

NASA Ames Research Center, Computational  
Sciences Division

NETMARK

NASA Ames Research Center  
Computational Sciences Division

David A. Maluf

NASA Ames Research Center, Computational  
Sciences Division

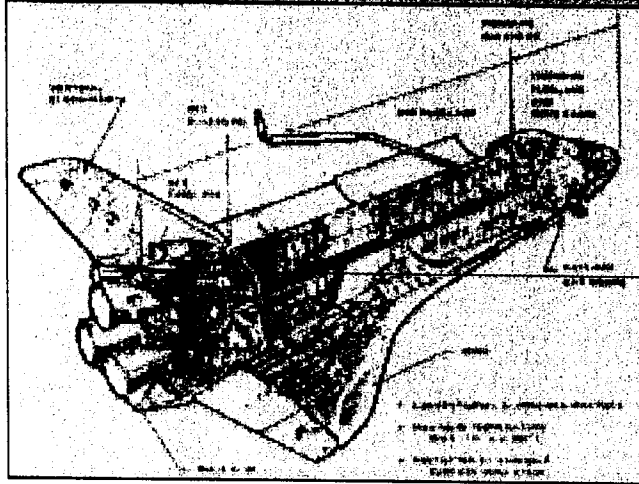
NEWMARK

NEWMARK

# NASA Ames Research Center, Computational Sciences Division **NETMARK**

**Purpose:** to control and interoperate with every block in a document, email, spreadsheet, power point, database, etc. across the lifecycle.

|  |  |     |                  |                 |              |
|--|--|-----|------------------|-----------------|--------------|
| 1.0 Engineering for Complex System         | 1.1 Risk Tools Development & Deployment  | JPL | Steve Forth      | forth@nasa.gov  | 619-394-5272 |
| 2.0 System Reasoning Risk Management       | 2.1 Risk Workstation                     | JPL | Steve Forth      | forth@nasa.gov  | 619-394-5272 |
| 3.0 Knowledge Engineering for Safe Systems | 3.1 Human & Org Risk Management          | ARC | Adam O'Neill     | adam@nasa.gov   | 650-864-7484 |
| 4.0 Resilient Systems & Operations         | 4.1 Intelligent & Adaptive Ops & Control | ARC | Gregory A. Doran | gdoran@nasa.gov | 650-864-4851 |



Spread sheet cell

Word document paragraph, title etc.

Media and data

Electronic mail paragraph, subjects, headings, etc.

**1.0 INTRODUCTION**

**1.1 PROJECT SUMMARY**

This plan provides a description of the NASA Aviation Safety Program's (AVSP) Aviation System Monitoring and Modeling (ASMM) Project.

**Background**

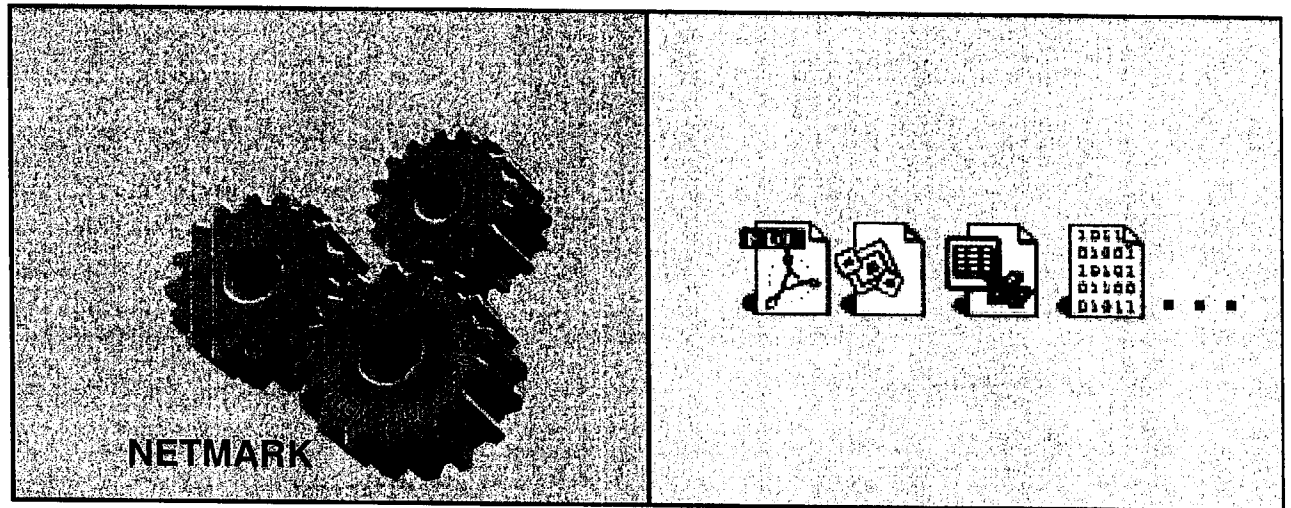
The government and the world aviation community continue to amass routinely large quantities of data that could be sources of information relevant to aviation safety. Increasingly, the accumulation of these data outpaces our ability to put them to practical use. It is difficult to combine data related to the same subject when they come from different sources. Often safety data cannot be retrieved after it has been put into computerized storage because of the way that the data was classified. There is a need for enabling technologies to facilitate efficient, penetrating, and insightful analysis of data collected from various sources throughout the National Airspace System (NAS) and to enable sharing of the information extracted from these diverse sources.

