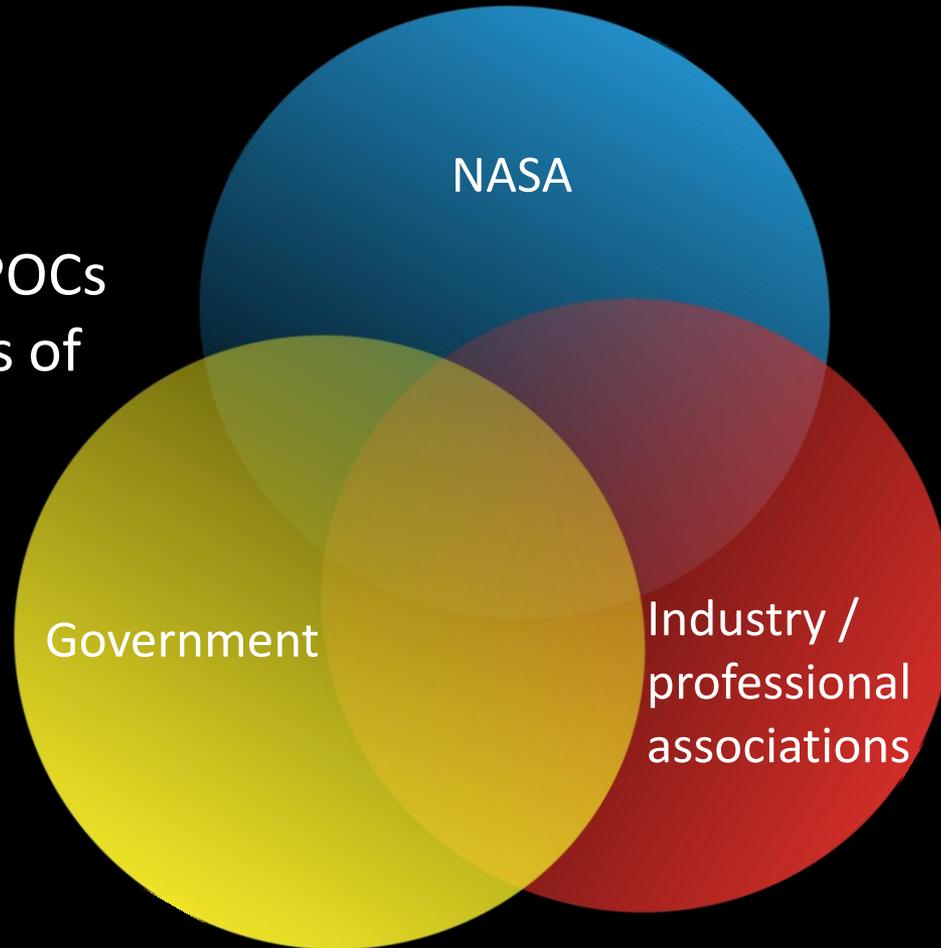
# NASA Imperatives

- Supports and extends Knowledge Services gains for the NASA Technical Workforce towards improved accessibility, searchability, findability, and visualization.
- No additional cost.
- Least administrative burden.
- Formal, rigorous, iterative, and Senior Leader supported.
- Integrated, reinforcing, and actionable.
- Measurable and objective.

# NASA Knowledge Community and Networks

- Agency CKO
- Local CKOs/POCs
- Communities of practice

- Federal KM Working Group



- APQC
- PMI
- IPMC
- IKTC

# Knowledge Services Strategy

The goal: *Where does the NASA Technical Workforce go to find and use the critical knowledge required now and in the future to achieve mission success in a highly complex and unforgiving environment?"*

Enable accessibility, findability, searchability, and visualization of data, information and systems.

Facilitate opportunities through better communications and processes for sharing and networking.

Establish best practices for capturing & retaining, sharing & applying, discovering & creating knowledge.

