Making Sense of Rocket Science

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Creating an Opportunity

- Knowledge management activities provide the chance to look across an organization, regardless of boundaries, and find opportunities to make a difference...

QuickTime™ and a Sorenson Video decompressor are needed to see this picture.

NASA’s Knowledge Management goal

Knowledge management 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 an organization and its partners.
A Tale of Three Portals

- **NASA Public Portal**
  - [http://www.nasa.gov](http://www.nasa.gov)

- **InsideNASA - NASA Internal Portal**
  - [http://insidenasa.nasa.gov](http://insidenasa.nasa.gov)

- **NASA Engineering Network**
  - [http://nen.nasa.gov](http://nen.nasa.gov)
The NASA Public Portal

- Was designed and intended to be a dramatic, interactive interface to NASA by the public, kids, media, educators, and students
  - Create “One NASA” on the web to enhance access
  - Exemplar of the President’s Management Agenda
  - Tie together NASA’s public-facing web resources

- Our known challenges included
  - An evolving architecture, with a 4-week deadline for deployment
  - Quick and easy navigation for our many audiences
  - Integrated search, content management, and portal
  - Industrial strength hosting solution: ~140,000 hits per day

- Our unknown challenge
  - On February 1, 2003 deployment, the Space Shuttle Columbia tragedy would occur
## Business Issues and Project Context

### The National Aeronautics and Space Act
- Effectively communicate the relevance of NASA’s work in the everyday lives of the American public – from medical devices to better tires and stronger homeland security.

### E-Gov Act and President’s Management Agenda
- Adopt a citizen-centric model with a focus on what the public needs and how best to serve them for their needs.
- Achieve economies of scale internally through the migration of common infrastructures, tools, software and processes and information sharing.

### NASA Management Goals
- Use the web as a primary communication avenue of the values & mission driving NASA today
- Demonstrate NASA’s leadership in response to the e-Gov initiative
- Transform NASA.gov into a “lever of public influence” to re-ignite and reunite the American people’s passion for NASA.
- Coordinate web traffic on NASA’s operational computer network

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**NASA Portal**

- **Privacy**
- **Portal Service Components**
- **Security**

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US Citizens and the World

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Alternatives and Rationale

- RFP to Industry August 2002
- 27 Proposals received September 2002
  - 22 deemed non-compliant
- Downselect to four candidates October 2002
  - Artistic design
  - Technical design
  - Relevant experience
- Funded candidates through Preliminary Design Review
  - Fixed Price R & D contract
- Bake-off in November 2002
- Contract awarded in December 2002
- Portal on-line and operational January 31, 2003
Project Details and Solution Used

- **Prime Contractor**
  - eTouch Systems Corporation

- **Hosting in 2 data centers**
  - VeriCenter, Inc.

- **Infrastructure**
  - Servers - HP DL 380 G4
  - Operating System: Red Hat Linux ES 3.0, ES, 2.1 and 7.3
  - Web Server: Covalent Apache 2.0.43
  - Application Server: BEA WebLogic Server/Express 6/8,
  - Database: Oracle 9i
  - Search Software: Verity Enterprise K2 Server 4.5
  - Server Monitoring: Sysedge
  - Email & List Server: QMail & EZMLM
  - Portal: Vignette Application Portal 4.1
  - Content Management: eTouch CMS 1.3
  - Webmetrics: Urchin and FunnelWeb
  - Discussion Forums: JIVE Forums
  - Backup: Veritas Netbackup

- **Caching and Streaming**
  - Akamai Technologies, Inc.
Business Results

- Public is being well served
  - Traffic in first 5 days of the Portal equaled the traffic for the previous six months
  - Mars Rover interest in 10 days in 2004 exceeded entire previous year
  - Deep Impact broke previous records by a factor of 7
  - While “regular” NASA.gov visitors have grown an average of 15% per year, Peak visitors have grown 50 times over the past 3 years!

- NASA is benefiting from increased exposure
  - Customer satisfaction ratings remain high
    - 79.0 vs 73.5 Government Aggregate

- Per user cost declining
  - 35% drop from 2004 to 2005
Challenges and Lessons Learned

- **Keep ahead of demand**
  - Increasing use and number of computers on the Internet
  - Explosion of broadband
  - Rich media and streaming media
    - NASA TV

- **Keep content fresh, meaningful and accessible**
  - Distributed publishing via CMS
  - Review by neutral outsiders
  - U.S Rehabilitation Act Section 508 compliance
  - Intelligent search
  - Personalization - MyNASA
    - Enabled by Vignette, along with authentication
When Success is Out of This World!