**Purpose**

Aviation System Monitoring and Modeling (ASMM) is one of six projects of the Aviation Safety Program that has been designed to address this growing need. The other five projects of the Aviation Safety Program are aimed, primarily, at developing solutions to problems that have been identified as causes of past accidents. ASMM, instead, is primarily concerned with extracting insightful interpretations of the health and safety of the National Airspace System (NAS) from monitoring current real-time operations and anticipating health and safety issues by conducting fact-tune

|     |       |         |           |             |               |
|-----|-------|---------|-----------|-------------|---------------|
| 1.1 | 1.1.1 | 1.1.1.1 | 1.1.1.1.1 | 1.1.1.1.1.1 | 1.1.1.1.1.1.1 |
| 1.1 | 1.1.2 | 1.1.2.1 | 1.1.2.1.1 | 1.1.2.1.1.1 | 1.1.2.1.1.1.1 |
| 1.1 | 1.1.3 | 1.1.3.1 | 1.1.3.1.1 | 1.1.3.1.1.1 | 1.1.3.1.1.1.1 |
| 1.1 | 1.1.4 | 1.1.4.1 | 1.1.4.1.1 | 1.1.4.1.1.1 | 1.1.4.1.1.1.1 |

The Mechanics



Load into Netmark using COTS

Context plus Content search

Regenerate arbitrary documents  
from arbitrary fragments

to some extent ...garbage in,  
garbage out.

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**Seamless information System**

**Sources identified:**

Non-normalized data: MS  
Word documents,  
Excel, Adobe PDF, XML,  
HTML, Binary, meta-data.  
Normalized data: relational  
and object oriented.

**Interlingua**

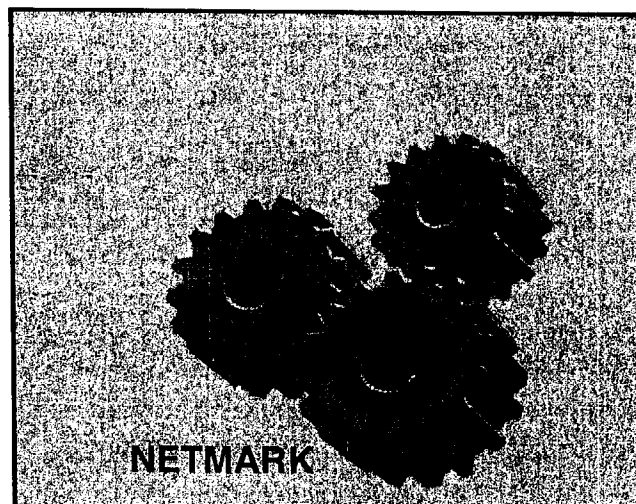
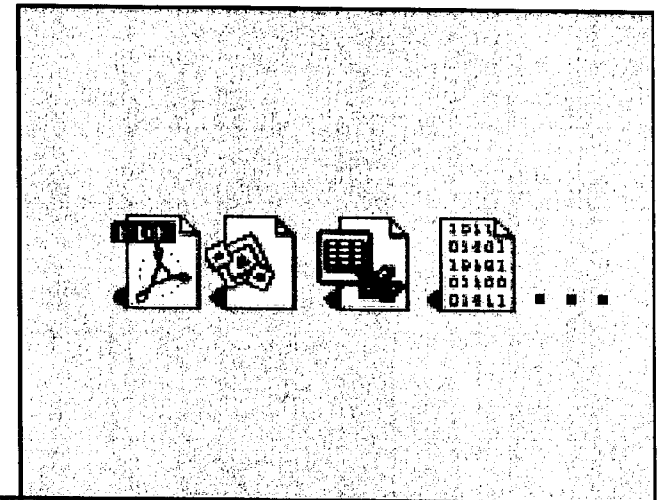
SGML: XML, HTML

