

Creating An Architecture to Deploy Knowledge Management at Your Organization

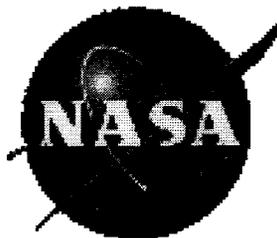
Jeanne Holm

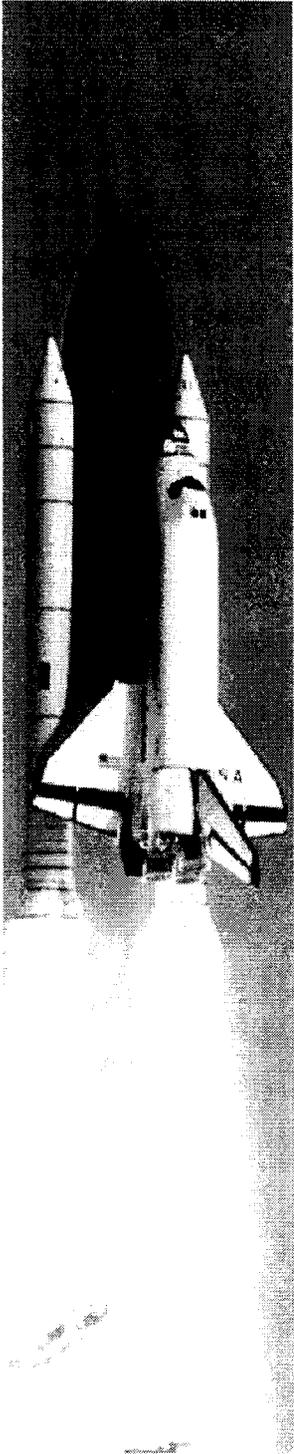
Jet Propulsion Laboratory/Caltech

NASA

KM Asia 2002

July 18, 2002



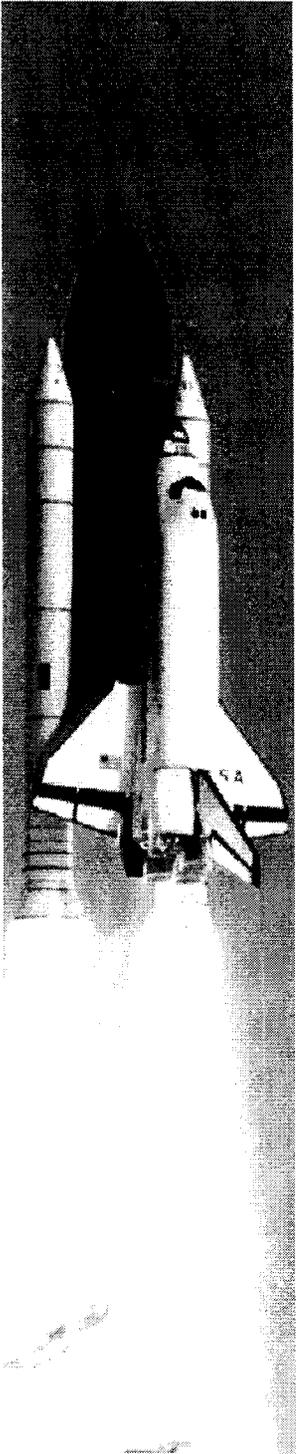


Agenda

- ◆ Identify critical success factors for successful KM implementation
- ◆ Learn how to develop a knowledge architecture comprising processes, services, and systems
- ◆ Share lessons from the front lines in KM implementations
 - U.S. Federal Knowledge Management Group
 - <http://km.gov>
 - IAA Working Group on Knowledge Management

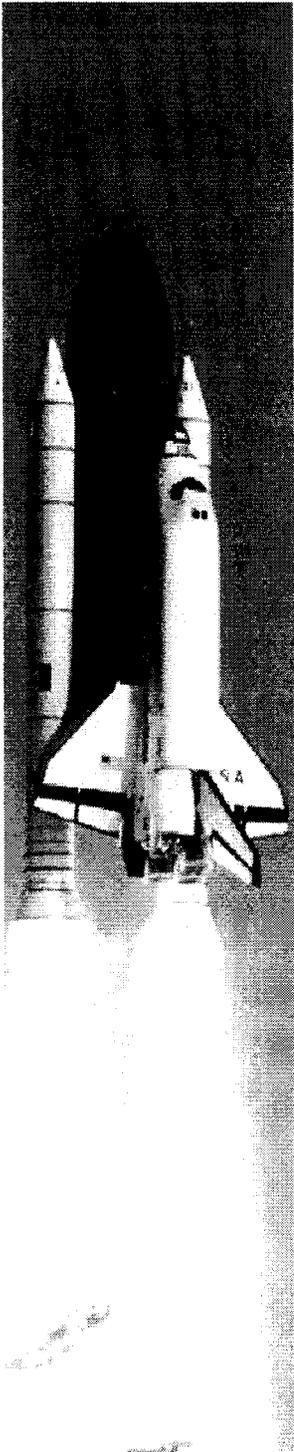
Drafting the Architecture

- ◆ Scoping the job
 - What are the drivers for KM in the Government?
- ◆ Creating the blueprints
 - What constitutes a knowledge architecture?
- ◆ Finding the builders
 - How do you start the community?
- ◆ Laying the foundation
 - How do you begin the initiatives?
- ◆ Moving in
 - How do you sustain the environment?



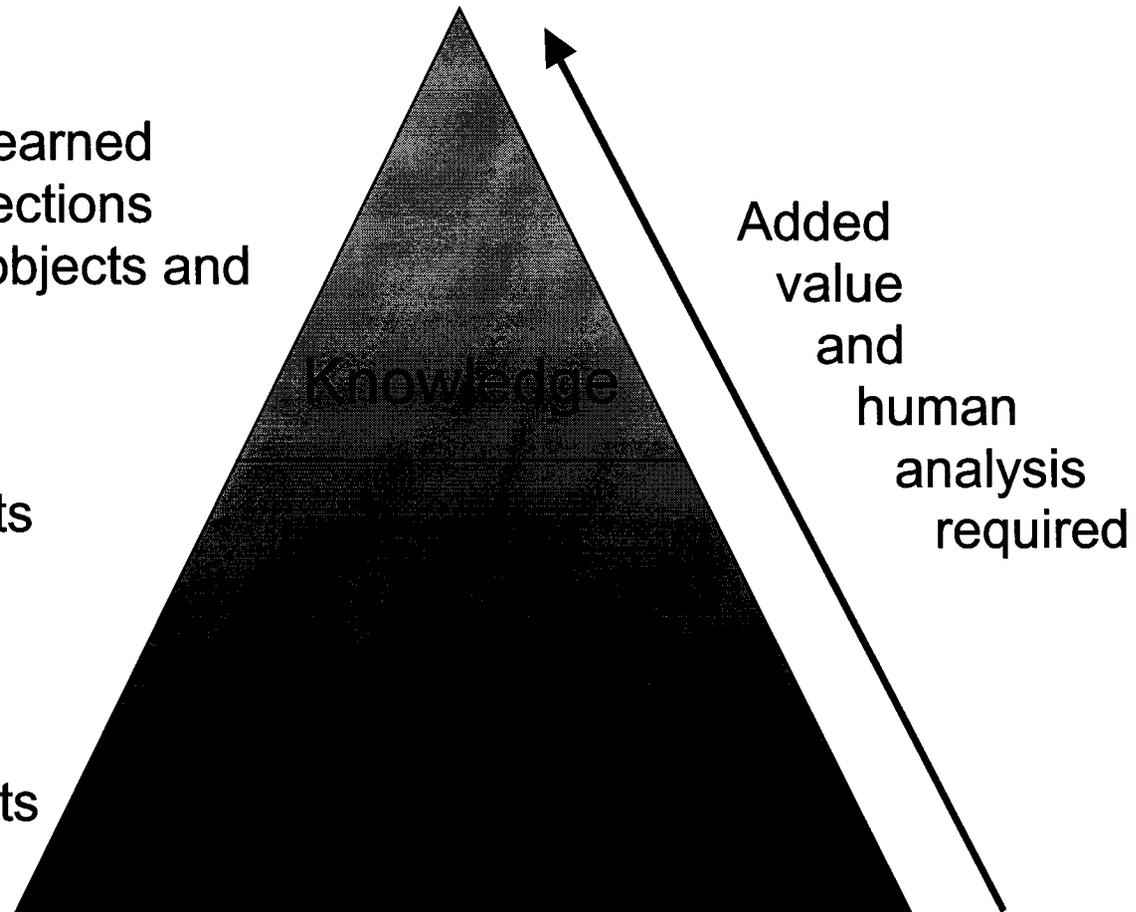
What is Driving KM?

- ◆ KM can be shown to
 - Improve efficiency
 - Speed up core processes and information retrieval
 - Free up workers' time for content production
 - Avoid knowledge loss
 - Compensate for dilution or loss of experts
 - Avoid costs and consequences of relearning lessons
 - Stimulate knowledge growth and creation
 - Improve collaborative environments to promote research and cross-discipline sharing
 - Recognize and reward knowledge reuse
- ◆ Current drivers include
 - Increasing percentage of workforce is eligible for retirement
 - People spend ~30% of their time looking for information
 - Of the Fortune 500, 2/3 have KM initiatives
 - In the U.S., *The President's Management Agenda*: “KM systems are just one part of an effective strategy that will help generate, capture, and disseminate knowledge and information relevant to the organization's mission.”



Differentiating “Information”

- Lessons learned
- Interconnections between objects and people
- Documents
- Drawings
- Raw data
- Test results



Types of Knowledge

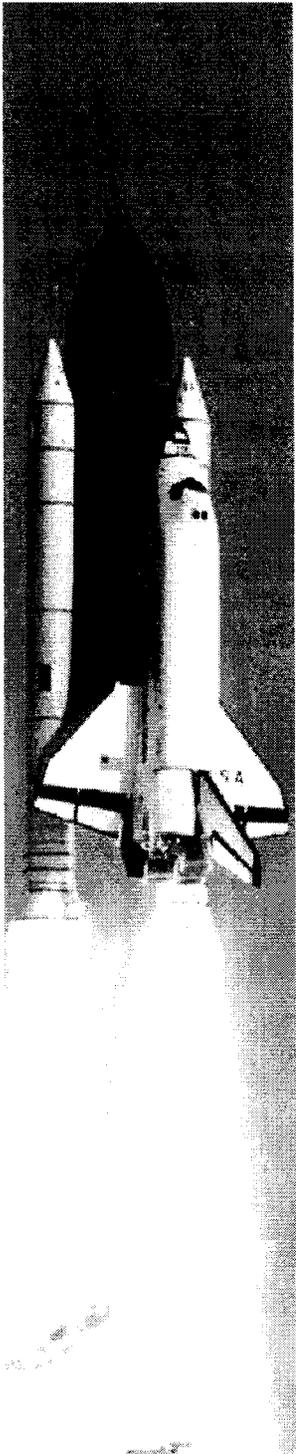
- ◆ There are two types of knowledge discussed in the literature and that need to be addressed
 - **Tacit:** That which is embedded in the minds of people and is difficult to or has not been written down or communicated
 - **Explicit:** That which has been written down or captured in some persistent way (video, web, documents)

Tacit

- Not teachable
- Not articulated
- Not observable in use
- Rich
- Complex
- Undocumented

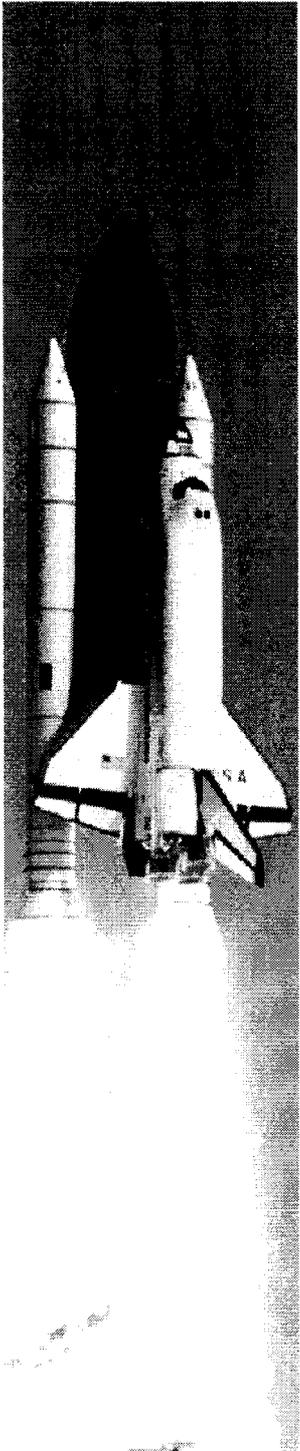
Explicit

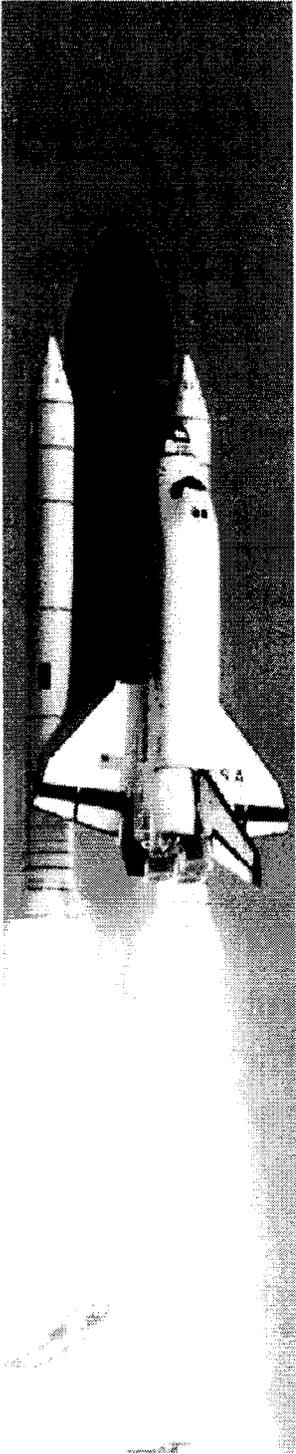
- Teachable
- Able to be expressed
- Observable in use
- Schematic
- Simple
- Documented



Types of Tacit Knowledge

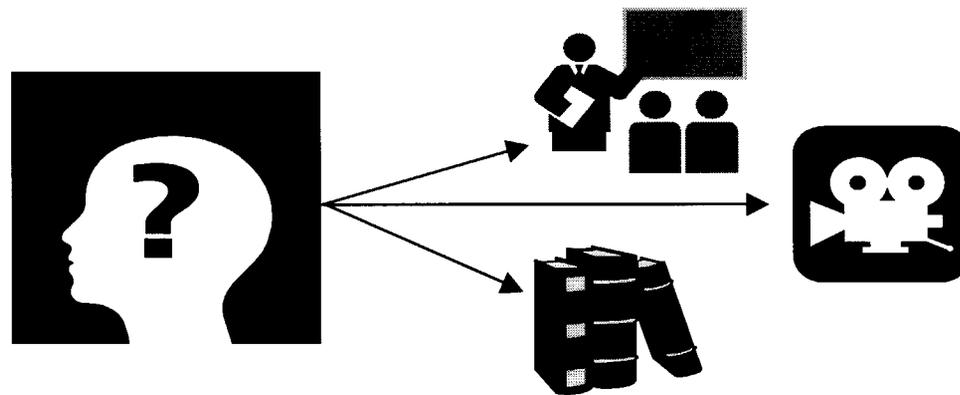
- ◆ Exists in individuals and groups, and is created through repeated experiences (or routines) and experiments (content + context)
- ◆ Tacit knowledge, internalized by a user, is almost impossible to put into a document or a database—we cannot codify it
 - Incorporates accrued, embedded learning
 - May not be separable from individual's actions
 - A musician's style
 - Steps a researcher follows to decide what to study
- ◆ Has been historically eased by turning it into explicit knowledge through language, printing, and collective understanding