- Landings of the Mars Exploration Rovers on the Red Planet and the dramatic Deep Impact mission became the largest online events to date
- Streaming live coverage, dynamic and distributed publishing, and automatic image upload brought fresh images within minutes of the spacecraft sending them to Earth
- Expanded content brings information to NASA’s six key audiences
- Rich, interactive media at the home page helps people see NASA’s message and understand our discoveries
## A Snapshot of Portal Traffic

### Deep Impact and Return To Flight Combined

<table>
<thead>
<tr>
<th></th>
<th>Visitor Sessions</th>
<th>Pages Viewed</th>
<th>Hits (number of items requested)</th>
<th>Amount of Information Sent to Public (megabytes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA Web TV</td>
<td>476,152</td>
<td>N/A</td>
<td>4,581,538</td>
<td>77,698,916</td>
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<tr>
<td>Yahoo NTV</td>
<td>2,174,411</td>
<td>N/A</td>
<td>6,909,343</td>
<td>98,754,685</td>
</tr>
</tbody>
</table>

**Comparison of STS-114, Deep Impact, and Mars Mer Events**

**Peak Web Traffic, mbps**

- STS-114 RTF Launch 7/26/05
- MARS Mer 1/6/04
- Deep Impact 7/4/05

24 hours
Intended for employees and partners
Customizable
Access to e-mail
Instant messaging
Collaborative tools
Application integration
Built on Vignette
Re-use of NASA Portal infrastructure
Inside NASA Facts

- The primary internal portal for the U.S. space agency
- Visitors (monthly):
  - 800,000 hits comprising 28,000 sessions
  - 10 minutes per session
  - Growth pattern: 43% increase monthly in unique visitors
- Content: 90+ portlets
- Links: ~1700
- Reliability: 99.995% uptime
- End-to-end support: 1.0 FTE (full time equivalent)
## Business Issues and Project Context

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<tr>
<th>E-Gov Act and NIST Guidelines</th>
<th>NASA Management Goals</th>
</tr>
</thead>
</table>
| • Achieve economies of scale internally through the migration of common infrastructures, tools, software and processes and information sharing.  
• Secure information based on classification and share appropriately within the Agency | • Use the web as a primary communication avenue of the values & mission driving NASA to the NASA workforce  
• Provide Access to the tools needed by the Workforce in an easy manner |

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**Inside NASA Portal**

- **Privacy**
- **Security**
- **Portal Service Components**

**NASA Workforce**

**EAR**

**Reuse**
Alternatives and Rationale

- When the decision was made to move the pilot operational, six alternatives were analyzed for:
  - Stabilize on pre-existing SunOne 3.0 (long-term viability and usability of SunOne inadequate)
  - Develop in-house portal software (cost-effective COTS solutions were available)
  - Competitive RFP for full market saturation (existing options were available within NASA)
  - Develop on open source portal options, like Jet Speed (technology was immature)
  - Upgrade to SunOne 6.1 (InsideJPL made this transition, which was very costly in time and money)
  - Separate, independent analysis by HR and OCIO of Plumtree (usability concerns and costs)
- Move to Vignette and shared infrastructure with NASA Portal (My NASA):
  - Evaluated Vignette independently and with eTouch to determine match to requirements
  - Functionality met requirements and provided good future capability deployment
  - Operational costs and complexity to OCIO would be minimized with shared infrastructure
Project Details and Solution Used

- **Prime Contractor**
  - eTouch Systems Corporation

- **Project Management, Content Lead, Application Integration**
  - NASA JPL

- **This initiative was part of a NASA Knowledge Management task (JPL Task Order 10260) sponsored by the NASA CIO and given to JPL for implementation in 1999.**

- **Migrated from the JPL infrastructure to the NASA Portal Infrastructure in April 2005**
Business Results

- **Agency-wide communications**
  - Managers and teams use Inside NASA for routine and critical communications
  - Highly distributed model allows prompt updates and information

