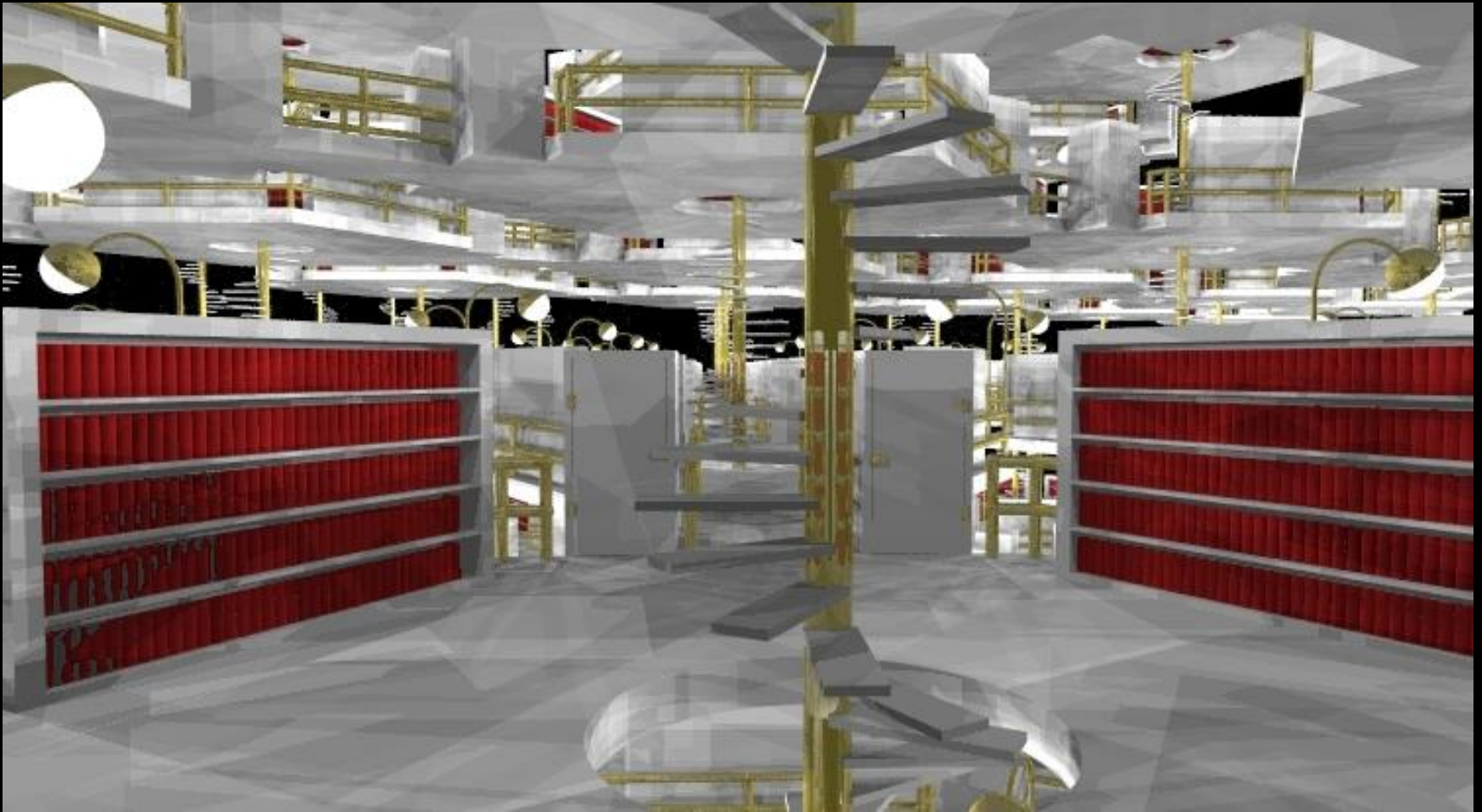# REAL Knowledge at NASA

Attracting, Retaining and Leveraging Talent in order to Build an Organizational Knowledge System at NASA