Establish maturity model for knowledge effectiveness to measure and validate.

*Respect local customs & enhance organizational norms  
(The Federated Approach).*

# CKO Role and Responsibilities (1)

Given the complex nature of knowledge at NASA, the agency has adopted a *Federated model* for coordination of knowledge activities.

The NASA CKO functions as a *facilitator* and *champion* for knowledge.

# CKO Roles and Responsibilities (2)

## The Federated Model

Autonomy

+

Responsibility

Each Center and Mission Directorate determines the approach that best meets its needs.

Knowledge applicable to all NASA missions and Centers will be shared to the extent possible across the entire Agency.

# Organizational Responsibility: Transferring Knowledge



# Individual Responsibility: 4 A's



# Individual Responsibility: Speaking Up



# Knowledge Map (1)

- Online resource at [km.nasa.gov](http://km.nasa.gov)
- Information hyperlinked and sortable by:
  - Organizations
  - CKOs/points of contact
  - Knowledge categories (see next slide)

# Knowledge Map (2)



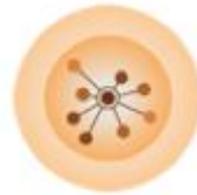
**Case  
Studies /  
Publications**



**Face-to-Face  
Knowledge  
Services**



**Online Tools**



**Knowledge  
Networks**



**Lessons  
Learned /  
Knowledge  
Processes**

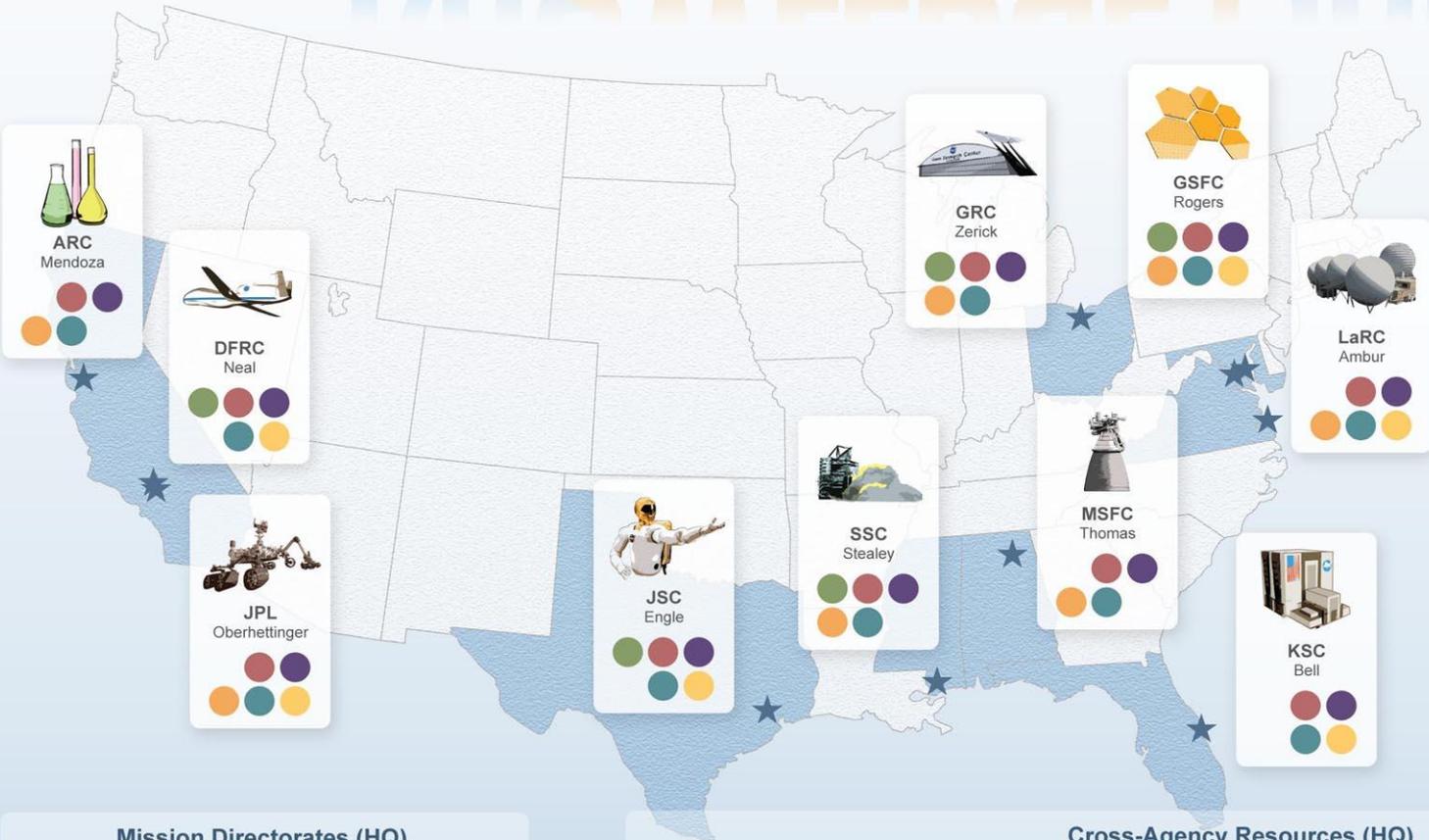


**Search / Tag  
/ Taxonomy  
Tools**



National Aeronautics and Space Administration's

# KNOWLEDGE MAP



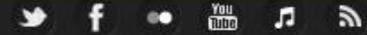
- Case Studies/ Publications
- Face-to-Face Knowledge Services
- Online Tools
- Knowledge Networks
- Lessons Learned/ Knowledge Processes
- Search/Tag/ Taxonomy Tools

## Mission Directorates (HQ)



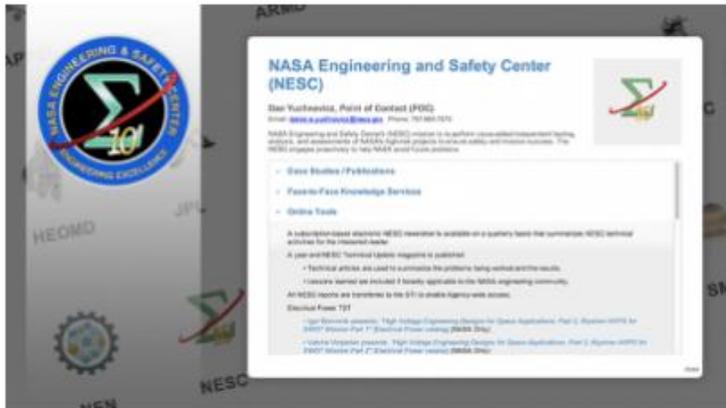
## Cross-Agency Resources (HQ)





Links, resources, and updates

## WHAT'S NEW >>



### NESC Academy Announces the Release of New Online Lessons

February 12, 2014 // No Comment  
The NESC Academy recently announced the release of new online lessons in the Electrical Power TDT, Loads and Dynamics TDT and Materials TDT areas.

[Full story](#)

## SEARCH

CKO communications

[CKO BLOGSPOT](#)



# III. The Road Ahead

- Strategic Knowledge Imperatives
- Reflective Leadership
- REAL Knowledge KS Model
- Process Gaps
- Big Challenges
- Critical Knowledge and Referee Process
- Digital Tools
- Questions