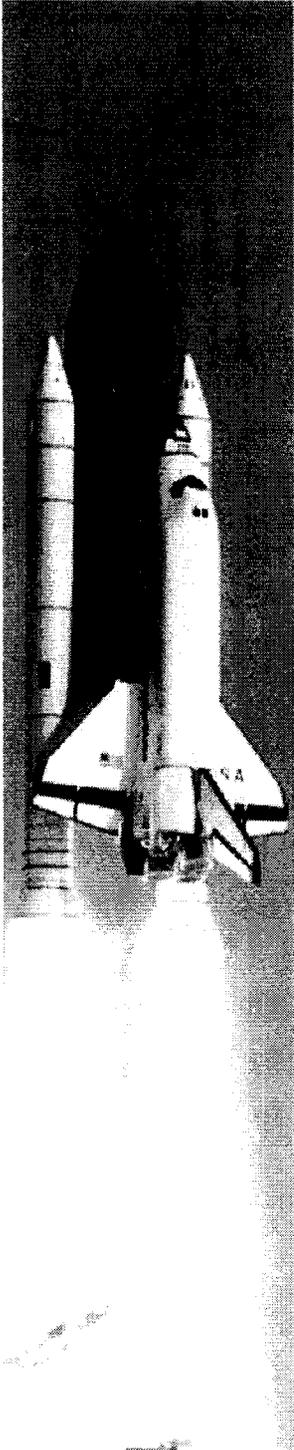
Polanyi's Theories of Knowledge

- ◆ Polanyi (1948) started the philosophical discussion of personal knowledge
- ◆ Polanyi's three theses
 - True discovery cannot be accounted for by rules or algorithms
 - Knowledge is both public and to a great extent personal (and contains emotions)
 - Knowledge that underlies explicit knowledge is either tacit or rooted in tacit knowledge



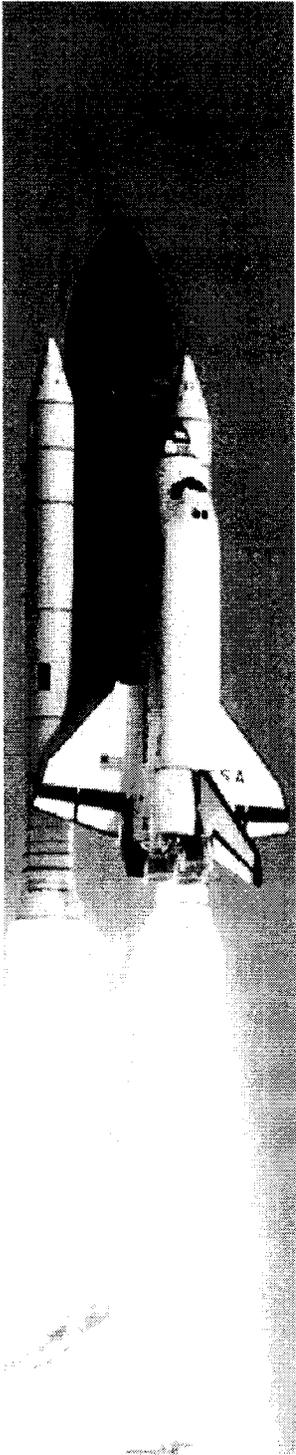
Polanyi's Hierarchy of Knowing

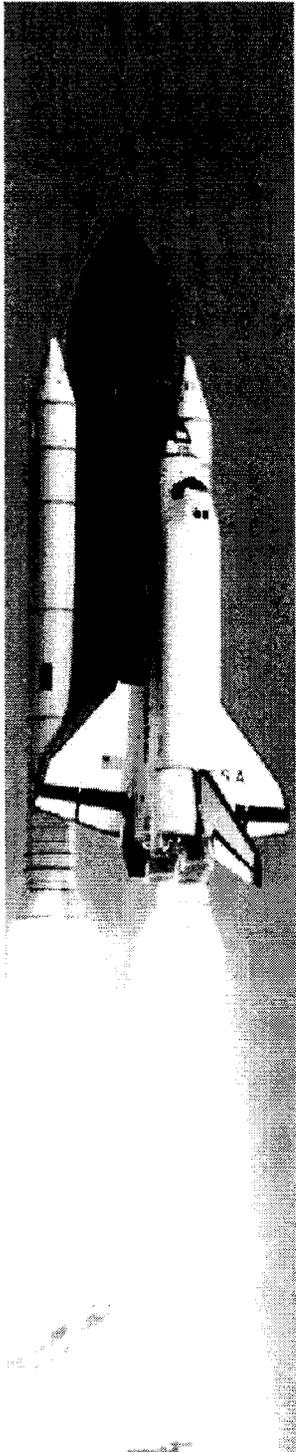
- ◆ Skill
 - The ability to act according to rules (typing)
- ◆ Know How
 - *Skill* + ability to act in social contexts (problem solving)
- ◆ Expertise
 - *Know How* + ability to influence the rules of the domain of knowledge (innovative solutions and new creations--doing what you *must*)



Other Theorists on Knowledge

- ◆ **Sveiby** looked at the implications and Polanyi and noted that knowledge is an *activity* that would be better described as a process of knowing (to know *is* to do)
 - Acquiring knowledge is *action*-oriented
 - A medical diagnostician’s skill is as much an art of doing as of knowing
- ◆ **Barnard** notes knowledge is skills + mental processes and attempts to combine logical (explicit) and non-logical (tacit)
- ◆ **Simon** develops “information processing theory”, stresses keeping information within company and dismisses tacit knowledge
- ◆ **Weick’s** “sensemaking” theory emphasizes that knowledge is created by individuals sharing and debating ideas and experiences

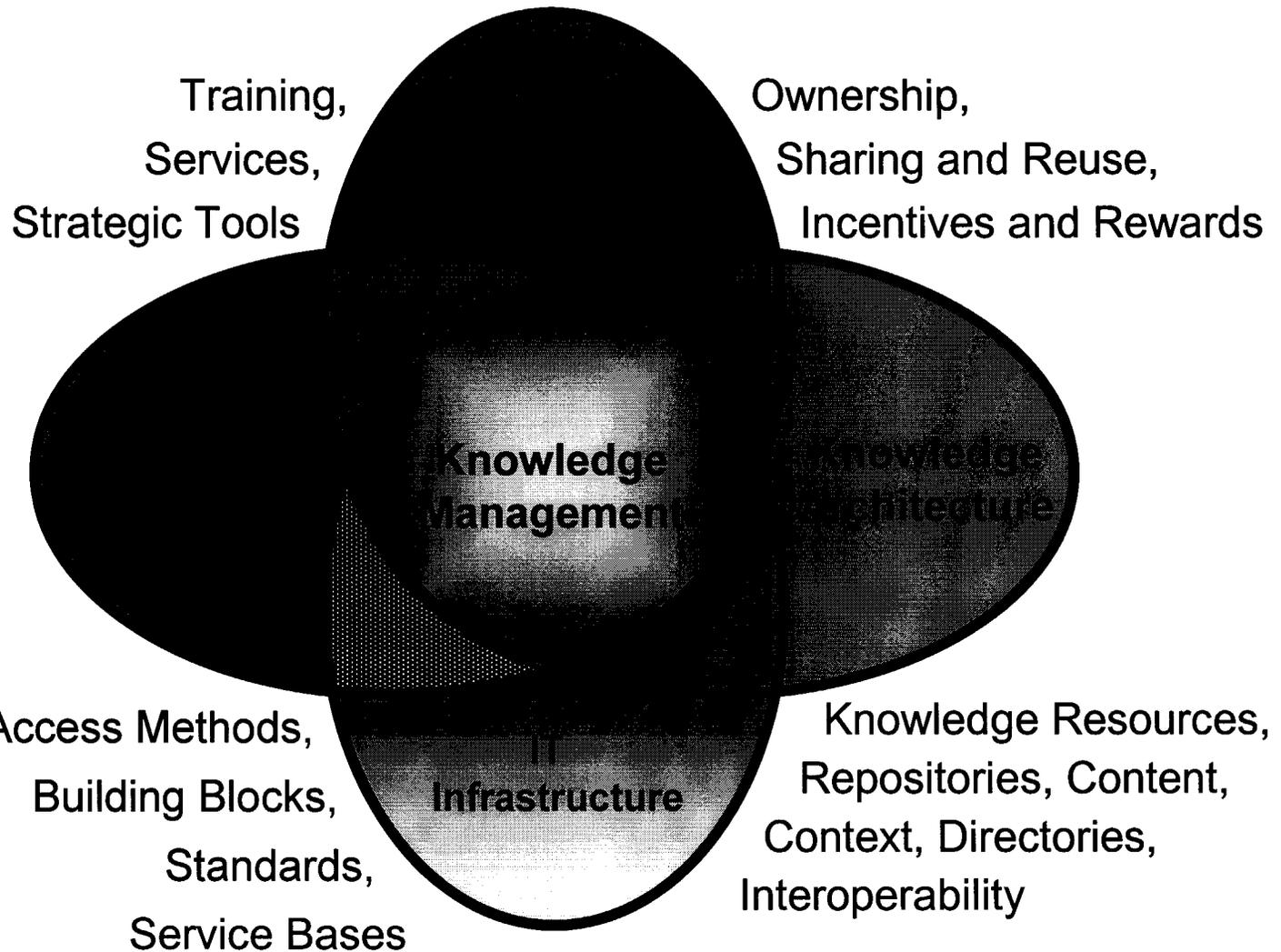




Benchmarking

- ◆ In 1998, we reviewed 43 published case studies and visited 6 organizations to understand what others were doing in KM
 - Standard set of questions, which generally devolved into long conversations
 - Analyzed for critical success factors or reasons why implementations failed or stumbled
 - Has held up over the test of time
- ◆ These organizations succeeded at KM when they were
 - Recognizing and rewarding people for sharing knowledge
 - Encouraging and supporting communities of practice
 - Balancing their long-term corporate needs (capturing knowledge) with short-term local needs (completing a task quickly)
- ◆ ***Culture*** was the most important factor: recognize, reward, and acknowledge the importance of knowledge sharing throughout the organization

KM Critical Success Factors



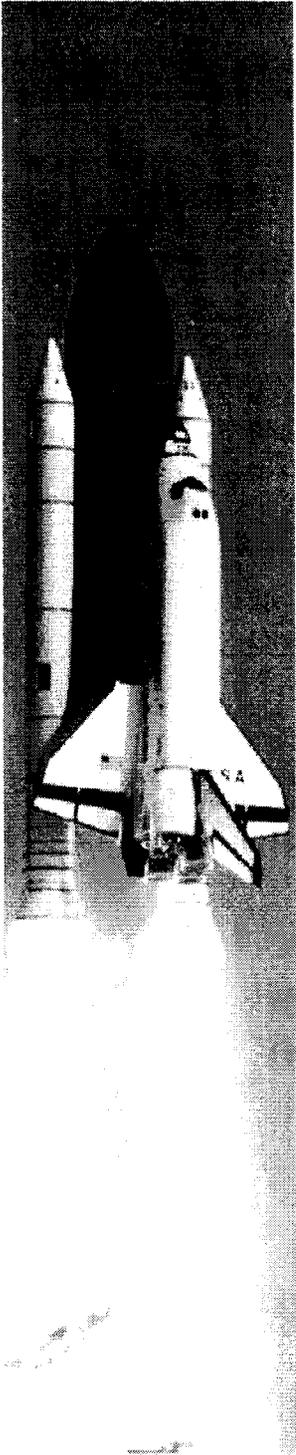
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12

Recognizing the Importance of Culture

- ◆ The most critical factor in the success of a KM implementation is cultural acceptance
 - Recognizing issues of data ownership
 - Individual vs. organization
 - Individual vs. team
 - Acknowledging the appropriateness and acceptance of knowledge sharing and reuse
 - Knowledge reuse is not always perceived by the individual to be “good” (innovation or creation is “better”)
 - Rewarding individuals and teams for promoting KM when they
 - Capture team discussions and decisions
 - Create a supportive environment for mentoring
 - Document and share lessons learned
 - Make tacit knowledge explicit



Cultural Differences in Sharing

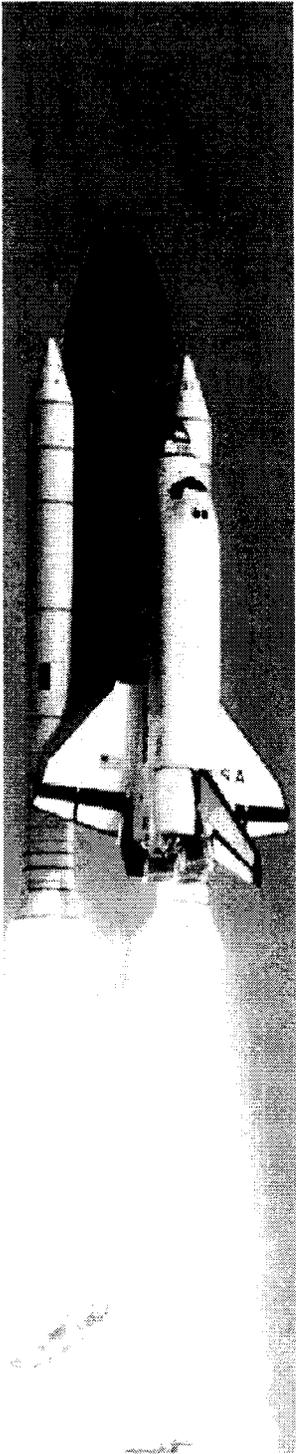
- ◆ Nonaka and Takeuchi (1995) studied knowledge-creating companies

Japanese

- Information is a resource that can be bought both internally or externally
- Value tacit knowledge

American

- ◆ Information is to be guarded and legally protected
- ◆ Ignore outside sources of knowledge
- ◆ Value explicit knowledge