Dr. Edward J. Hoffman
NASA Chief Knowledge Officer

The Library of Babel – Jorge Luis Borges

I. Knowledge at NASA

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

Knowledge Spans Generations

X-15 ⟶ Space Shuttle
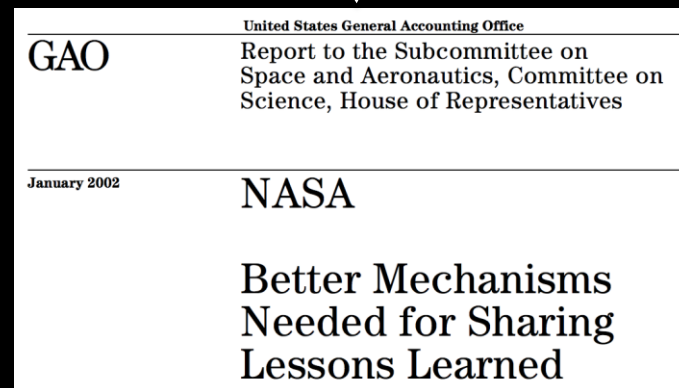Introduced: 1958   Retired: 2010

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.

NASA: Human error caused loss of Mars orbiter

November 10, 1999
Web posted at: 4:27 p.m. EST (2127 GMT)

In this story:

Report Summary

Signs of trouble came early

Will Polar Lander be safe?

United States General Accounting Office

GAO   Report to the Subcommittee on Space and Aeronautics, Committee on Science, House of Representatives

January 2002   NASA

Better Mechanisms Needed for Sharing Lessons Learned

Projects, Products, Entrepreneurship

	Complex Project-Based Organization	Mass-Production Organization	Entrepreneurial Organization
Product	One-and-only	Scalable manufacture	Permanent beta
Problems	Novel	Routine	Hackable
Technology	New/invented	Improved/more efficient	Frugal
Cost	Life cycle	Unit	-> Zero marginal
Schedule	Project completion	Productivity rate	Iterative
Customer	Involved at inception	Involved at point of sale	Involved in testing
Knowledge Need	Innovation	Continuous improvement	Bootstrap + innovation

Complexity at NASA

Confusing, vague, and poorly defined priorities, strategies, lines of authority, governance, policies, roles, responsibilities, support

Multiple customers, stakeholders, and partners at multiple levels of interest, involvement, responsibility

COMPLEXITY

Increasing amounts of data and information for process input, throughput, output
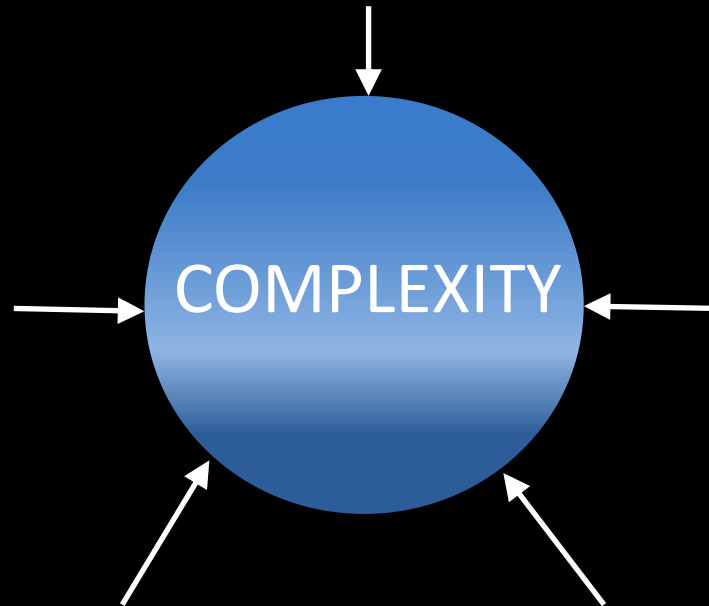
Technical complexity and system integration issues within & across multiple disciplines and systems