# Strategic Knowledge Imperatives (1)



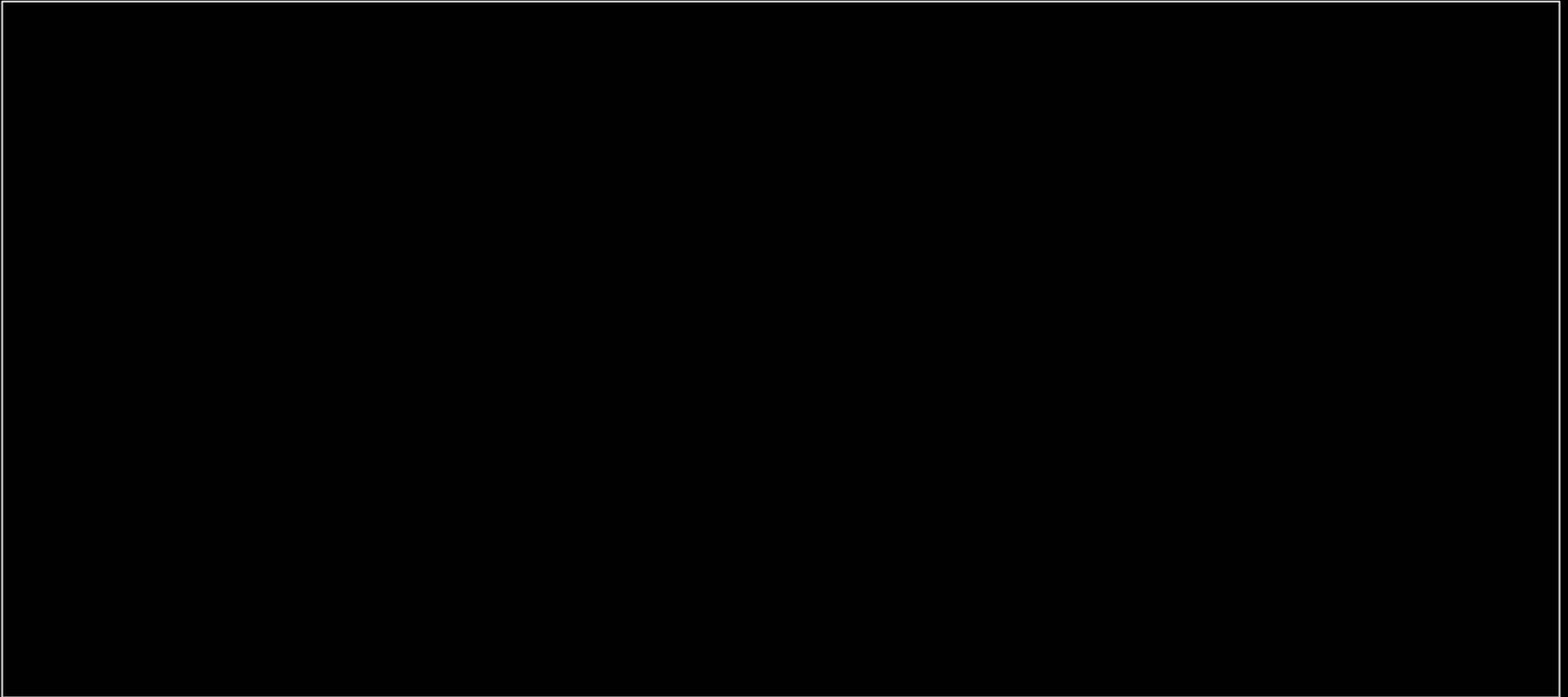
# Strategic Knowledge Imperatives (2)

- *Leadership*: Without leadership, KS results are at best serendipitous, at worst fail.
- It is a *Project World*: An adaptable discipline that maximizes use of learning to promote efficiency and effectiveness.
- *Knowledge*: Organized set of content, skills, and capabilities gained through experience and formal and informal learning that is applied to make sense of new and existing data and information.
- *Talent Management*: Specification, identification, nurturing, transfer, maintenance, and expansion of the competitive advantage of practitioner expertise and competence.
- *Portfolio Management*: Integrates projects with strategy and creates an organizing framework and focus driving organizational purpose and activities.
- *Certification*: Objective, validated standards and functions to benchmark achievement in defined categories of practitioner performance and capability.