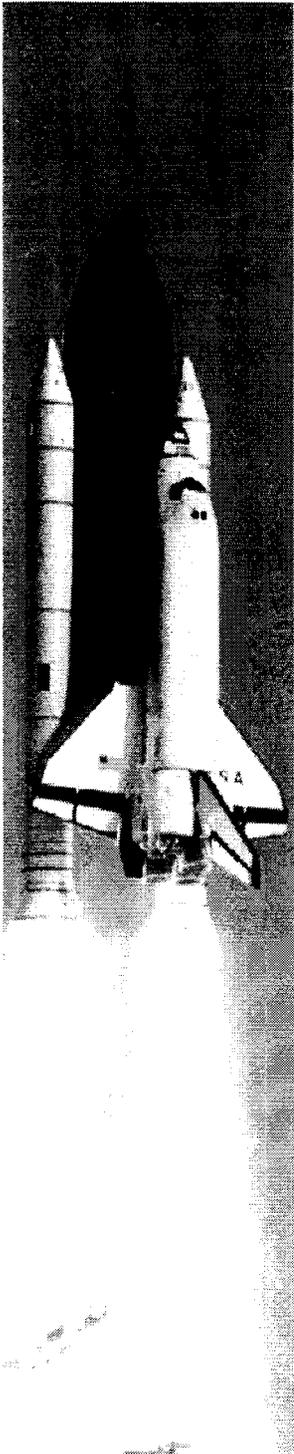
Importance of Mentoring

- ◆ Benefits to the protégé
 - A stimulating environment to develop intellectual (Haensly & Parsons, 1993) and creative skills (Buhler, 1996; Edlind & Haensly, 1985)
 - Advancement of career (Turban & Dougherty, 1994)
 - Development of a personal ethic (Edlind & Haensly, 1985)
 - Increase in confidence (Newby & Heide, 1992)
 - Protégés hold a greater influence on their organizations and also are more apt to control organizational resources than workers who do not have the benefit of a mentor (Fagenson, 1988)

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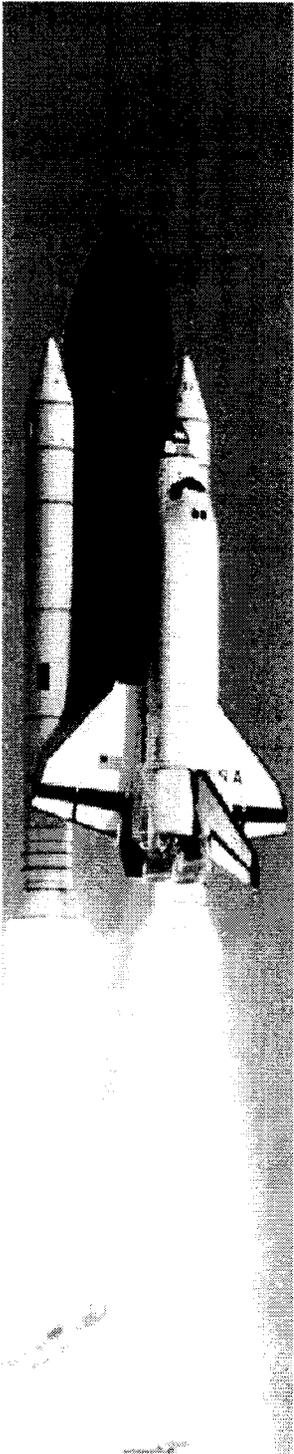
Mentoring study conducted by Howard Fero
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15



Importance of Mentoring (continued)

- ◆ Benefits to the mentor
 - Assistance in completion of work
 - Work and personal stimulation
 - Personal satisfaction (Edlind & Haensly, 1985)
 - Continued life of their ideas (Buhler, 1996)
- ◆ Benefits to the organization
 - Mentoring leads both parties to greater levels of job satisfaction (Corzine, Buntzman, & Busch, 1994)
 - Increase in organizational loyalty (Buhler, 1996)



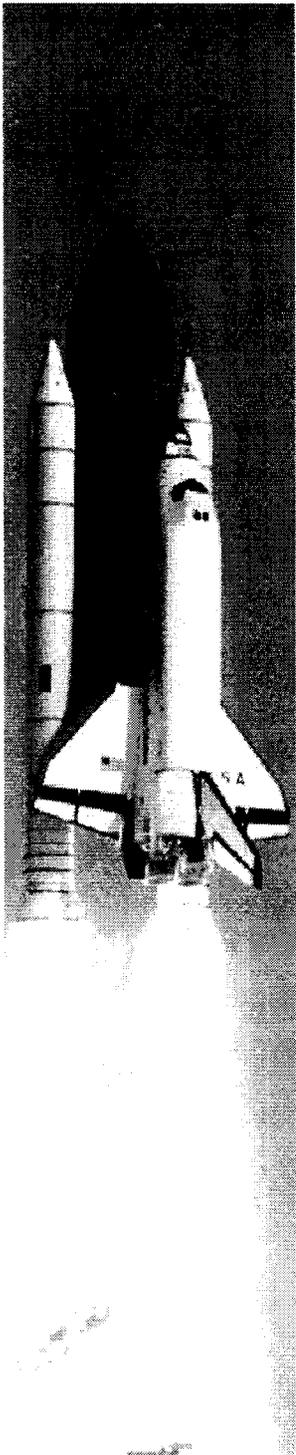
Mentoring Study at JPL

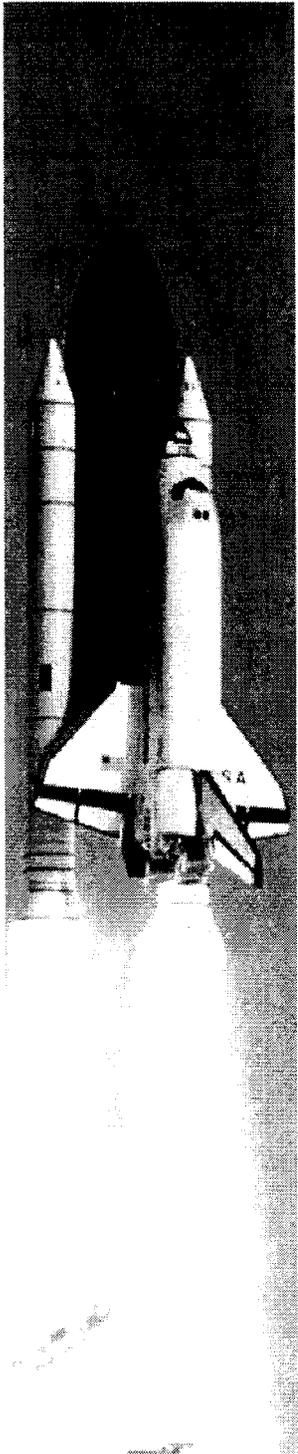
◆ Research Questions

- Can shared interests be transmitted between mentor and protégé?
- What characteristics of the mentor or the mentor's method of transmission affect the protégé's perspective of the mentoring relationship?
- What promotes a protégé to exhibit the positive experiential state of flow?

◆ Online survey instrument

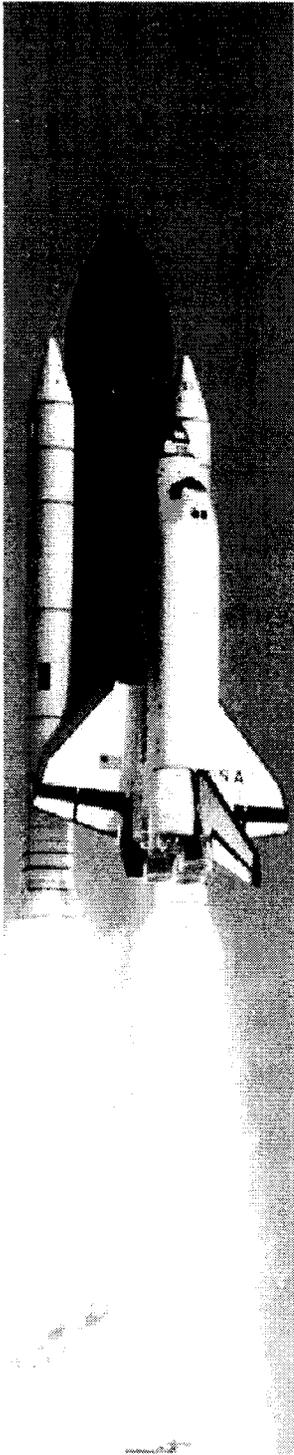
- N = 147
- Those who report having a mentor, n = 95
- Those who report having a protégé, n = 88
- Those who report having both a mentor and a protégé, n = 42
- ~55% from administrative and management, 45% from technical areas





Significant Findings on Mentoring

- ◆ Mentor's primary method of conveying message is oral and/or written communication vs. modeling
 - Protégées reported that when their mentor used modeling, as opposed to oral/written communication, they were more apt to attribute their interests to them
- ◆ Protégés are most likely to attribute their interests to the influence of their mentor when
 - Protégés feel they share their work-related interests or are working on specific projects with their mentor
 - When protégés felt that the mentor supported their personal growth
- ◆ Protégés report that one of the most important things their mentor did for them was related to socialization within JPL



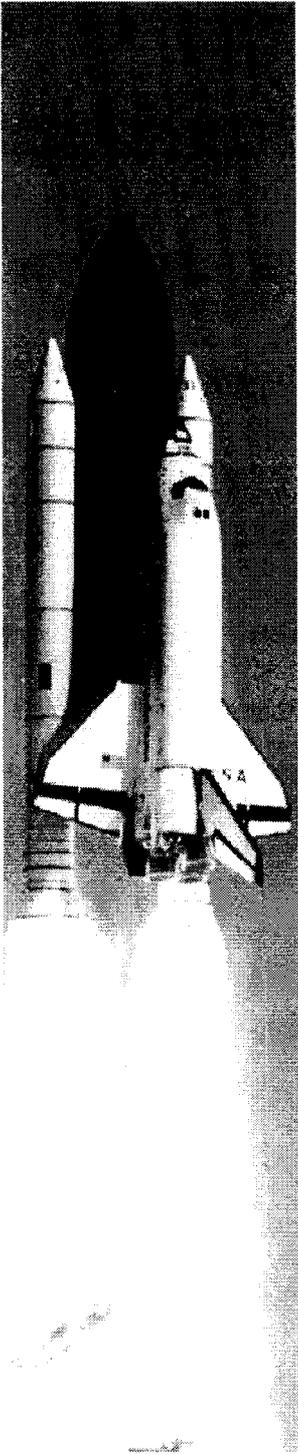
The Essence of Transferring Knowledge

- ◆ There are two types of knowledge we deal with in an organization
 - **Tacit:** Embedded in the minds of people and difficult to write down or communicate (a musician's style, the steps a researcher follows to decide what to study)
 - **Explicit:** Captured in a persistent way (video, documents)
- ◆ Knowledge transfer occurs in one of two modes, through
 - Making tacit knowledge explicit to another person synchronously
 - Imitation (apprenticeship, mentoring)
 - Identification (familiarity)
 - Learning by doing (experience)
 - Making tacit knowledge explicit to another person asynchronously
 - Capture tacit knowledge explicitly (books, programs, or procedures)
 - Share that explicit knowledge through discussions or tools
 - Sustain access to that knowledge across generations and projects

Creating Architectural Approaches to Knowledge Management

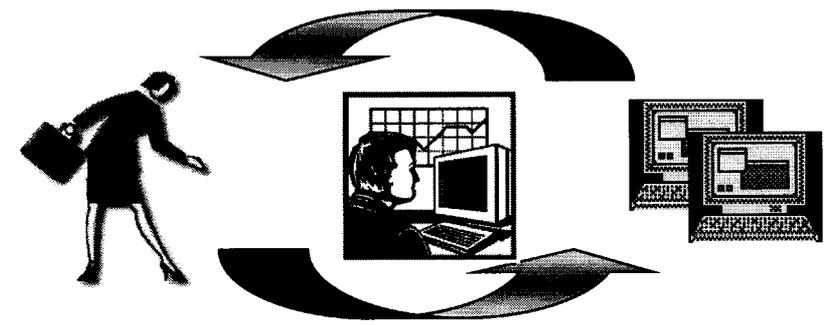
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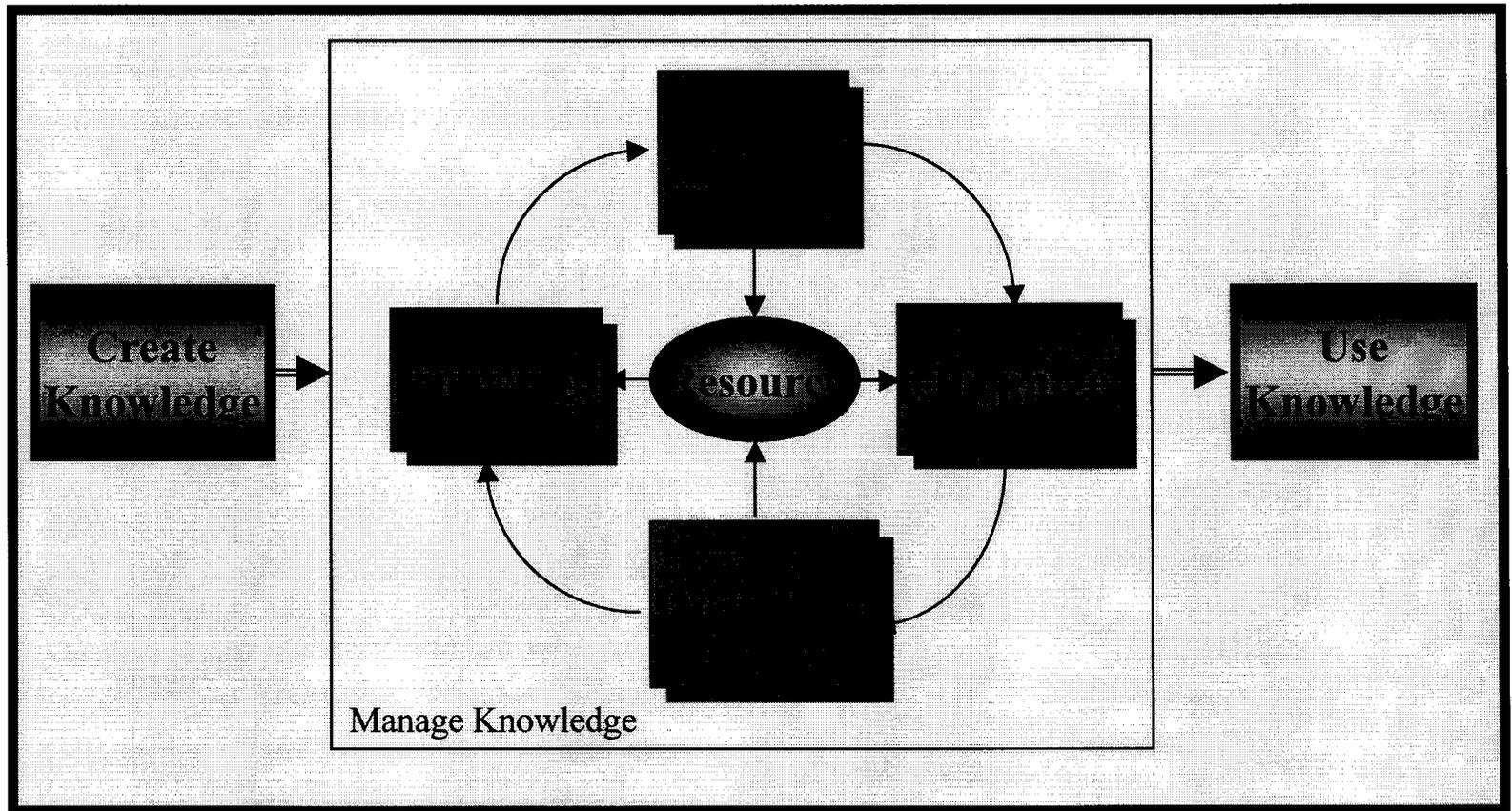
Creating a Knowledge Architecture

- ◆ There are three ways to look at architecting a KM program
 - *Process*: Oriented on the way in which people do their day-to-day work in the organization (the *how* and *why*)
 - *Services*: Focused on who will help people share their knowledge and who will maintain tools and processes (the *who*)
 - *Systems*: Are the IT infrastructure and tools necessary to deliver the processes and services efficiently and effectively to the end users (the *what* and *where*)