Multiple overlapping, conflicting, outdated processes and procedures involving multiple POCs across multiple levels & across multiple oversight & advisory entities
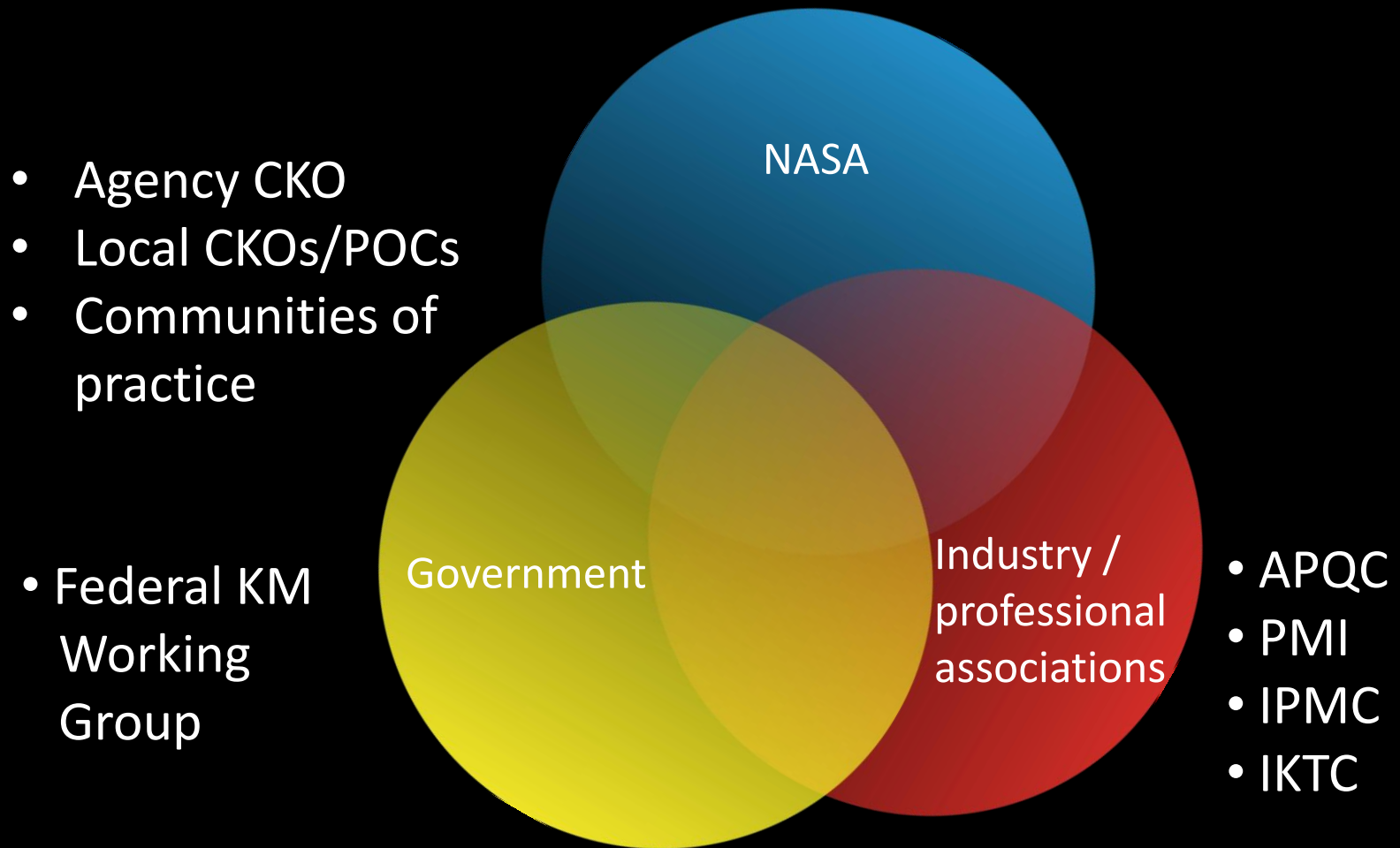
II.   Areas of Progress