**Translation:**

Microsoft Office  
Adobe

**Mass Storage:**

Oracle



Dynamic Schema-less Definitions

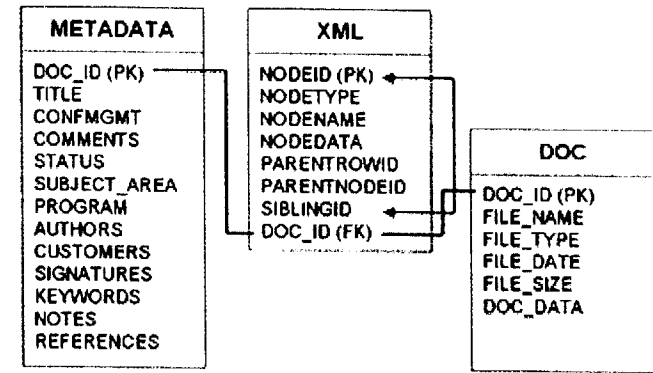


Figure 3: NETMARK Generated Schema

Extensible Architectures

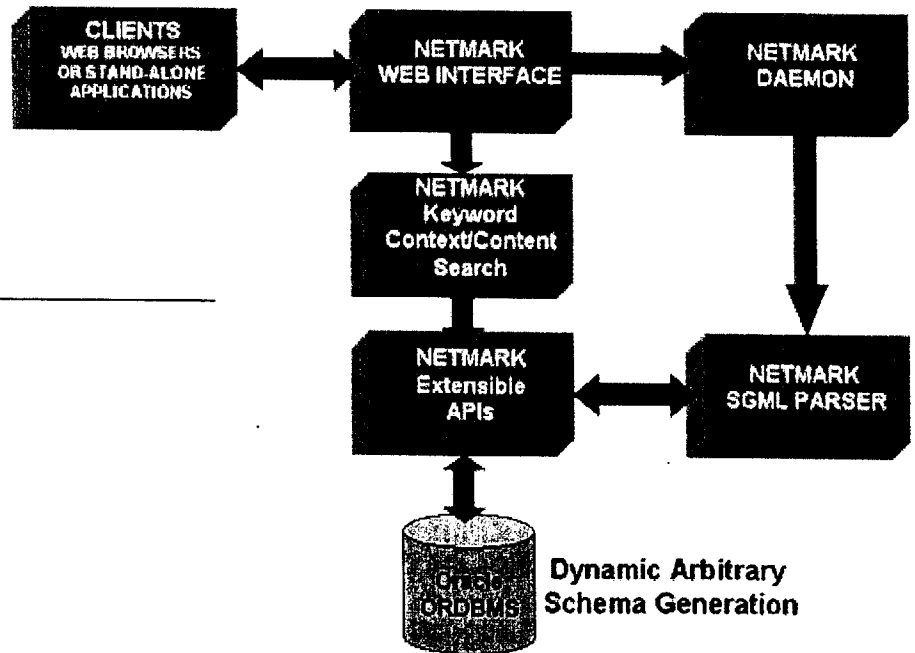


Figure 2: NETMARK Universal Process Flow

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### Requirements

#### OPERATING SYSTEM

Sun Solaris™ 2.6, 2.7 & 2.8

Red Hat Linux 7.0 (\*)

#### JDK SUPPORT

Java 2 (JDK 1.2, 1.3)

C/C++

#### SYNCHRONIZATION WITH RDBMS

Oracle

### Extensible API

C/C++

Java

PL/SQL

### Out of the Box

WebDav,

NFS, FTP, HTTP

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## Engineering for Complex Systems Mishap Report Analysis

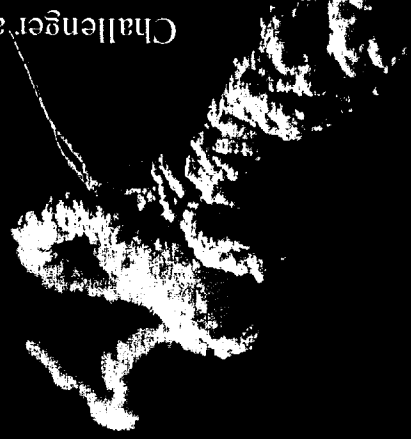


Mars Polar Lander accident



X-31 accident

Challenger accident



DC-XA accident

(COURTESY, NRE)