- **Emergency operations**
  - Provides real-time information for employees during emergencies (such as recent hurricanes)
    - Integrated information source
    - Available on remote devices (via VPN or token from cyber-cafes, Blackberry, and PDA)
    - Help desk support for for everything from return to work status to local supplies and evacuation routes

- **Communities of practice**
  - Allows broad-based, open collaboration across NASA and its partners
  - Spurs innovation and creative solutions
  - Elicits tacit knowledge from our experts
  - Captures and manages key knowledge for the Agency

- **Application integration**
  - Serves as the fulcrum for single sign on (still to come) and application integration (underway)
  - Absolute simplicity of portal application allows for levels of integration (from web connectors through full re-hosting)
  - Allows NASA to utilize investments in existing technologies and harness the power of Vignette for customization, distributed publishing, and easy integration

- **Per user cost declining**
  - In FY '07 projected to drop ~80 over FY ‘06
Challenges and Lessons Learned

- Sunset existing services once integrated into InsideNASA to achieve full cost savings
- Funding reduction has implications
  - Limitation on the number of personnel
  - The amount of content housed
  - Response time to users
  - Reduction in reliability
- Management strategy for consolidation across NASA
- Additional navigation needed as portal grows
- Critical Agency content owners/publishers offer RSS and XML feeds
- More external content sources are automatically exploited in portlets
- Implement Agency-wide strategy for search.
- Full integration with NISE (when delivered)
  - E-Authentication
  - Directory
NASA Engineering Network (NEN)

- Our newest system and is still emerging
- Sponsored by the NASA Office of the Chief Engineer
- NEN is a robust, flexible knowledge management system that
  - Provides a multi-purpose community management tool, task management tool, and lessons learning tool
  - Allows for managing and sharing of discipline standards, requirements and processes with a minimum of labor
  - Includes ITAR/EAR-compliant space for restricted content
- NEN integrates a content management system, portal, search engine, and engineering community management system in support of engineering discipline communities and NASA lessons learned
- NEN is built on the NASA Portal and InsideNASA, to reach across organizations and ensure that information is made available across NASA secured networks with 99.95% availability
  - NEN uses the Vignette portal software
- NEN also reaches to the Ames’ NX (NASA Xerox DocuShare) system
- NEN complies with all Agency IT standards, including Section 508 conformance
Communities for Collaboration

- Collaborate
- Communicate
- Innovate
- Motivate

**EAR Reuse**

- Discussions and Q&A
- Standards
- Integration to document management
- Find information

- Plus action item tracking, saved searches and subscriptions and more.

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Learning Process Occurs Behind All Components: Embed learnings into tools and communities

- Center Lessons Learned
- NASA Lessons Learned
- Interagency/Aerospace Lessons Learned

Responsibility Areas:
- NASA Engineering Network—Blue
- Agency Resources—Green

Feedback

Training

Collaborative Tools

Competency Management System

Document and Data Repositories

Advanced Engineering Tools

Expertise Locator

Community Portals

Metasearch

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Looking Ahead

- We are working on a variety of new initiatives that are still being formulated, including
  - Agency-wide knowledge architecture
    - Update structured approach to integrating distributed content systems
  - Accelerating learning
    - Integrated approach to e-learning and support to the project managers
  - NASA Engineering Network
    - Portals to organize community and individual access to information
    - Collaborative tools expanded for secure access with our partners
    - Expertise and expert directories organized around sharing knowledge person-to-person over virtual social networks
    - Metasearch across distributed repositories
    - Semantic web technologies for enhanced search and expertise location
  - Managing knowledge for aerospace and government
    - International Astronautics and Aeronautics (IAA) Working Group on KM for Aerospace
    - Federal KM Working Group--Knowledge and Human Capital Retention
Integrating Distributed 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 NASA, its partners, and customers

Sharing Knowledge

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

Enables sharing of essential knowledge to complete Agency tasks

- MarsNet
- Mars Exploration Rovers
- Space Interferometry Mission

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 NASA’s knowledge system

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

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

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 lunar and Martian colonies

Knowledge Management Roadmap

- Mars robotic outposts
- Comet Nucleus Sample Return
- Saturn Ring Observer
- Terrestrial Planet Finder

2003  2007  2010  2025
Thanks!

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  Jeanne.Holm@jpl.nasa.gov  (818) 354-8282

- More information can be found about
  - NASA’s KM program: http://km.nasa.gov
  - NASA’s portal: http://www.nasa.gov