- Policy and Governance
- Management Imperatives
- Knowledge Community and Networks
- Knowledge Services Strategy
- CKO Roles and Responsibilities
    - ✓ Knowledge Transfer (Chris Scolese)
- The 4 As
    - ✓ Career Development Framework
    - ✓ Technical Skills (B. Gerstenmaier)
- Knowledge Map and 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 to focus communications and distribution.

NASA Knowledge Community and Networks

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

- Federal KM Working Group

NASA

Government

Industry / professional associations

- 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.

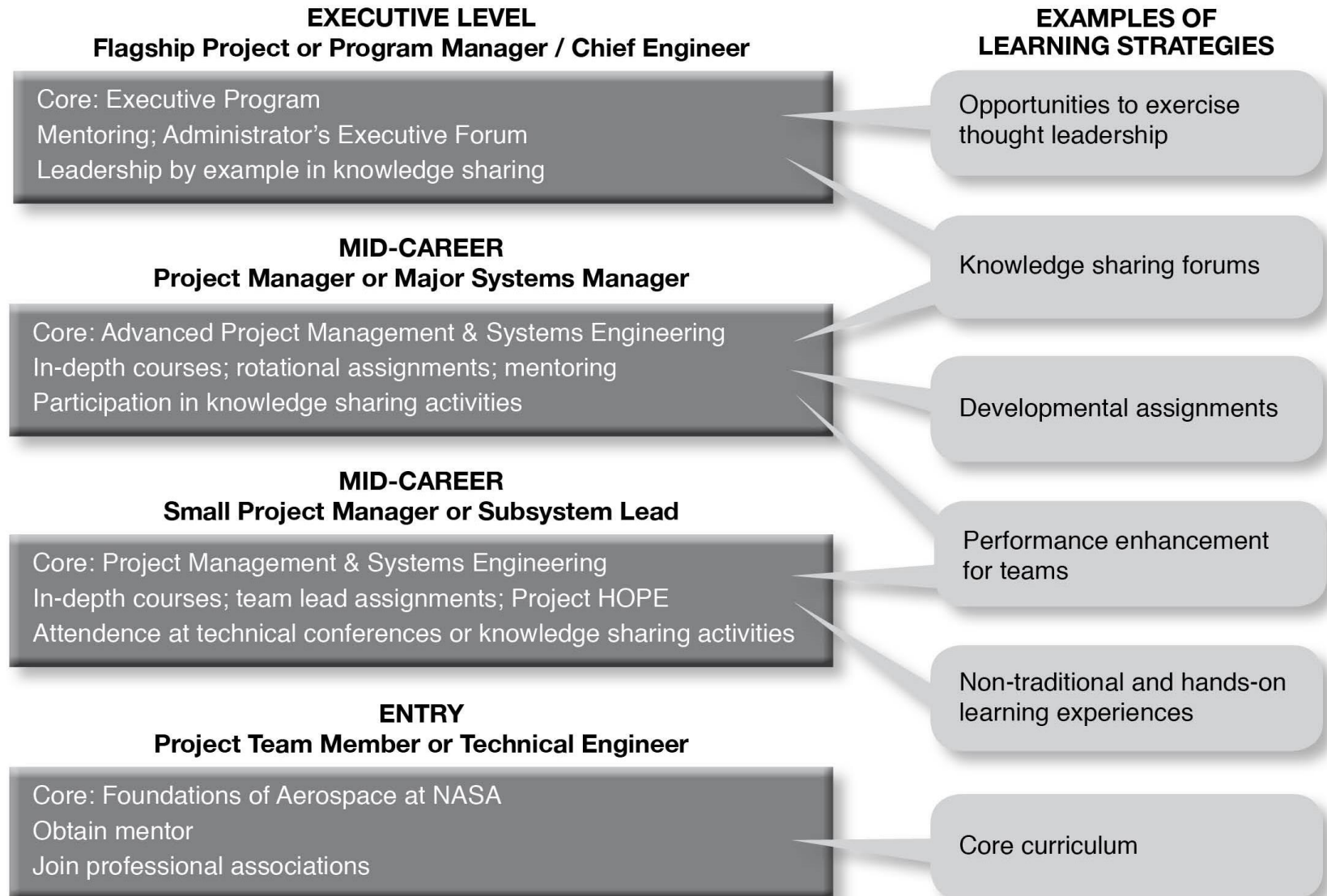# Organizational Responsibility: Transferring Knowledge