Services Processes Systems

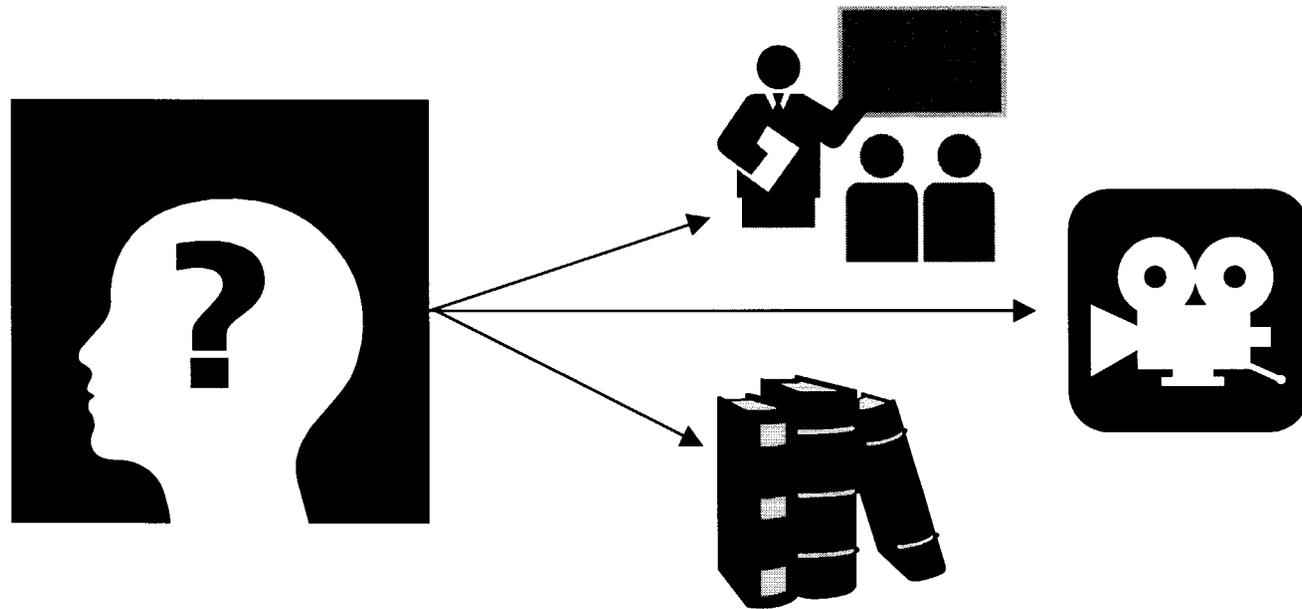
Step 1. Creating KM Processes



Adapted From Ernst and Young

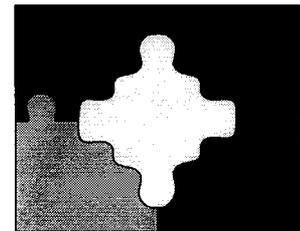
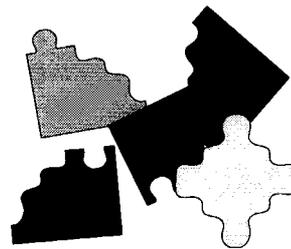
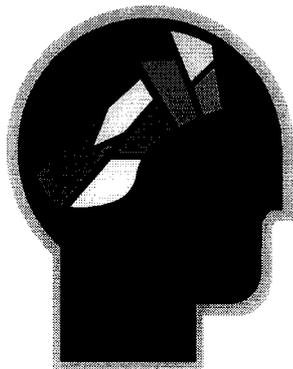
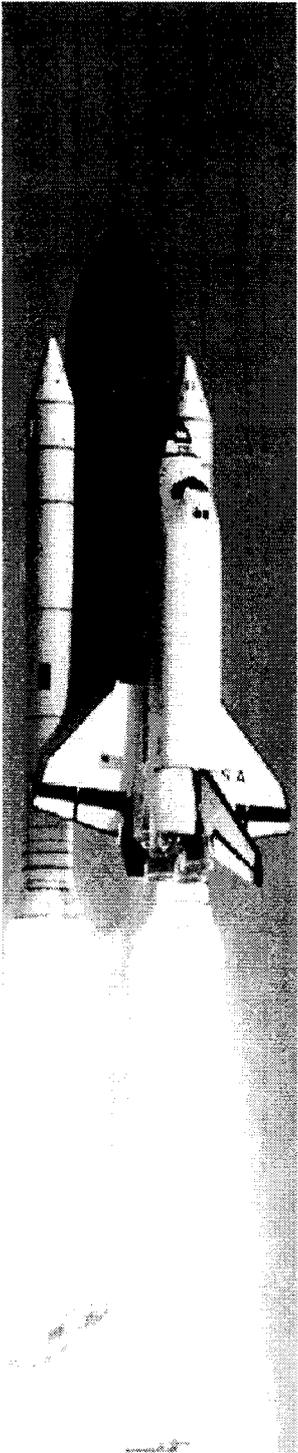
Capture Knowledge

- ◆ Helping people articulate knowledge that can be easily shared and reused
- ◆ Supporting people in moving tacit knowledge to explicit knowledge



Organize Knowledge

- ◆ Organize information so that people can easily share it, find it, and use it once it's found
- ◆ Structure information in standardized ways for use by others



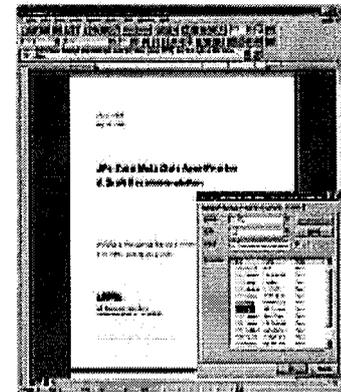
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24

Develop Knowledge

- ◆ Refining knowledge so that it can be easily reused by others (such as others on your team, future teams, or in your discipline)
- ◆ Selecting which knowledge will be most useful based on the question asked or the need defined



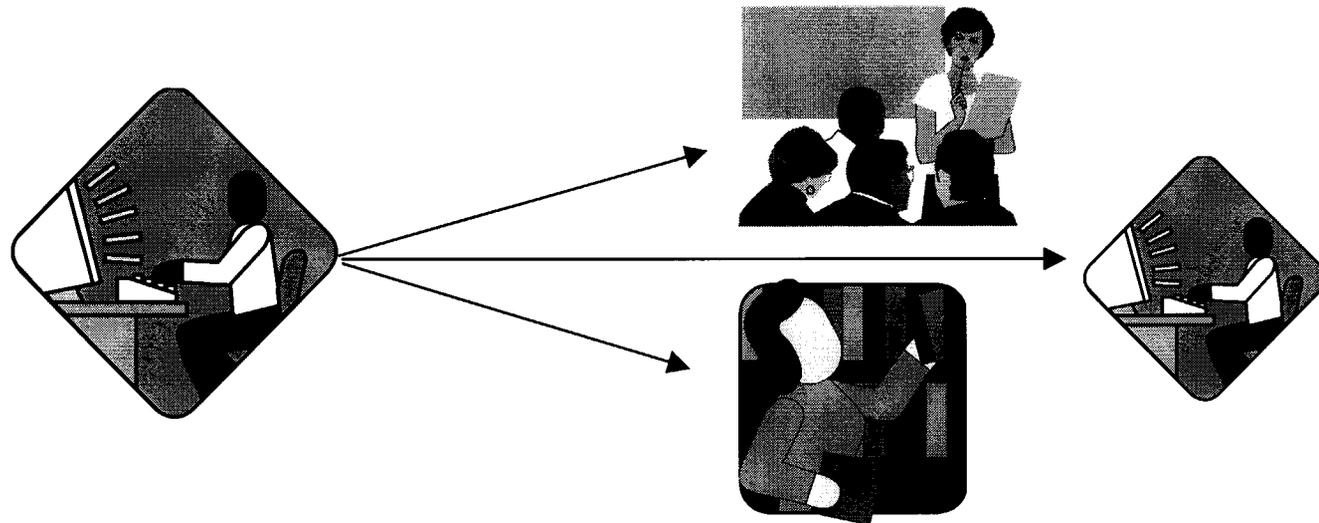
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25

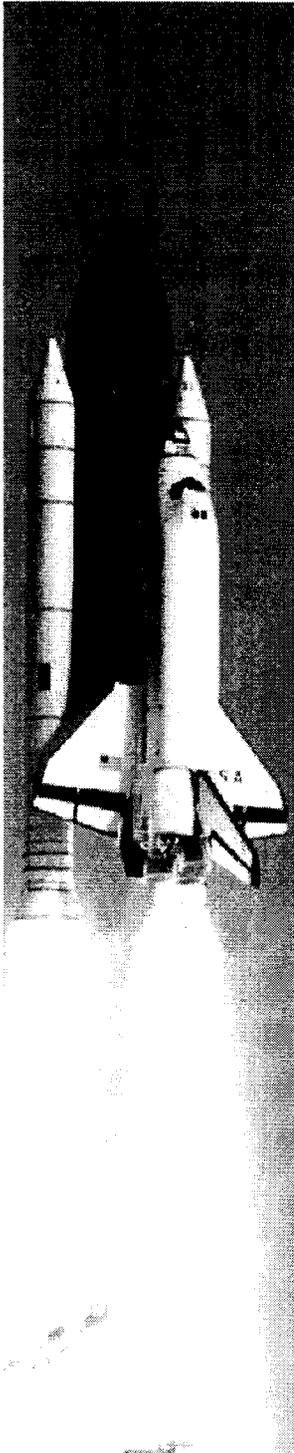
Distribute Knowledge

- ◆ Helping people get access to knowledge
- ◆ Encouraging people to use and reuse knowledge
- ◆ Training people in how to use the knowledge management tools

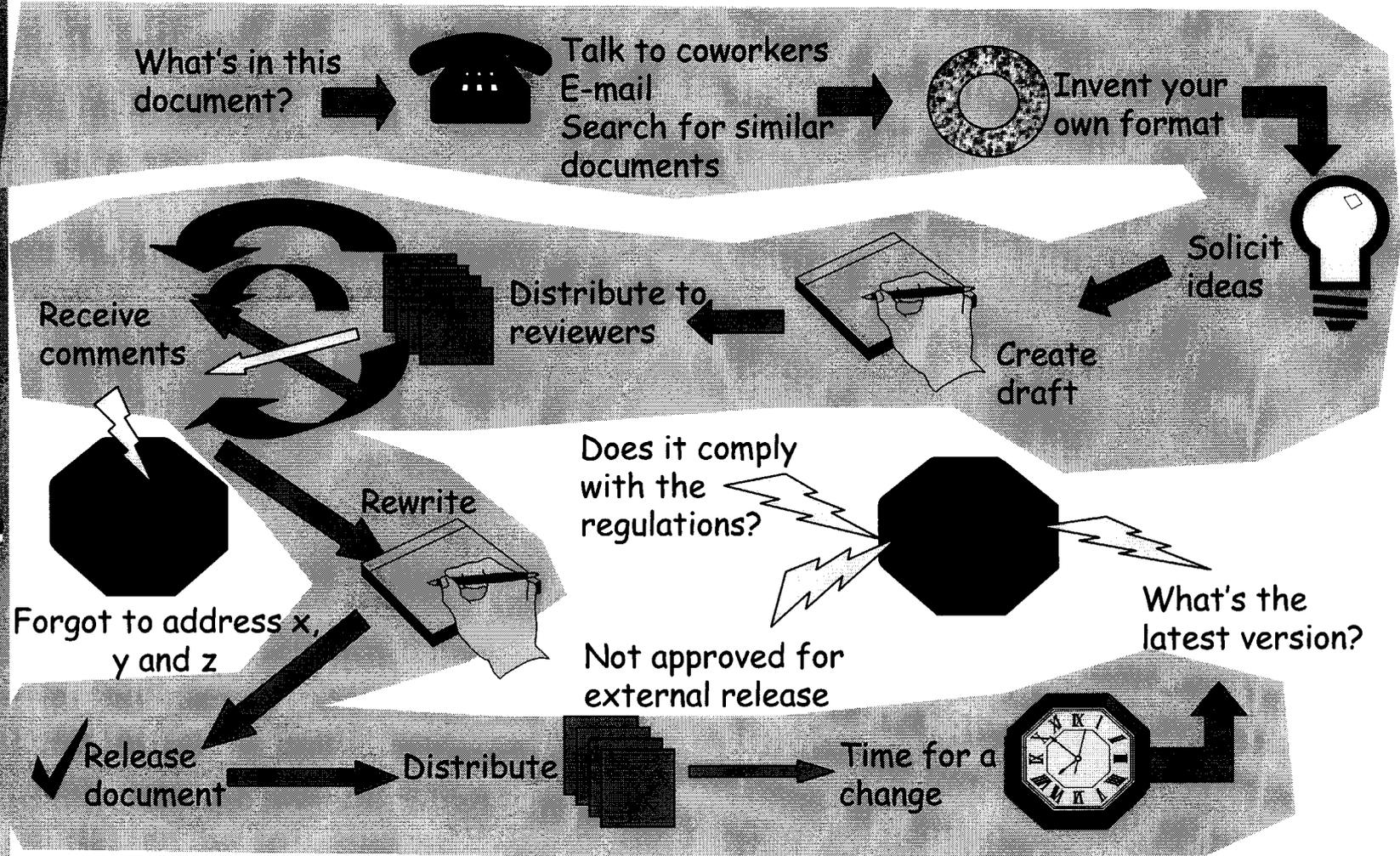


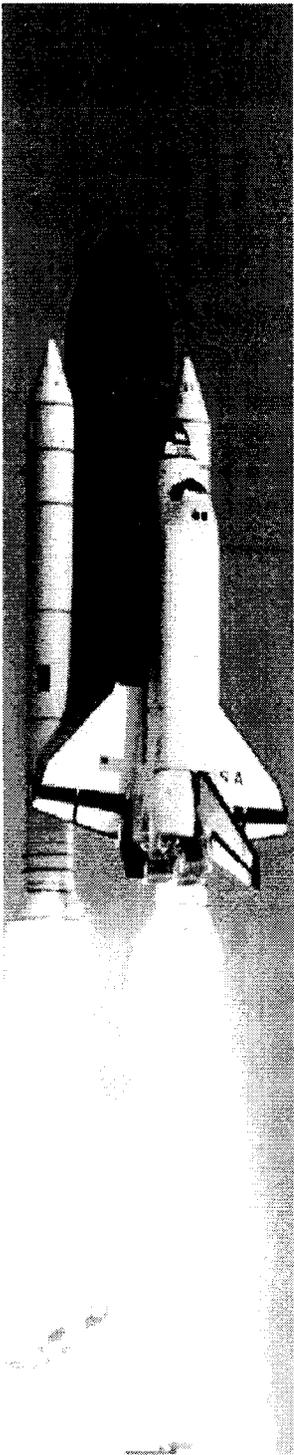
Step 2. Establishing KM Services

- ◆ The way in which people in an organization interact with knowledge management activities is through a *service*
- ◆ Services integrate processes, people, and systems into a cohesive support structure for how people actually do their work
- ◆ The “build it and they will come” mentality doesn’t work in the deployment of content-rich, enterprise-wide systems
 - Users need to be an active part in order to keep content refreshed, accurate, and relevant



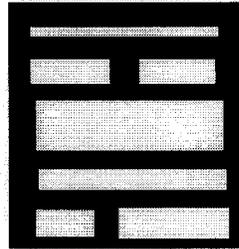
Writing a Document Today...