# Strategic Knowledge Imperatives (3)

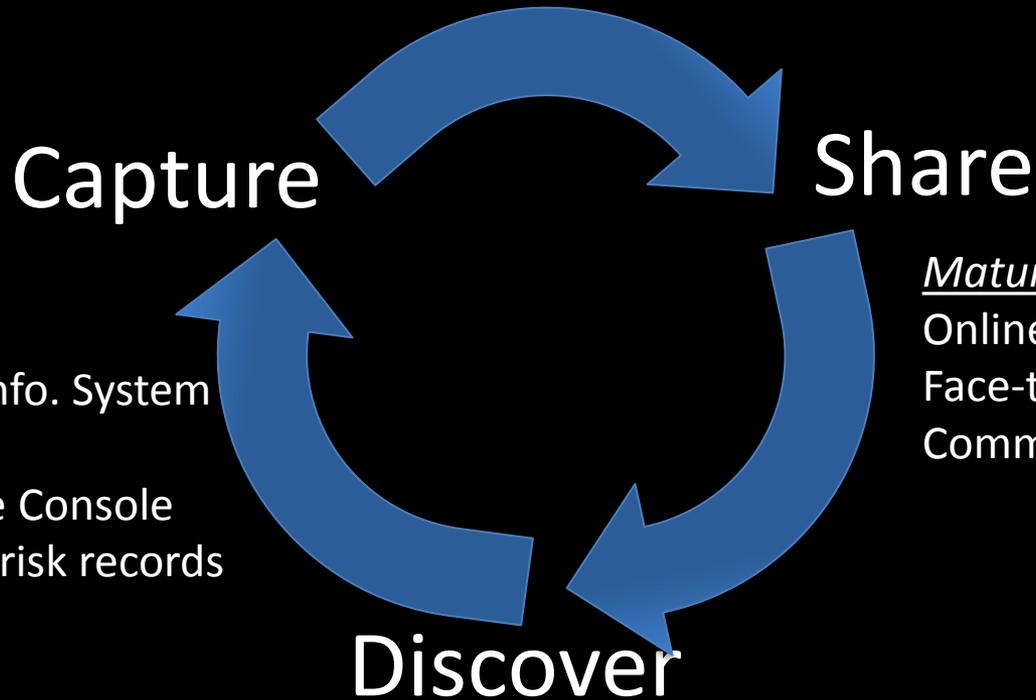
- *Transparency*: Nothing hidden for long, especially errors.
- *Frugal Innovation*: Viewing constraints as opportunities in an era of restricted and diminished resources.
- *Accelerated Learning*: Broadest view of learning using digital technologies, knowledge-sharing, learning strategies, social media, cross-discipline content.
- *Problem-centric Approach*: Non-partisan, non-biased, non-judgmental, pragmatic orientation to problems and solutions, focusing on achievement, improvement, and innovation.
- *Governance, Business Management and Operations*: Pragmatic alignment, oversight, approvals, and implementation of project operations that are not administratively burdensome.
- *Digital Technology*: Can result in open, social network-centric, non-proprietary, adaptable, and flexible frameworks to accelerate learning.

# Modeling Reflective Leadership





# NASA's Gaps in Core Knowledge Processes



Mature capability:

Case studies  
Lessons Learned Info. System  
Videos  
Shuttle Knowledge Console  
Knowledge-based risk records

Mature capability:

Online tools and portals  
Face-to-face events  
Communities of practice

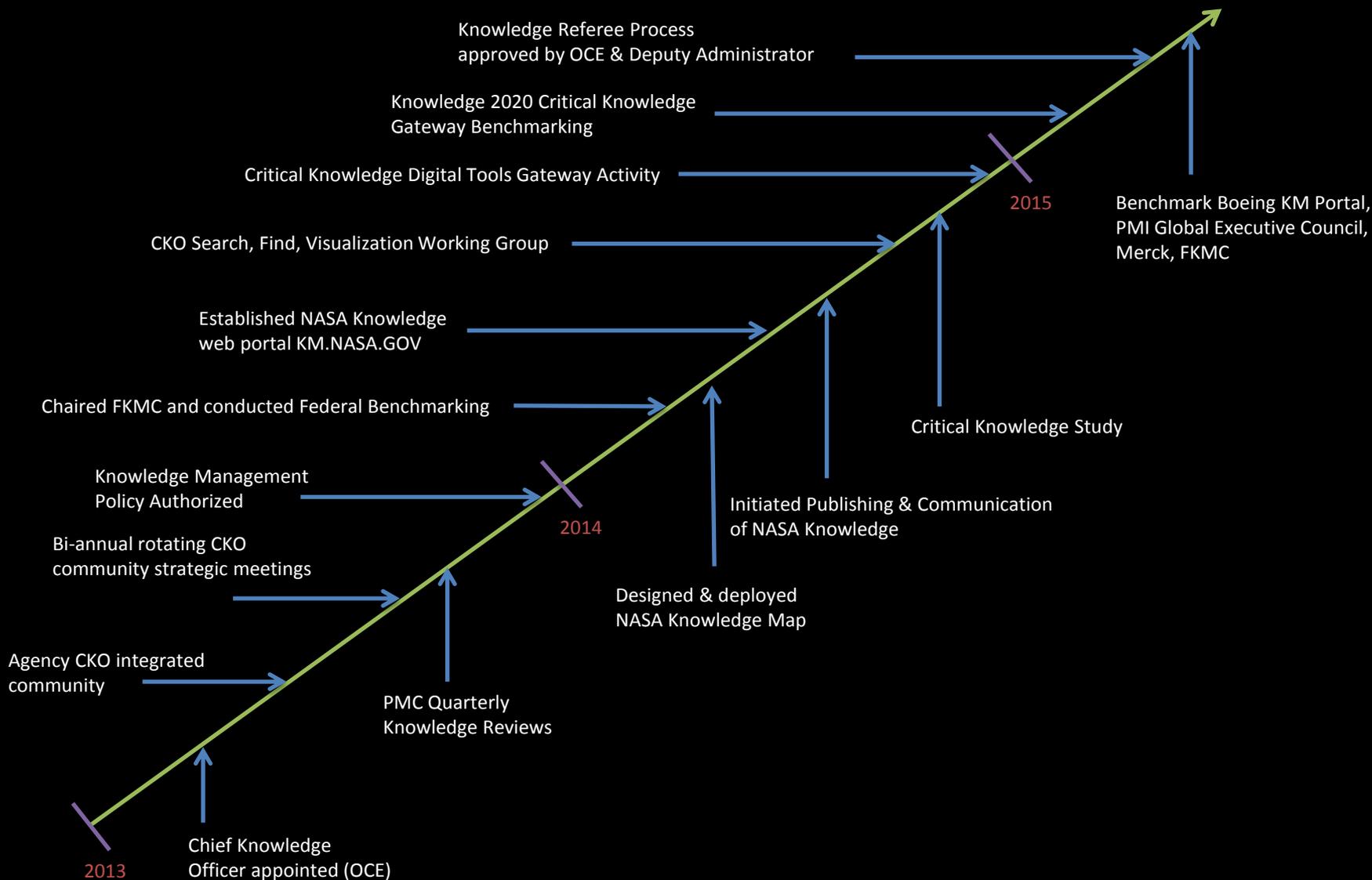
Inadequate capability:

Search – enhanced ability to discover  
Culture – expectation to discover  
“Nudges” – reminders to discover

# Big Challenges: Please help me solve these key challenges in the afternoon knowledge jam session

- Findability, Searchability, Adaptability
- Prioritization of Agency Critical Knowledge
- What are the metrics and measures that capture effectiveness and efficiency in the core knowledge processes?
- What is the relationship between Knowledge Services, accelerated learning, and reducing complexity?
- Can an understanding of biases and heuristics that drive organizational and societal expectations help organizations make better decisions and design better knowledge services?