Individual Responsibility: 4 A's

Individual Responsibility: Speaking Up

Ability - Career Development Framework

EXECUTIVE LEVEL
Flagship Project or Program Manager / Chief Engineer

Core: Executive Program

Mentoring; Administrator's Executive Forum

Leadership by example in knowledge sharing

MID-CAREER
Project Manager or Major Systems Manager

Core: Advanced Project Management & Systems Engineering

In-depth courses; rotational assignments; mentoring

Participation in knowledge sharing activities

MID-CAREER
Small Project Manager or Subsystem Lead

Core: Project Management & Systems Engineering

In-depth courses; team lead assignments; Project HOPE

Attendence at technical conferences or knowledge sharing activities

ENTRY
Project Team Member or Technical Engineer

Core: Foundations of Aerospace at NASA

Obtain mentor

Join professional associations

**EXAMPLES OF
LEARNING STRATEGIES**

Opportunities to exercise thought leadership

Knowledge sharing forums

Developmental assignments

Performance enhancement for teams

Non-traditional and hands-on learning experiences

Core curriculum

Knowledge Map (1)

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

Knowledge Map (2)

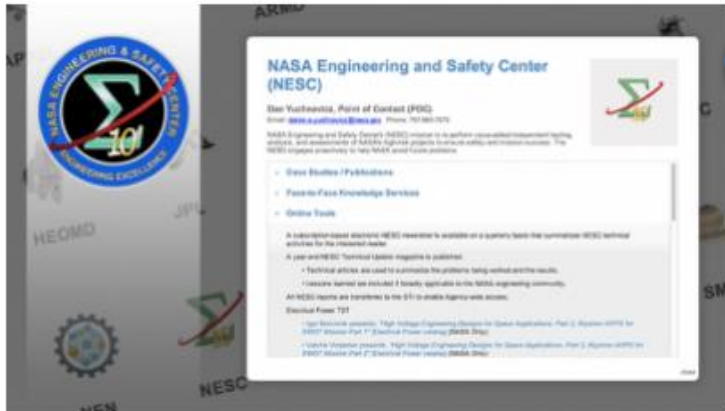| Case Studies / Publications | Face-to-Face Knowledge Services | Online Tools | Knowledge Networks | Lessons Learned / Knowledge Processes | Search / Tag / Taxonomy Tools |