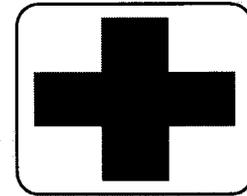


Writing a Document in a KM-Enabled World...

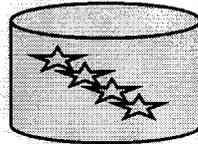
What's in this document?



Template with all required areas

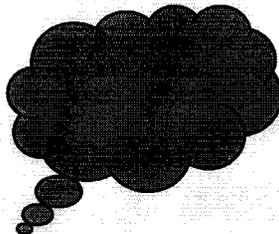


Subject matter experts



Good examples

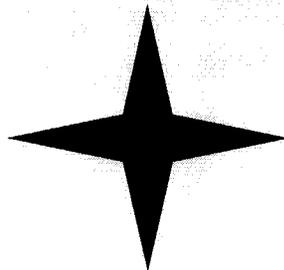
Review and release



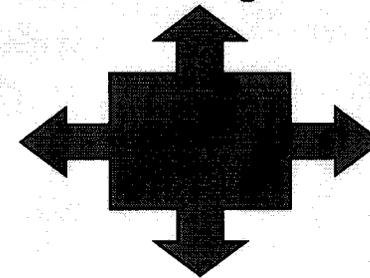
Collaboration tools



Regulatory compliance



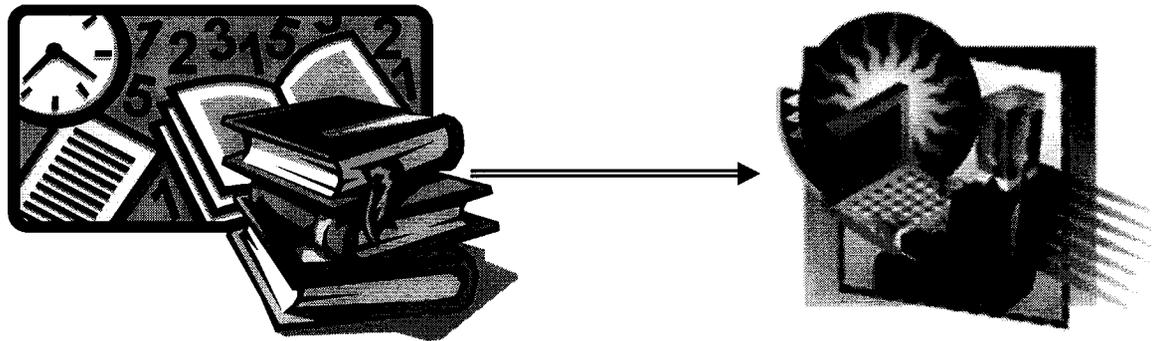
Rules and regulations

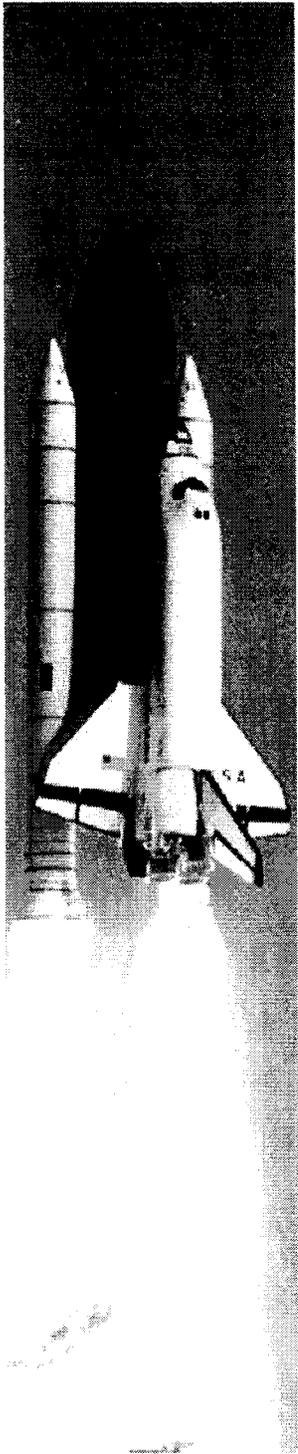


Routing and distribution

A Sample Service: Document Management

- ◆ Document management is about much more than a shared, accessible repository enabled by workflow:
 - Authoring environment (templates that include content guidelines and samples of good material)
 - Information lifecycle (how do objects move from stage to stage and how are they reused?)
 - Service base (where and who do you go to for support today, tomorrow, and in two years?)
 - *A one-stop shop for all information publishing needs*

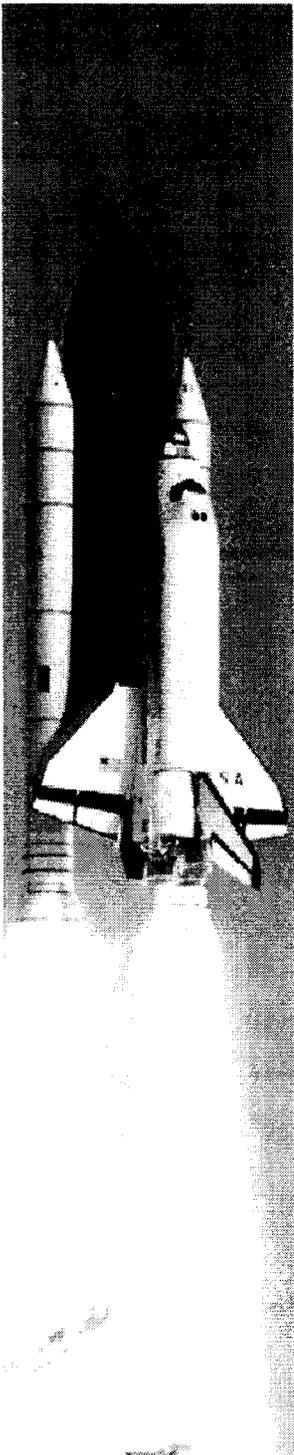




Step 3. Develop a System Architecture

- ◆ A layered approach, building upon already existing infrastructure and services, KM provides
 - User interface
 - Enterprise portal or web sites with data channels for roles, interests, and disciplines
 - KM functions
 - Virtual team environments (sharing and collaborating)
 - Taxonomies for browsing
 - Robust search capability
 - Application infrastructure services
 - Document management
 - Content management
 - Standards for documentation
 - Metadata management





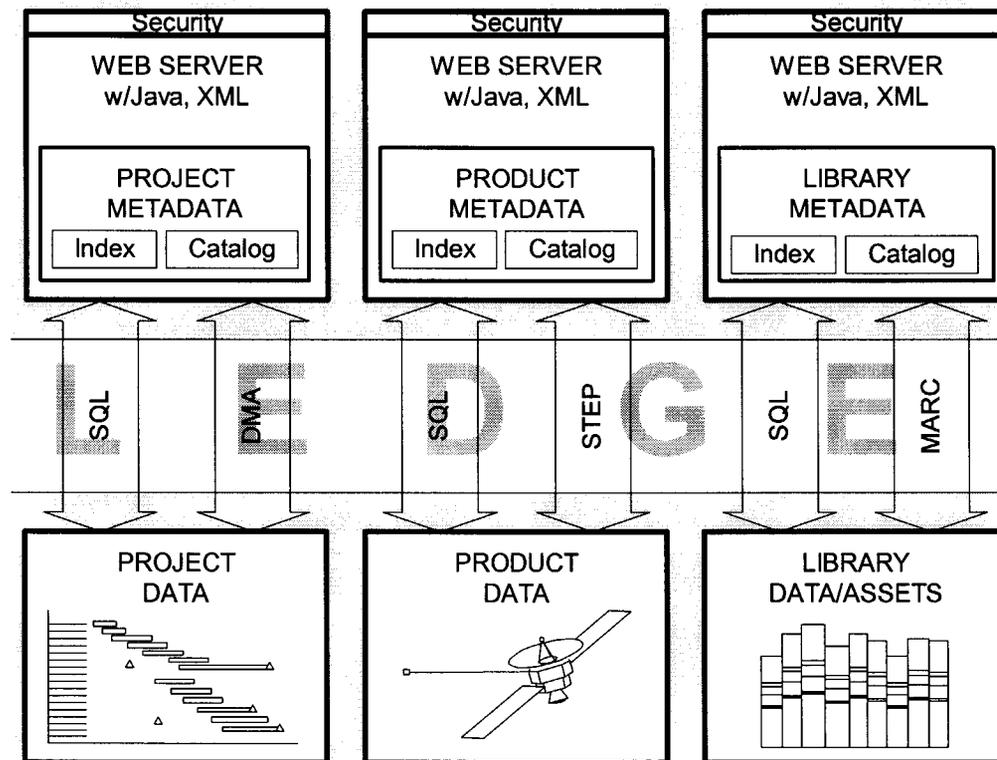
Step 3. System Architecture (continued)

– Knowledge resources

- Existing resources
- Experts profiles
- Q&A databases

– Infrastructure services

- Network
- Messaging
- File
- Desktop support
- Data access
- Security

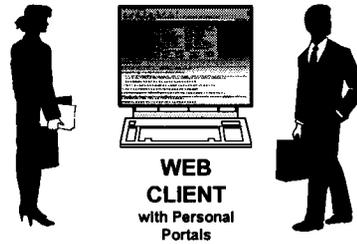


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32

INFORMATION SYSTEM ARCHITECTURE



"What do you want to do?"

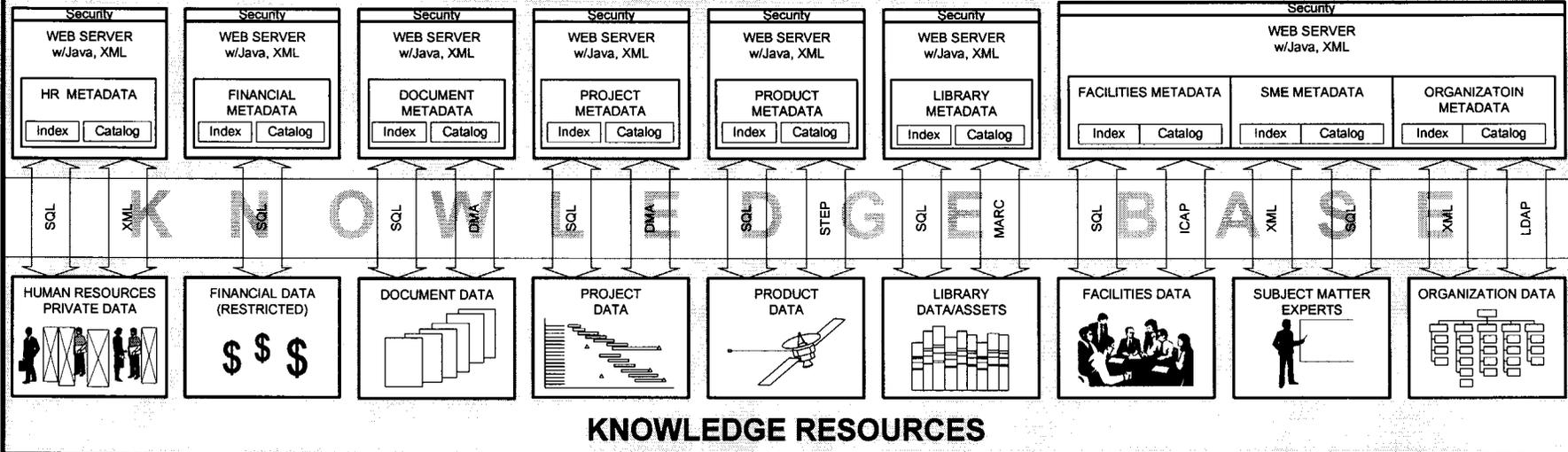
"Who are you?"

"How do you want it?"

KNOWLEDGE MANAGEMENT FUNCTIONS

Search, Browse, Retrieve, Create, Add Value (metadata), Update, Archive, Index, Filter, Catalog, Analyze, Validate, Associate

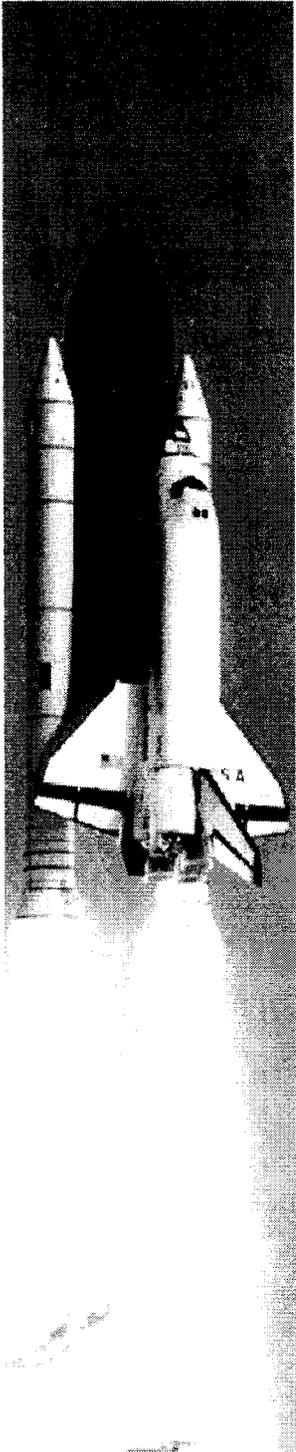
APPLICATION INFRASTRUCTURE SERVICES



KNOWLEDGE RESOURCES

INFRASTRUCTURE SERVICES

Security, Networks, File Service, Database Service, Messaging

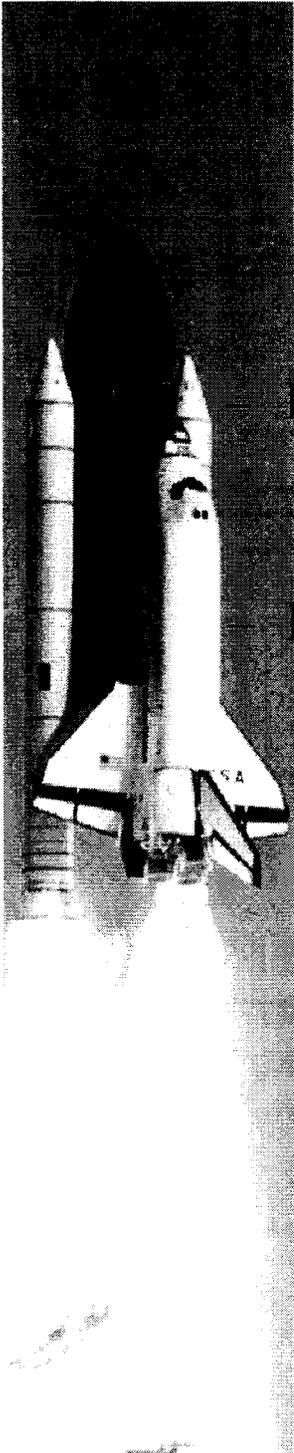


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Step 3. KM System Architecture (continued)