# CKO Timeline



# Digital Tools for Critical Knowledge at NASA (1)

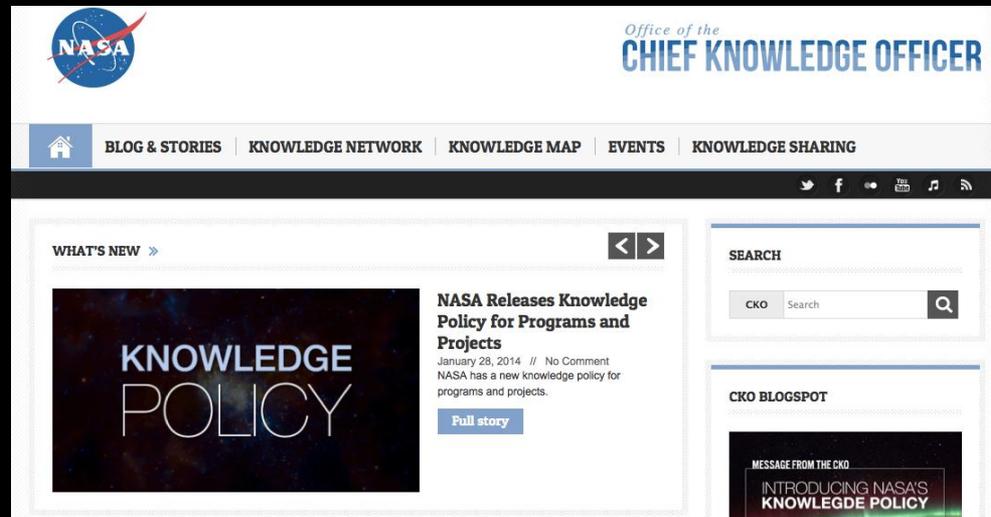
- km.nasa.gov serves as integrating mechanism and critical knowledge gateway.
- Data and information visibility, searchability, findability, and visualization are key factors driving Agency improvement efforts for Data Management, Knowledge Services, and Analytics.
- Critical Knowledge from Knowledge Referee Process drives priorities and administrative actions.

# Digital Tools for Critical Knowledge at NASA (2)

- Additional actions on modern digital tools are moving rapidly by leveraging KM federated infrastructure. Examples:
  - Creation of *JPLTube* video with spoken keyword search capabilities.
  - Capture & sharing lessons at GSFC of over 50 *Case Studies* & direct support of JPL, GRC & MSFC case development & digital distribution.
  - LaRC *Oral Lessons Learned* documentation & digital distribution.
  - KSC analysis & update of *Agency Lessons Learned Information System (LLIS) Database*.
  - Active analysis at JSC of cutting-edge *Searchability & Findability Capabilities & Shuttle Console* development that captures thousands of documents & lessons related to the program.
  - NASA CKO Office *Agency Knowledge Map* update with new content & interactivity including a new *HEOMD Knowledge-Based Risk Dashboard*.
  - New *Masters with Masters* video series on Lessons Learned and Critical Knowledge & digital distribution.
  - *Young Professionals* assisting NASA in citing best digital tools.
  - Benchmarking best-in-class Knowledge Services (Boeing and others)