km.nasa.gov

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

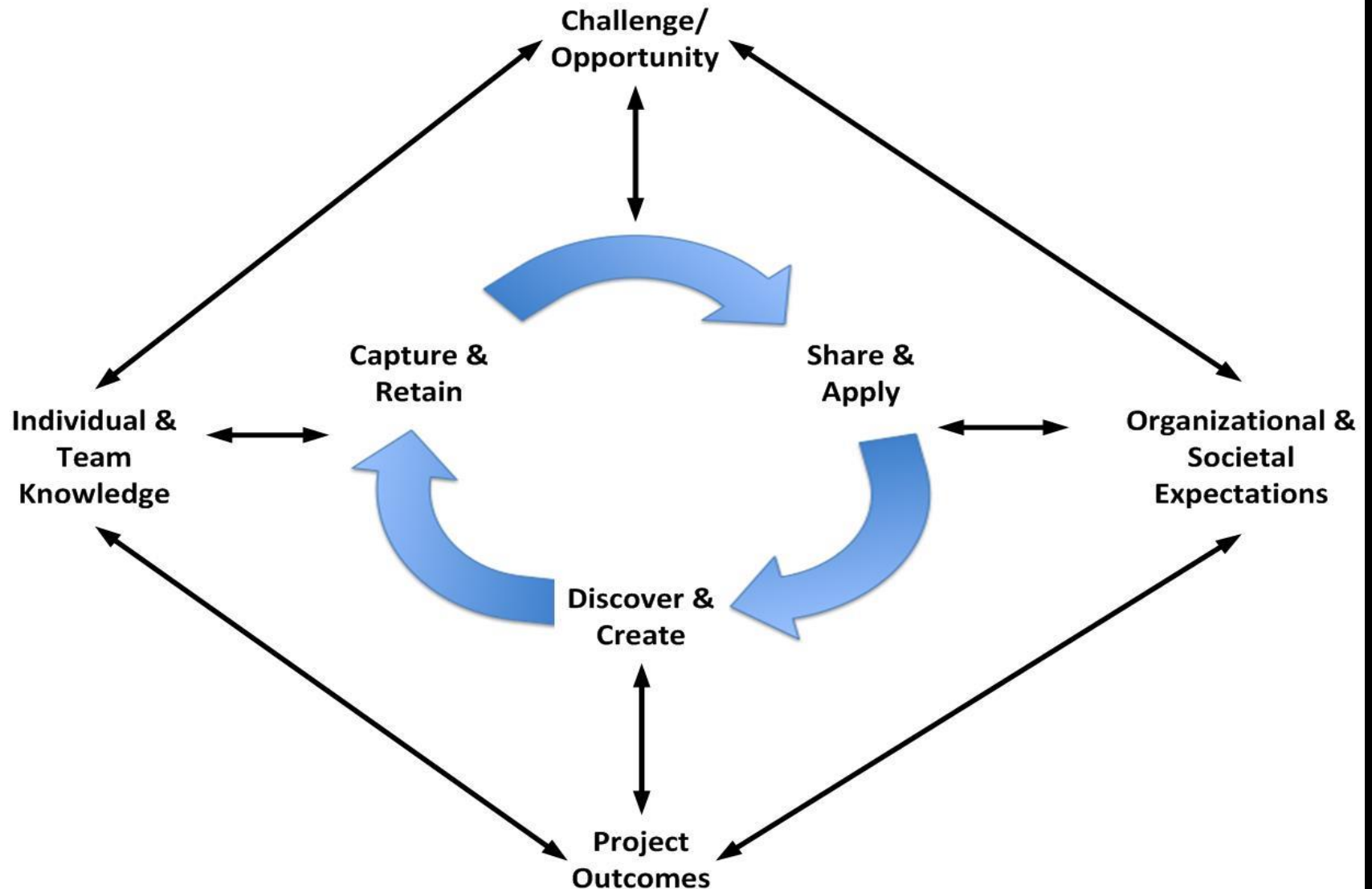# Strategic Knowledge Imperatives (1)

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.