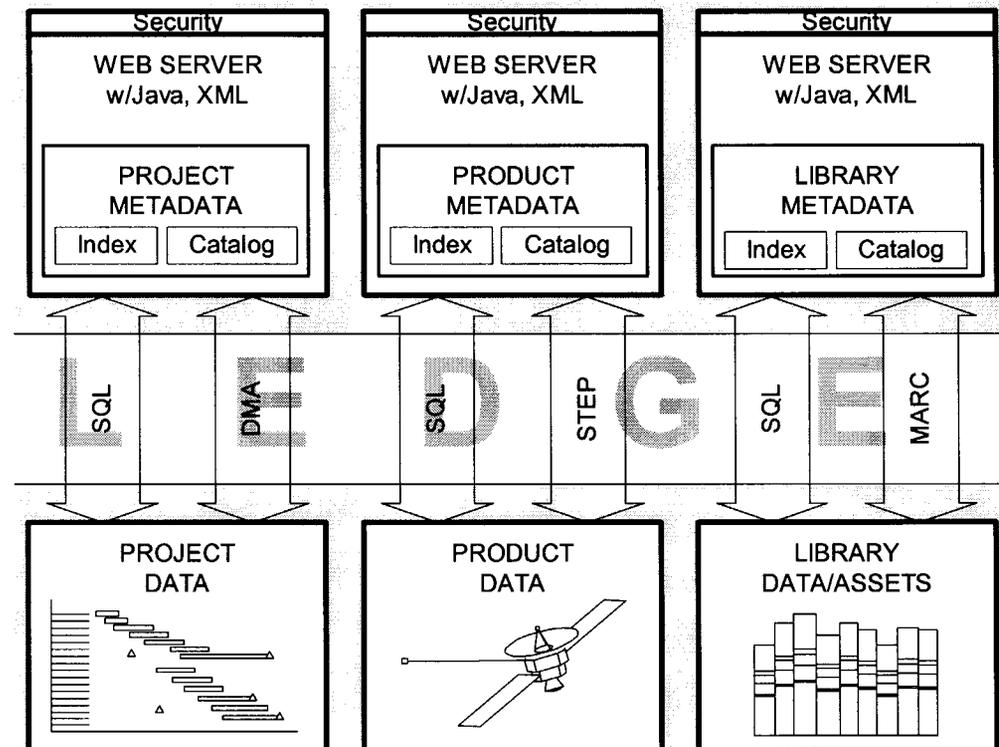


Knowledge resources

- Existing resources
- Experts database

Infrastructure services

- Network
- Messaging
- File
- Desktop support
- Data access
- Security



INFORMATION SYSTEM ARCHITECTURE



"What do you want to do?"

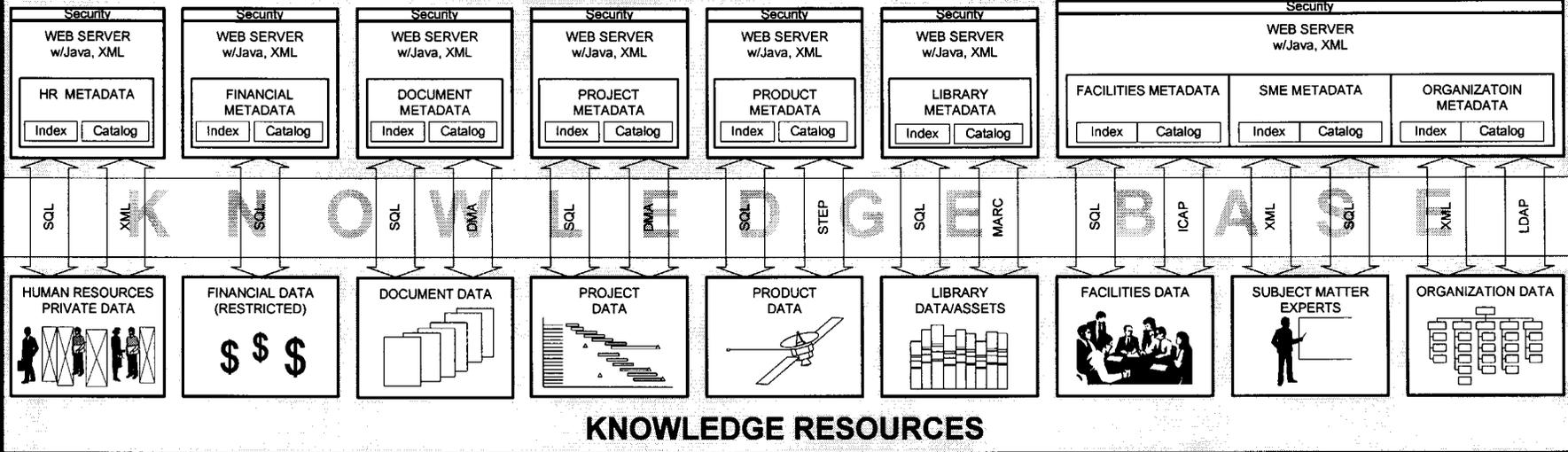
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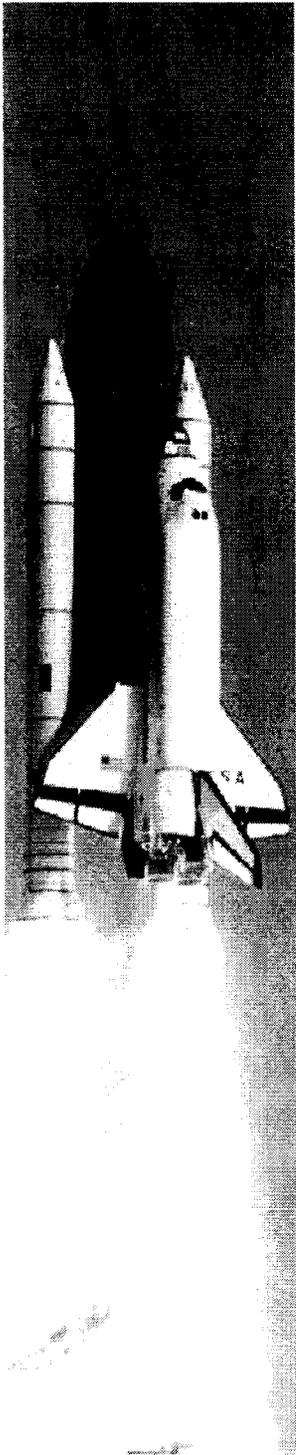
APPLICATION INFRASTRUCTURE SERVICES



KNOWLEDGE RESOURCES

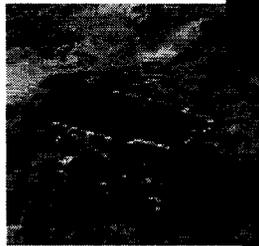
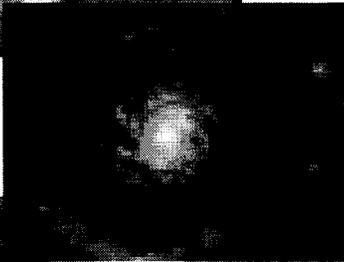
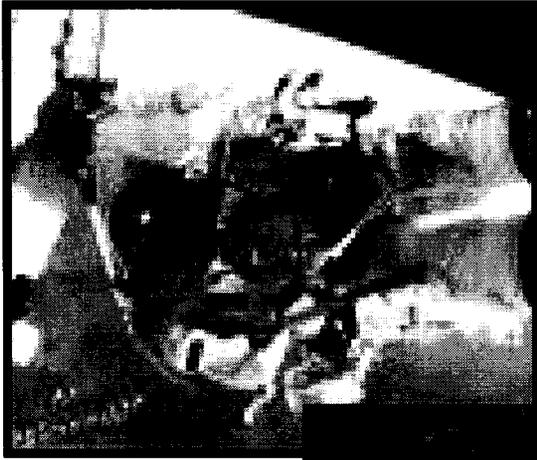
INFRASTRUCTURE SERVICES

Security, Networks, File Service, Database Service, Messaging



Checklist for Successful KM Systems

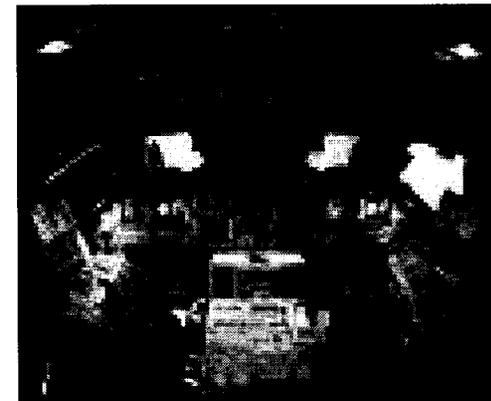
- In looking at best practices in technology implementation, KM choices should judge success by ensuring
 - ✓ High accessibility, searchability, and ease of use
 - ✓ Potential to save a large amount of work
 - ✓ Potential to help avoid expensive problems
 - ✓ Richness of the data repository
 - ✓ Features such as online help, help desk, and frequently asked questions
 - ✓ Openness to unsolicited submissions of information
 - ✓ Information that is maintained and accurate

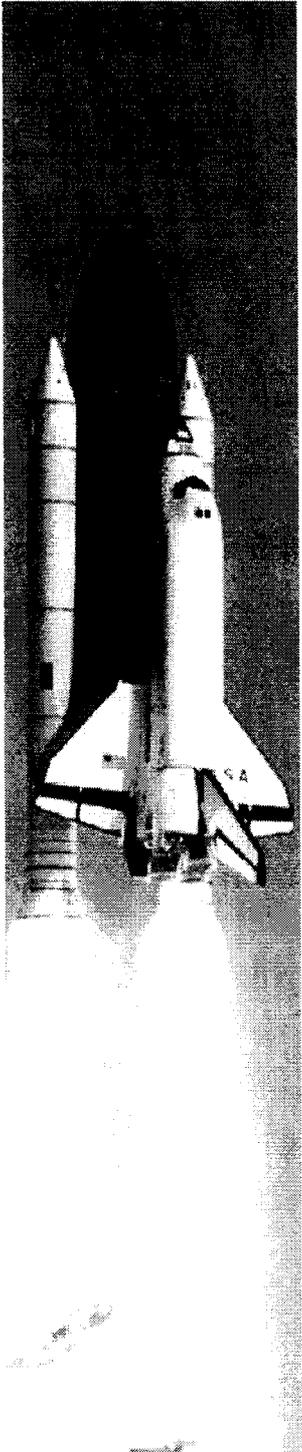


Implementing a Knowledge Architecture at NASA

What is Knowledge Management?

- ◆ *Knowledge management (KM) is getting the right information to the right people at the right time, and helping people create knowledge and share and act upon information in ways that will measurably improve the performance of NASA and its partners*
- ◆ **Driving forces at NASA**
 - Less experienced project teams need to see key information quickly
 - Highly specialized and compartmentalized knowledge
 - Management drivers
 - *Better Mechanisms Needs for Sharing Lessons Learned (GAO)* recommends linkage between KM and lessons learning at NASA
 - Administrator O'Keefe: Make NASA a leader in e-Government
 - *NASA Integration Action Team*: Promote the continuous capture, dissemination and utilization of knowledge



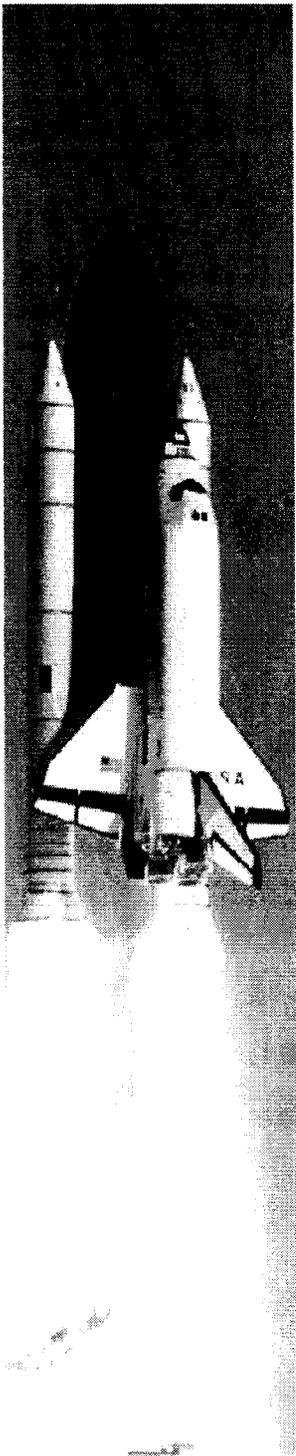
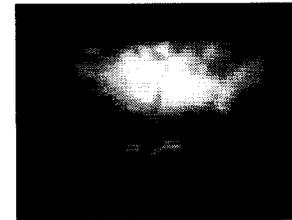
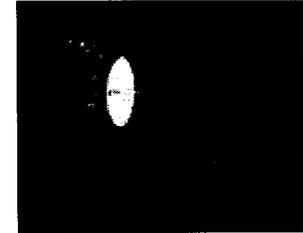


Creating a KM Community at NASA

- ◆ NASA's KM Team is chartered by the Chief Information Officer (Lee Holcomb)
 - Representatives from across the Agency, system architects to authors to anthropologists
- ◆ We find good solutions, fill the gaps, and build a federation of resources to support our missions and research communities
 - KM supports and enables other processes and initiatives by advocating best practices, promoting good solutions, and building infrastructure and applications to bridge distributed systems
 - KM's goal is to help infuse new ideas or needed technology and to leave or turn over operations to the appropriate content area
- ◆ Actively share and benchmark with other Agencies, the National laboratory community, and academia