# Questions

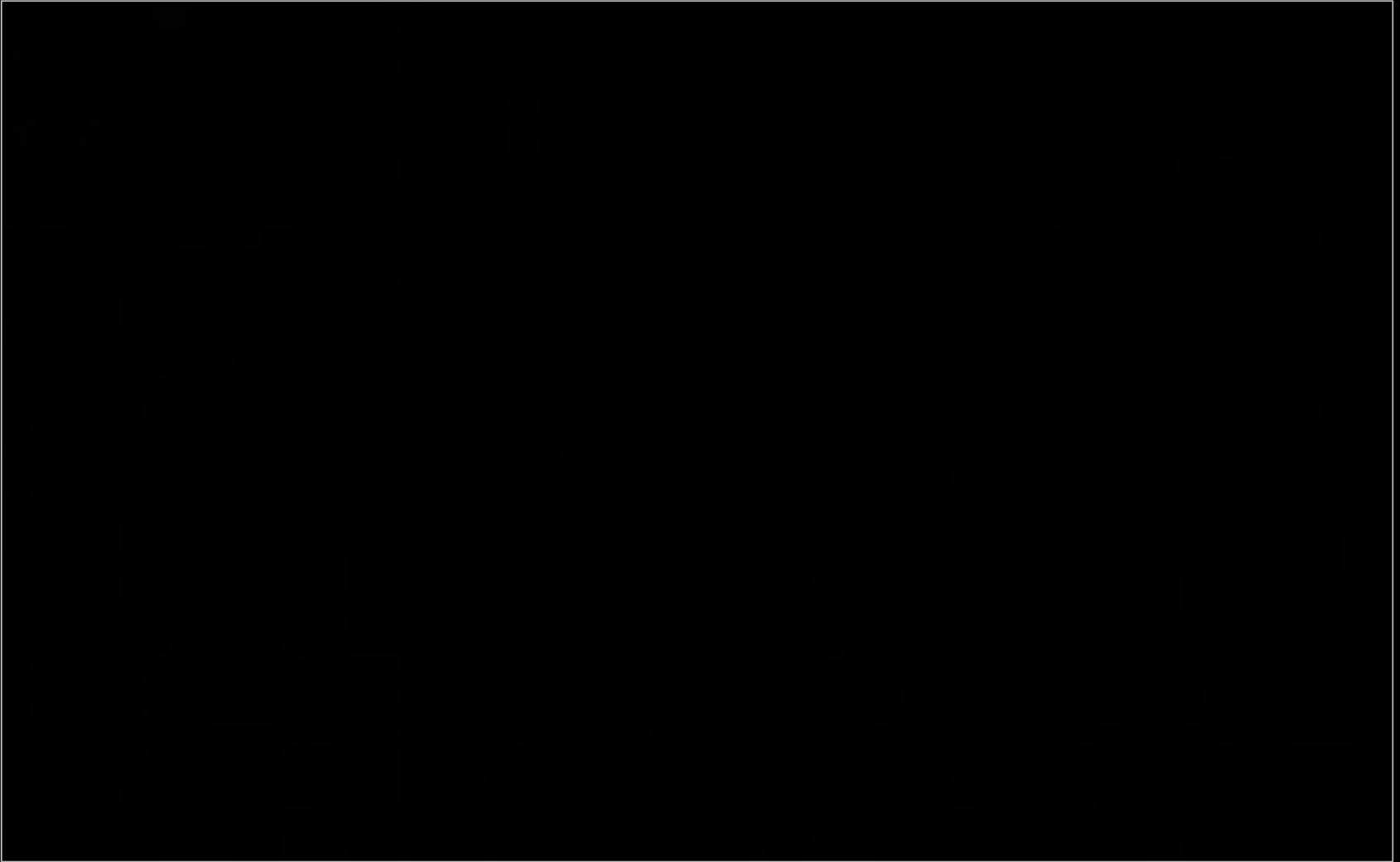
web: km.nasa.gov



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[jonboyle1@verizon.net](mailto:jonboyle1@verizon.net)

# Curiosity Landing



# Help us with these 3 'wicked' problems/challenges

1. Rapid engagement and accelerated learning – how can we do a better job?
2. Prioritization of agency critical knowledge
3. Enterprise search