Rapid Engagement through Accelerated Learning (REAL) Knowledge Flow

Challenge/Opportunity

Capture & Retain

Share & Apply

Individual & Team Knowledge

Organizational & Societal Expectations

Discover & Create

Project Outcomes

NASA's Gaps in Core Knowledge Processes

Capture

Share

Discover

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
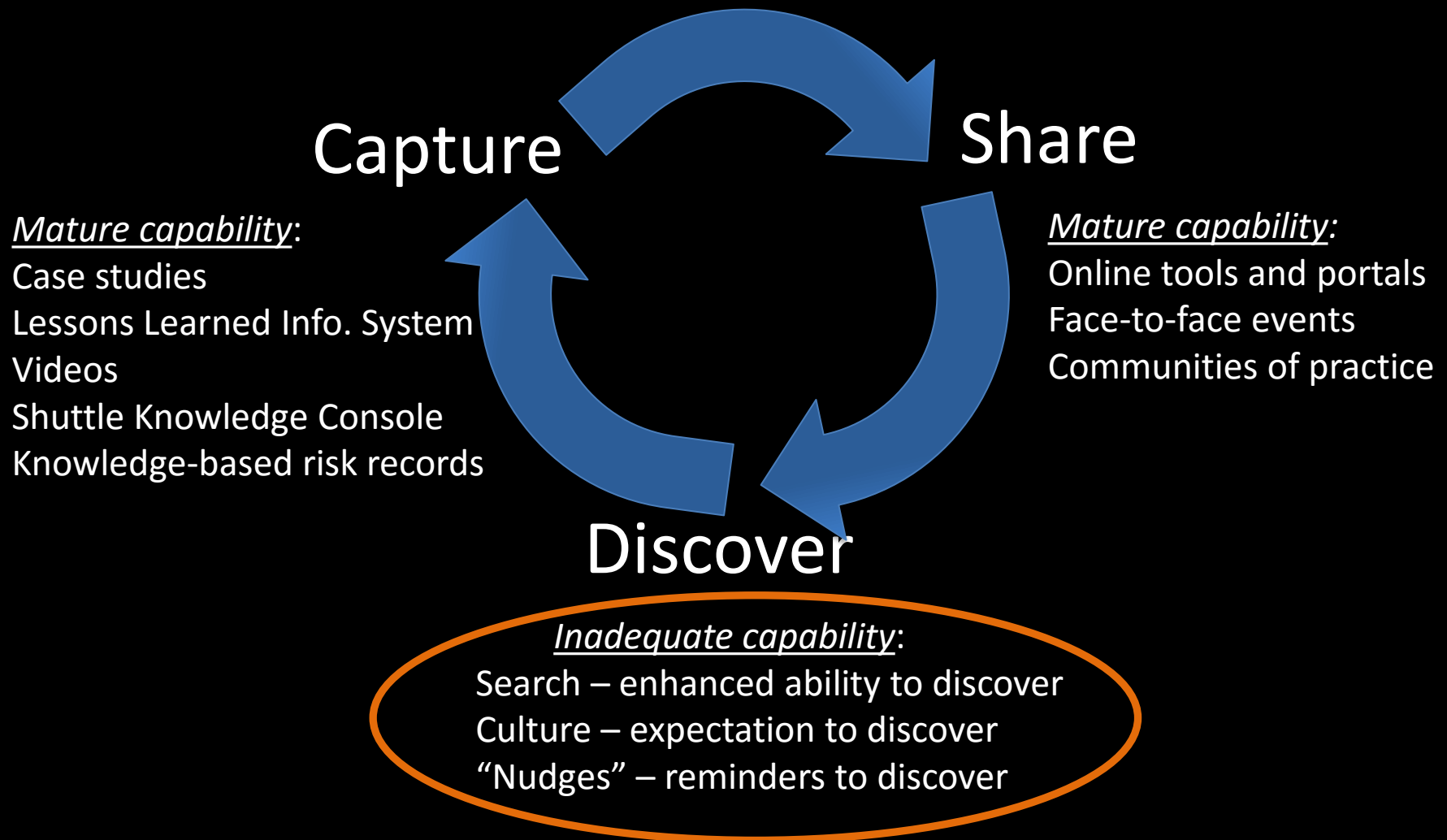
Big Challenges

- 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?