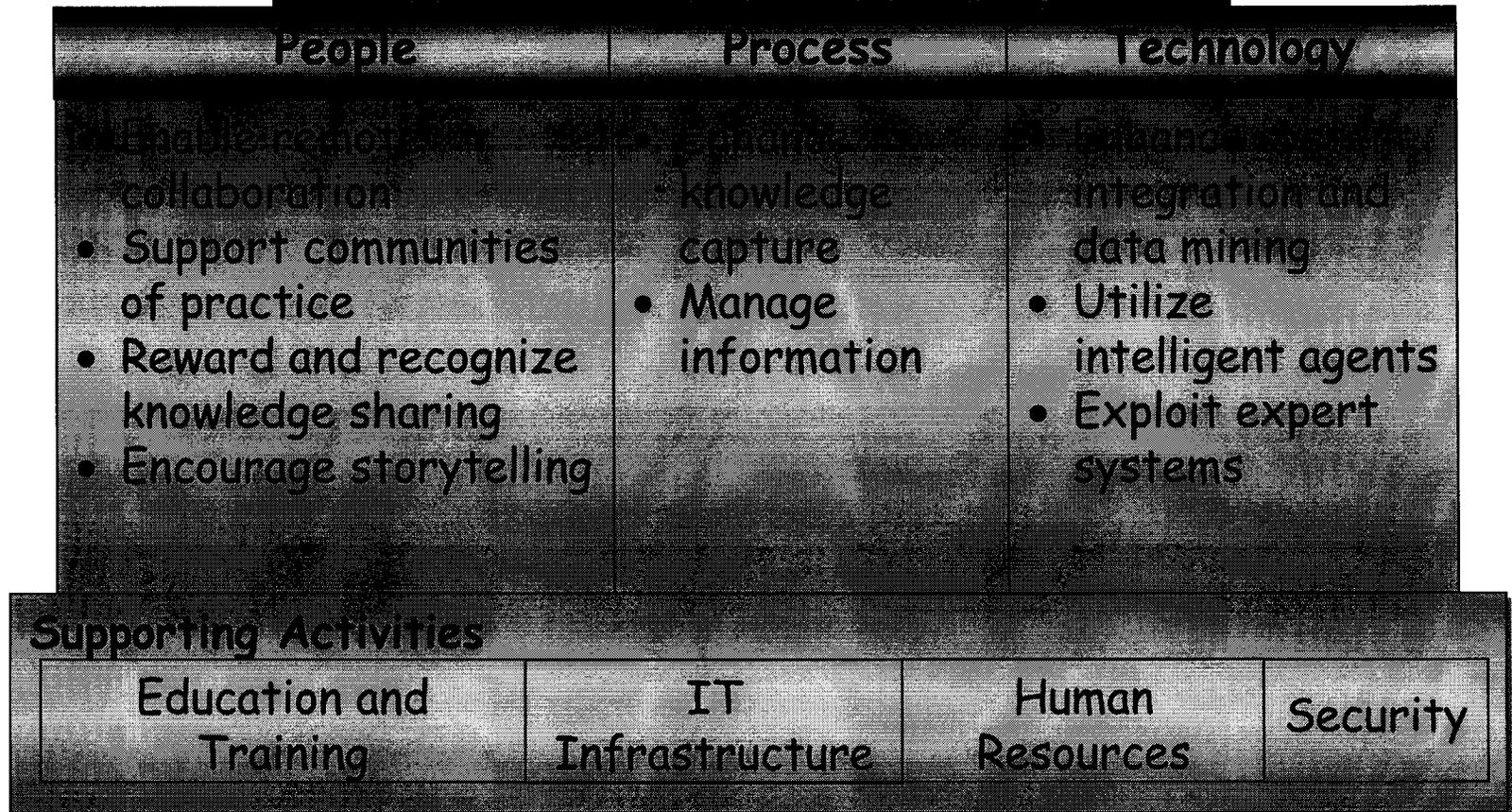
Key Areas for NASA's KM Strategy

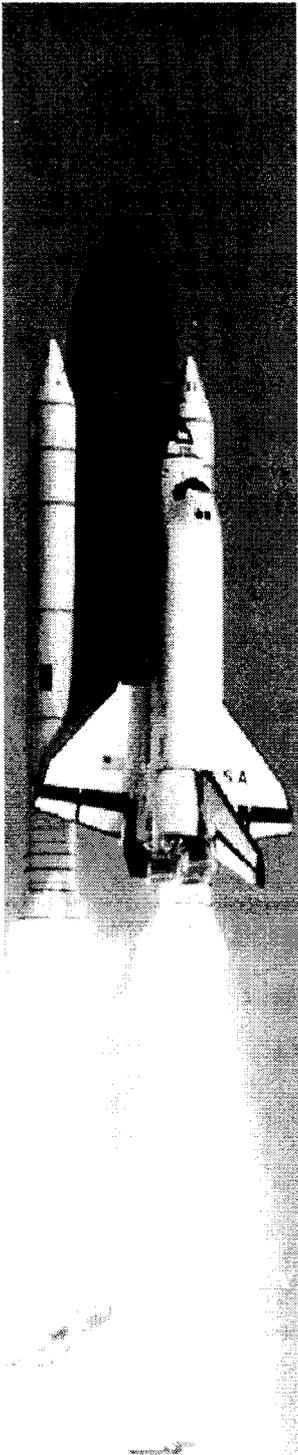
- ◆ To sustain NASA's knowledge across missions and generations
 - KM will identify and capture the information that exists across the Agency
- ◆ To help people find, organize, and share the knowledge we already have
 - KM will efficiently manage NASA's knowledge resources
- ◆ To increase collaboration and to facilitate knowledge creation and sharing
 - KM will develop techniques and tools to enable teams and communities to collaborate across the barriers of time and space



Framework for KM at NASA

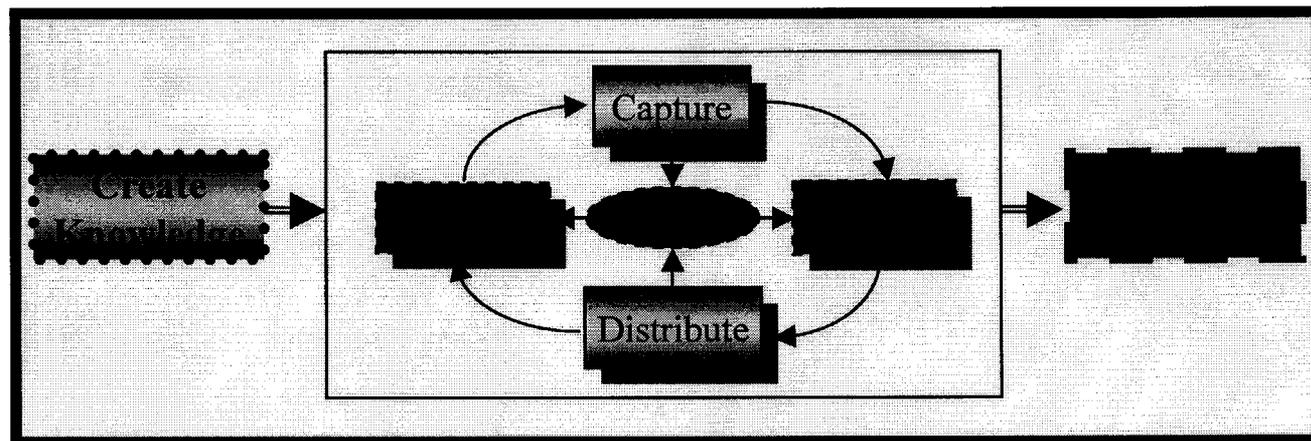
Sharing and Using Knowledge

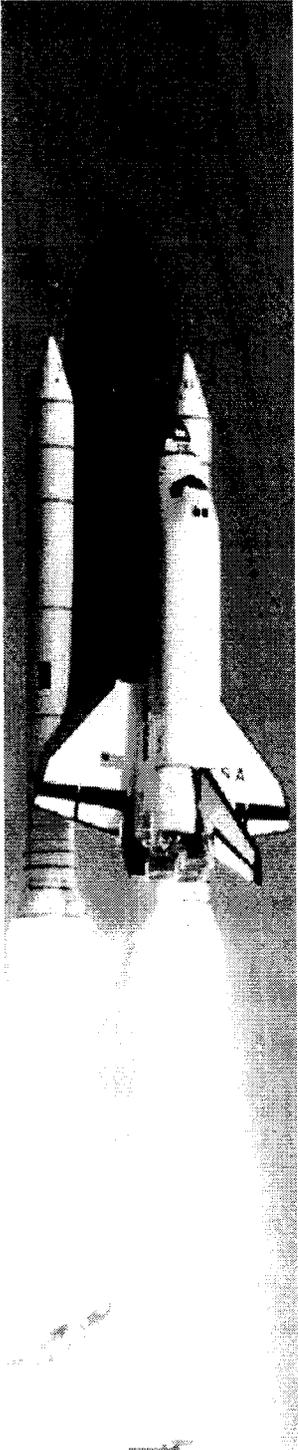




Creating a Process Architecture in 2001

- ◆ The NASA KM Team first focused on three pilot activities to prove the viability of KM at NASA
 - **Knowledge Navigation:** enabling access to information
 - **Lessons Learned Information System:** improving the capture of key knowledge and infusion into engineering processes for better decision making
 - **Experts Directory Service:** helping to find scientists and engineers to facilitate collaboration across boundaries





Deploying Systems and Services in 2002

◆ Information portals

- For the public, scientists, and employees to streamline access to NASA's 4,000,000 web pages
- Identifying content and publishing processes
- Building framework and technology for distributed use
- Creating taxonomies and metadata standards for ease of interoperability

◆ Collaborative environments for missions

- Creating access to tools, training, and venues for managing virtual teams
- Quick start environment for proposals and tasks

◆ Capture design knowledge

- Creating a service and tools to capture in-process design decisions for use on current and future missions

Portal in Development

NASA Mockup:
<http://km.jpl.nasa.gov/portal/insidenasa>

JPL Prototype:
<http://insidejpl.jpl.nasa.gov>

Inside JPL
 a portal to the JPL intranet
 Jet Propulsion Laboratory
 California Institute of Technology

Sunday, December 9, 2001

Home 1 Home 2 Organization Demo

Login [?]
 Username:
 Password:
 Login Sign Me Up

Why Log In? Sign Me Up

Messages from Inside JPL [?]
INSIDE JPL BETA RELEASE

Inside JPL News

- [Welcome to Inside JPL](#)
- [About Inside JPL](#)
- [Data Channel Guide](#)
- [FAQ's for inside JPL](#)
- [About This Version](#)

Find a Person [?]
 Last Name:
 First Name:
 Search Clear Form

Boss Phonebook
 NASA X 500 Directory

Google Internet Search [?]
 Google
 Search the Web

 Google Search

NBS [?]

Daily Planet [?]
DailyPlanet

NEW! Jason-1 launched from Vandenberg
(posted Dec. 7)
 The Jason-1 spacecraft was launched today from Vandenberg Air Force Base, and has separated from the Delta II rocket. The launch was shown live on the Daily Planet, is now available as an archived webcast.

TODAY! Ready, aim, launch! (posted Dec. 7)
TODAY! Ethics training on Friday (posted Dec. 7)

Directory to JPL Web Space [?]
Directory to JPL Web Space

Employee Resources
 Timekeeping, Cafeteria Menus, Credit Union...

Institutional News and Events
 Events, JPL Communication Vehicles, JPL Newsgroups...

JPL Organizations
 Hierarchically by Directorates, List of Service Organizations...

Business & Administration
 Acquisition, Budget and Financial, Shipping, Receiving and Transportation...

Missions & Projects
 Alphabetical Listing, Funding Opportunities, Data & Research Centers...

Infrastructure Services
 Computer Services, Facilities, Safety & Security...

Libraries, Information & Education
 Education, Technical Publications, Libraries & Collections...

External Information
 Information, News, Organizations...

Finding Peoples, Places & Things
 Finding People, Yellow Pages, Maps...

Policies & Procedures
 JPL Rules! (DMIE), Ethics, NASA Directives...

My Calendars [?]
JPL Events Calendar
 No Events today
[Science and Technology](#)
[NASA Launches](#)
[JPL Space Calendar](#)

Quick Links [?]

- [JPL Interactive Maps](#)
- [JPL Conference Rooms](#)
- [JPL Online Yellow Pages](#)
- [Timecard Log In](#)
- [Cafeteria Menus](#)
- [JPL Policies](#)
- [JPL Library](#)
- [Universe](#)
- [New to JPL](#)
- [Printable Phone Book](#)
- [Boss Phone Book](#)

Science Links [?] [?] [?]

- [American Astronomical Society](#)
- [American Geophysical Union](#)
- [American Society for Mass Spectrometry](#)
- [Astronomical Society of the Pacific](#)
- [Elsevier](#)
- [Icarus](#)
- [Institute of Physics](#)
- [Sky and Telescope](#)
- [Chicago Press Journals](#)
- [NIST](#)
- [National Science Foundation](#)
- [Web of Science](#)

Engineering Links [?] [?] [?]

- [JPL's DNP Reengineering Initiative](#)
- [American Society of Mechanical Engineers](#)
- [JPL Standards Home Page](#)
- [Elec Eng Institute of elec and lectronic Eng \(IEEE\)](#)
- [International Council on Systems engineering \(INCOSE\)](#)
- [NASA's STEP Website- Engineering tandards](#)
- [JPL's STEP Website](#)
- [NASA Lessons Learned](#)
- [Technical Questions Database](#)

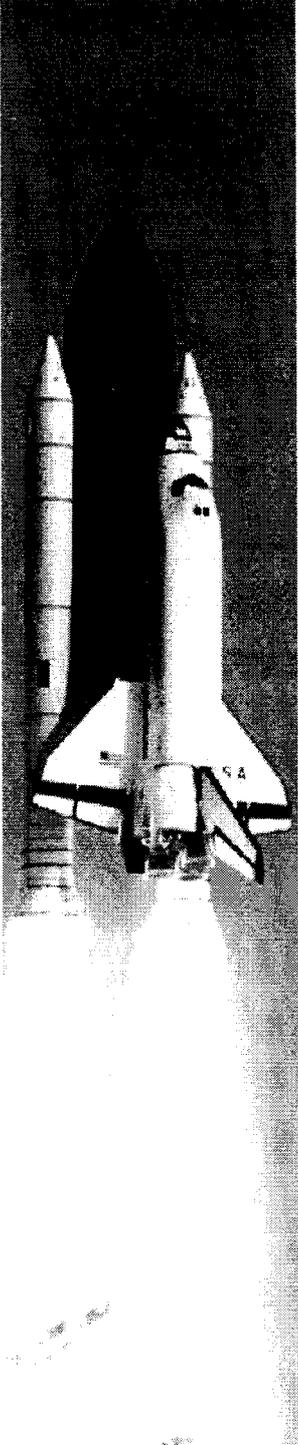
Labwide Announcements [?]
Budget [?] [?] [?]

Budget

Category	Planned	Obligated	Costed
1-Oct	~300	~300	~300
1-Nov	~150	~150	~150
1-Dec	~250	~250	~250
YTD	~600	~600	~600

Expert Connections

- ◆ Finding people to get answers or work on a project, includes profiles of 1100 technical experts
- ◆ Linked to other systems
 - Publications database
 - Caltech experts
- ◆ Search or browse



JPL KnowWho

Home/Quick Search Advanced Search Add Profile Help

JPL personnel possess expertise in a broad spectrum of Scientific, Engineering and other technical and non-technical areas. The Expert Connection will help you locate people with the expertise you need.

Related Sites: [Caltech Experts Guide](#) [Community of Science Expertise](#) [Publications](#)

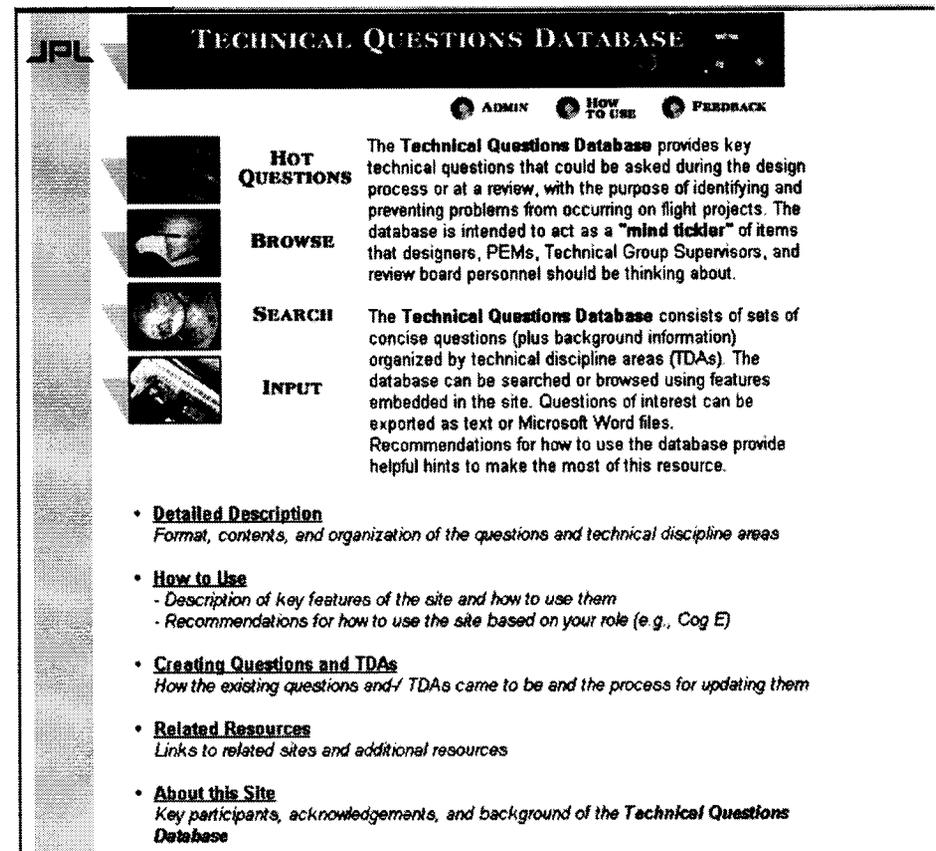
Click a category below or enter a name, subject area or other descriptor of the information you seek in the search field at the right.

Exact Match? Yes No [Advanced Search](#)

Technical	Non-Technical	
• Astrodynamics & Navigation	• Finance	• Health and Safety
• Computer Science	• Human Resources	• Industrial Relations
• Detectors & Detector Systems	• Institutional Computing	• Legal and Regulatory
• Environmental Compatibility	• Logistics and Facilities	• Planning
• Materials	• Public Affairs	• Quality and Reliability
• Metrology	• Technical Information	
• Mission Design		
• Optics		
• Reliability Engineering		
• Science		
• Telecommunications		
• Chemical Systems & Processes		
• Control Systems		
• Energy/Power		
• Integration & Test		
• Mechanical & Thermal		
• Microdevices		
• Operations		
• Propulsion		
• Robotics		
• Systems Engineering		

Technical Questions Database

- ◆ Best questions asked at technical reviews
- ◆ Helps to create a virtual presence when key people cannot be there
- ◆ Over 700 questions
- ◆ 42 subject areas

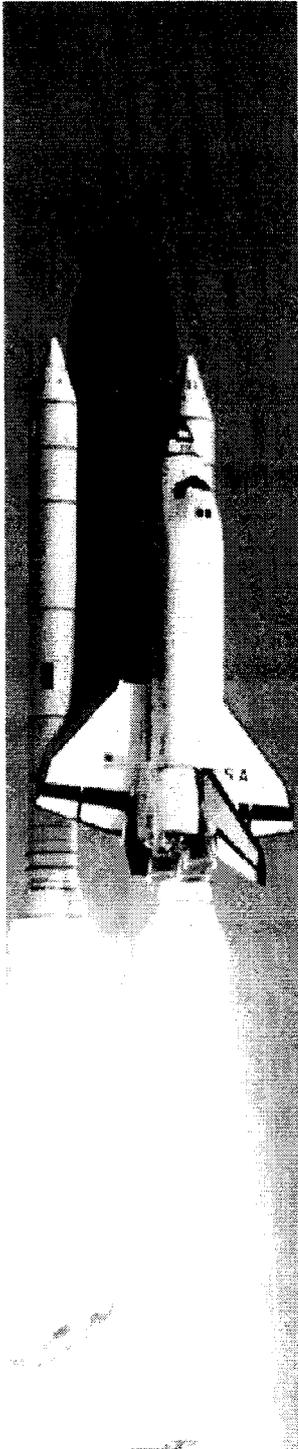


The screenshot shows the JPL Technical Questions Database website. At the top left is the JPL logo. The main header is "TECHNICAL QUESTIONS DATABASE" with a "HOME" link. Below the header are three navigation links: "ADMIN", "HOW TO USE", and "FEEDBACK". The main content area is divided into four sections, each with a small image icon and a title:

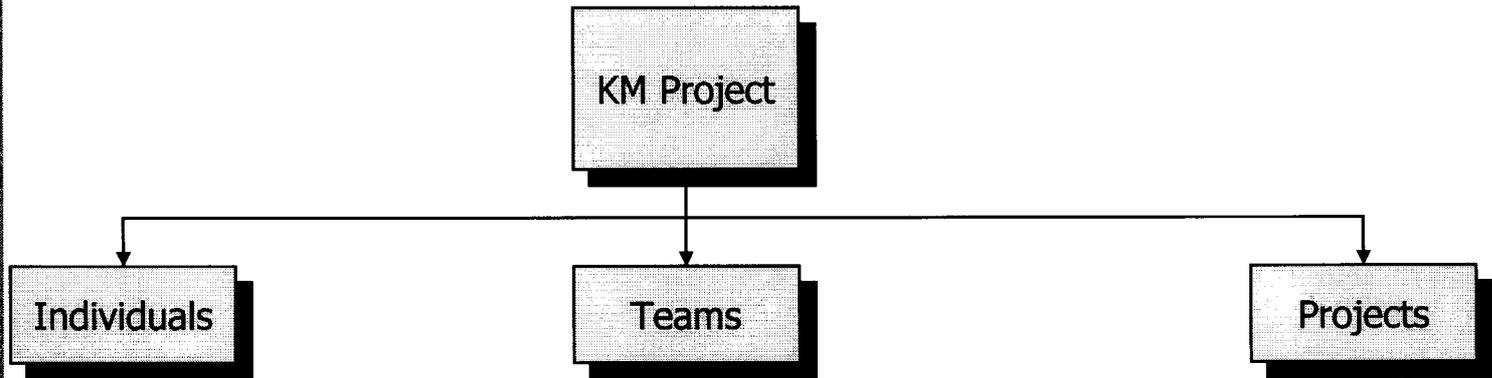
- HOT QUESTIONS**: The Technical Questions Database provides key technical questions that could be asked during the design process or at a review, with the purpose of identifying and preventing problems from occurring on flight projects. The database is intended to act as a "mind tickler" of items that designers, PEMs, Technical Group Supervisors, and review board personnel should be thinking about.
- BROWSE**
- SEARCH**: The Technical Questions Database consists of sets of concise questions (plus background information) organized by technical discipline areas (TDAs). The database can be searched or browsed using features embedded in the site. Questions of interest can be exported as text or Microsoft Word files. Recommendations for how to use the database provide helpful hints to make the most of this resource.
- INPUT**

Below these sections is a list of links:

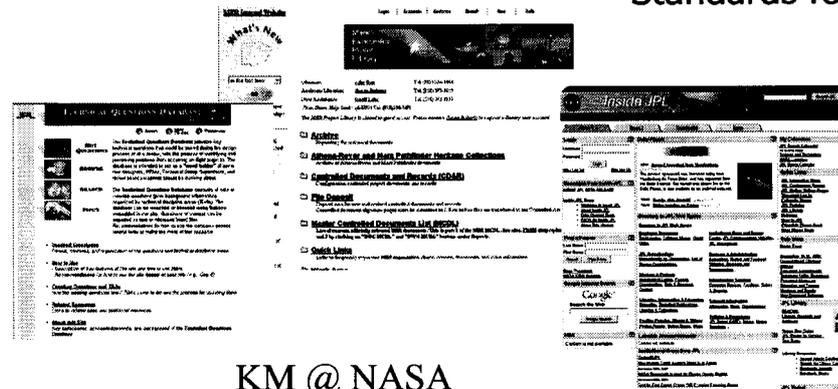
- **Detailed Description**
Format, contents, and organization of the questions and technical discipline areas
- **How to Use**
 - Description of key features of the site and how to use them
 - Recommendations for how to use the site based on your role (e.g., Cog E)
- **Creating Questions and TDAs**
How the existing questions and/ TDAs came to be and the process for updating them
- **Related Resources**
Links to related sites and additional resources
- **About this Site**
Key participants, acknowledgements, and background of the Technical Questions Database



KM Embeds Methods and Technology Into The Way People Work



- **Finding information**
Taxonomies and portals
- **Finding people**
Know Who
- **Capturing information**
Technical Questions and design decisions
- **Sharing information**
Portals
- **Sharing information**
Project Libraries online
- **Collaborating**
Collaborative tools and rooms and portals
- **Preparing for reviews**
Technical Questions
- **Making design decisions**
Knowledge capture
- **Ensuring easy collaboration**
Standards for engineering



July 18, 2002

KM @ NASA

JPL Knowledge Management Roadmap

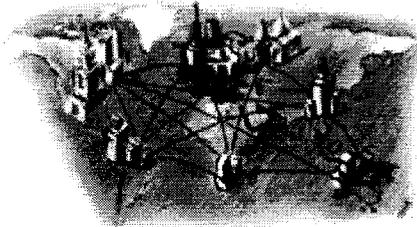


Sharing Knowledge

- Adaptive knowledge infrastructure is in place
- Knowledge resources identified and shared appropriately
- Timely knowledge gets to the right person to make decisions
- Intelligent tools for authoring through archiving
- Cohesive knowledge development between JPL, its partners, and customers

Enables sharing of essential knowledge to complete Agency tasks

- MarsNet
- Europa Orbiter
- SIM

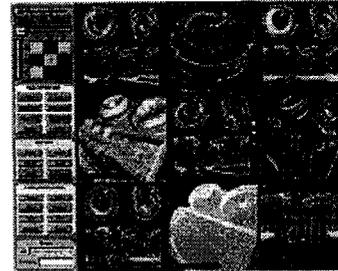


Integrating Distributed Knowledge

- Instrument design is semi-automatic based on knowledge repositories
- Mission software auto-instantiates based on unique mission parameters
- KM principals are part of Lab culture and supported by layered COTS products
- Remote data management allows spacecraft to self-command

Enables seamless integration of systems throughout the world and with robotic spacecraft

- Europa Lander/Submersible
- Titan Organics: Lander/Aerobot
- Neptune Orbiter/Triton Observer



Capturing Knowledge

- Knowledge gathered anyplace from hand-held devices using standard formats on interplanetary Internet
- Expert systems on spacecraft analyze and upload data
- Autonomous agents operate across existing sensor and telemetry products
- Industry and academia supply spacecraft parts based on collaborative designs derived from JPL's knowledge system

Enables capture of knowledge at the point of origin, human or robotic, without invasive technology

- Mars robotic outposts
- Comet Nucleus Sample Return
- Saturn Ring Observer
- TPF



Modeling Expert Knowledge

- Systems model experts' patterns and behaviors to gather knowledge implicitly
- Seamless knowledge exchange with robotic explorers
- Planetary explorers contribute to their successor's design from experience and synthesis
- Knowledge systems collaborate with experts for new research

Enables real-time capture of tacit knowledge from experts on Earth and in permanent outposts

- Interstellar missions
- Permanent colonies

2003

2007

2010

2025

Sharing Knowledge (2003)

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- Interstellar missions
- Permanent colonies

Enables capture of knowledge at the point of origin, human or robotic, without invasive technology

MarsNet
 • Comet Nucleus Sample Return
Europa Orbiter
Space Interferometry

Enables seamless integration of knowledge from all over the world and with robotic spacecraft

Enables sharing of essential knowledge to complete Agency tasks

Enables seamless integration of knowledge from all over the world and with robotic spacecraft

Enables sharing of essential knowledge to complete Agency tasks

- Europa Lander/Submersible
- Cassini: Lander/Aerobot
- Neptune Orbiter/Triton Observer

Enables sharing of essential knowledge to complete Agency tasks

- MarsNet
- Europa Orbiter
- SIM

2003

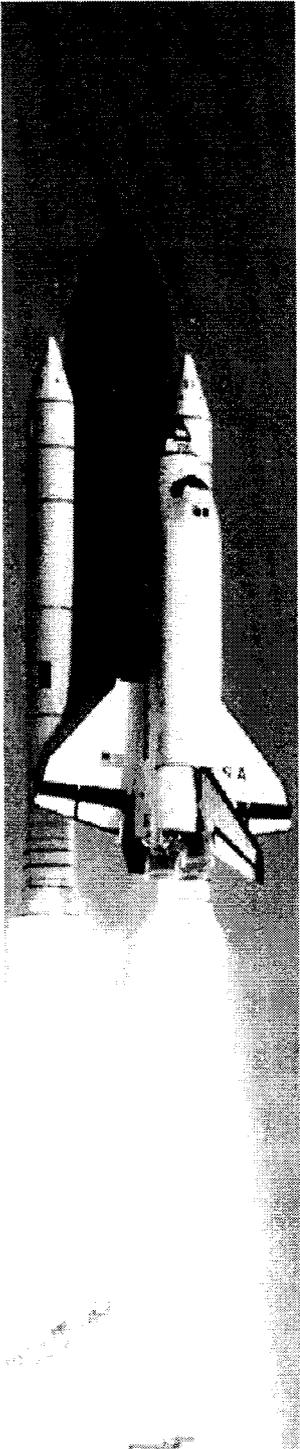
2007

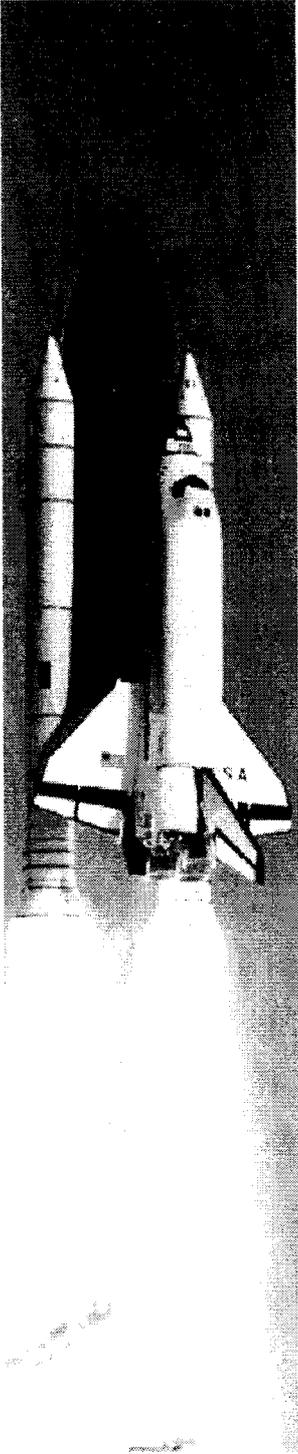
2010

2025

Lessons Learned

- ◆ Enlist, encourage, empower (baptize the evangelists)
- ◆ Develop solutions, services, and rewards
 - Deliver specific solutions to specific customers
 - Build KM into the way people already do their jobs
 - Understand that cultural acceptance is key
 - Make services operational (including funding and metrics)
 - Reward knowledge sharers through promotions, recognition, and time to learn and share
 - Recognize and celebrate contributions of the KM team and others
- ◆ Keep the alliances strong
- ◆ Balance long-term desires (capturing knowledge) with local requirements (specific solutions to a problem)
- ◆ Don't try to solve the whole problem—just start somewhere and solve part of the problem





Thanks!

- ◆ Many thanks to my JPL and NASA colleagues and our academic partners who contributed to these ideas and to the excellent work they are doing in implementing knowledge management solutions at JPL and NASA
- ◆ If you have any additional questions, please contact me:

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(818) 354-8282

- ◆ More information can be found at
 - NASA's KM program: <http://km.nasa.gov>
 - JPL's KM program: <http://km.jpl.nasa.gov>