NASA CKO Knowledge Referee Process

Information Collection	Information Evaluation	Knowledge Disposition

CENTER/HQS/MD/FO

Information & knowledge sources for Agency/Centers/HQS Directorates/Functional Offices: Knowledge Services (lessons-learned activities; case studies; workshops; training; missions & projects; other).

Centers/HQs/Mission Directorate/Functional Office CKOs/POCs follow local knowledge policy to capture/retain & share/apply information for evaluation in semi-annual Knowledge Referee process.

Centers/HQs/Mission Directorate/Functional Office CKOs/POCs follow local knowledge policy to analyze risk and prioritize information and knowledge, segregate local and Agency categories, local and Agency-level knowledge referee items defined & formatted.

Reports forwarded to local & Agency designates.

Distribute & implement in local Governance, policy, training, digital tools, taxonomies, keywords, other.

AGENCY

NASA CKO notifies Center/HQs/Mission Directorate/Functional Office CKOs/POCs on semi-annual Knowledge Referee process, assembles Knowledge Referee panel, sets date, agenda, and location.

Agency CKO chairs semi-annual Knowledge Referee Panel to categorize, assign risk, prioritize & recommend information/knowledge disposition according to NASA policies & guidance; Agency-level knowledge referee items defined & formatted.

Information/knowledge forwarded to distribution POCs.

Distribute & implement in Agency Governance, policy, training, digital tools, taxonomies, keywords, other.

PROGRAMS/PROJECTS

Agency CKO briefs APMC, ASAP, & monitors information/knowledge outcomes.

Tips on Talent Management Practices

1.   <u>Ability</u>: Establish governance to build organizational commitments to growth and development

2.   <u>Attitude</u>: Create an environment of collective intelligence leveraging access to senior leaders and experts

3.   <u>Assignments</u>: Leverage projects to create work experiences, assignments, tours for challenging problems

4.   <u>Alliances</u>: Engage in learning through community exchange and dialogue to address collaboration and competition

5.   <u>Knowledge</u>: Establish systems that make critical knowledge accessible and innovative

6.   <u>Young professionals</u>: Listen to novices and "nex'perts"

Questions

web: km.nasa.gov
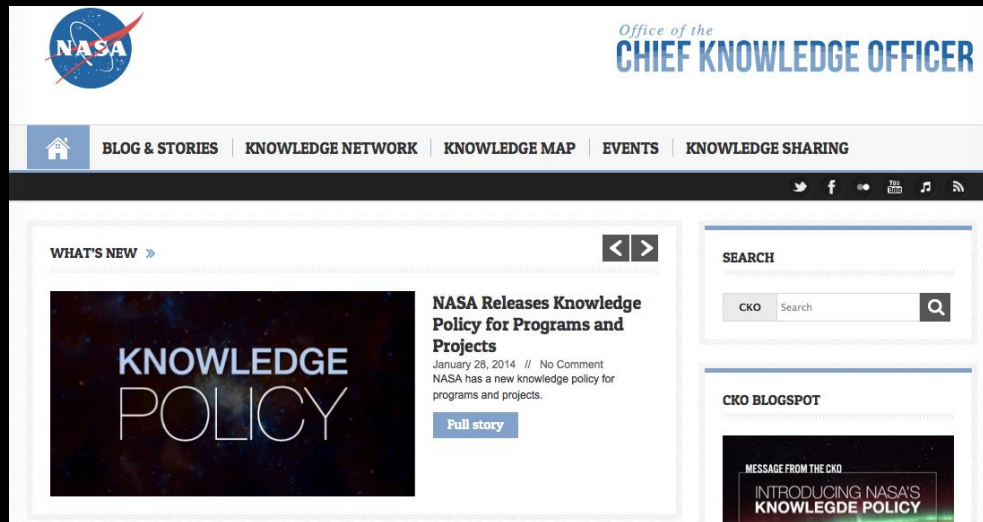
ehoffman@nasa.gov
jonboyle1@verizon.net