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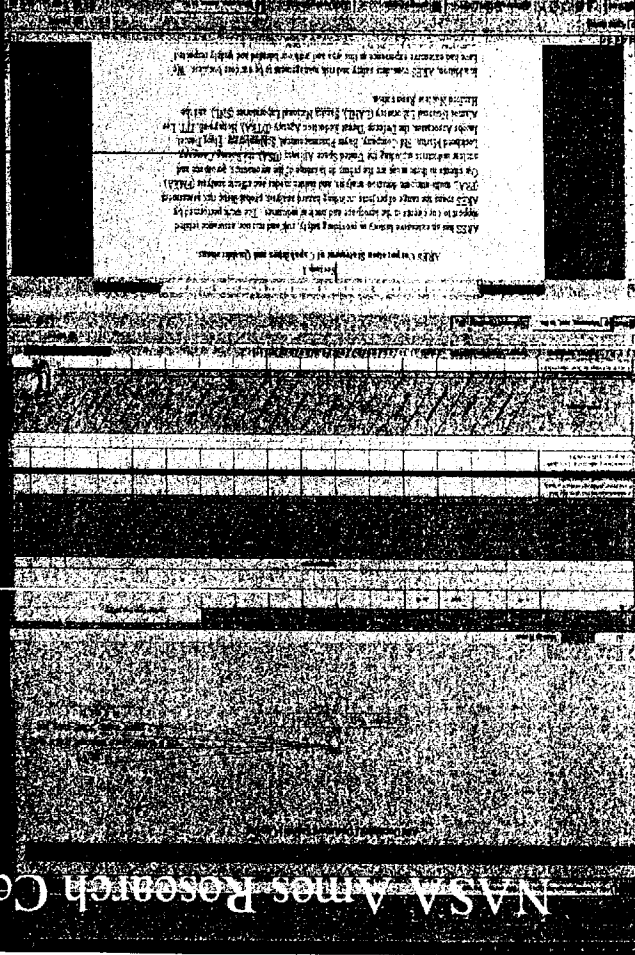
Software development Zero  
Setup time/integration 1FTE, 2 Days

23 Mishap Report Analyzed

Analysis of range of incidents  
involving NASA & non-NASA  
aircraft/spacecraft

Selected Sections from the Mishap  
Reports were loaded into the data  
analysis tool

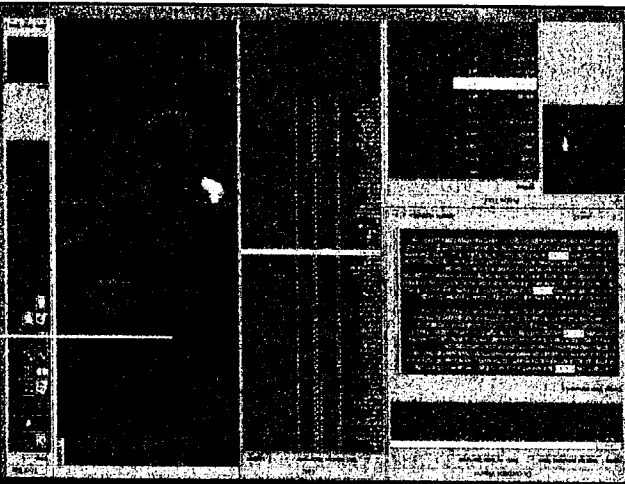
Drill-down into Documents



Reports distributed across  
a two-dimensional space based  
on similarities between reports

Content-based visualization derived  
from Galaxies visualization

3D visualization in abstract  
landscape that represents areas of  
high thematic content



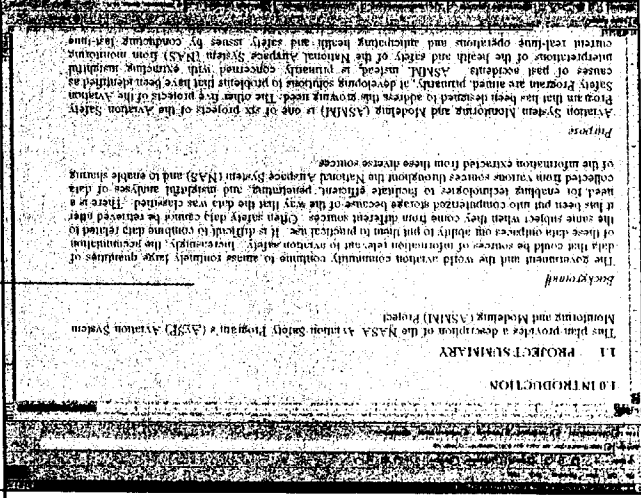
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Software development Zero  
Setup time/Integration 0 FTE, 0 Days

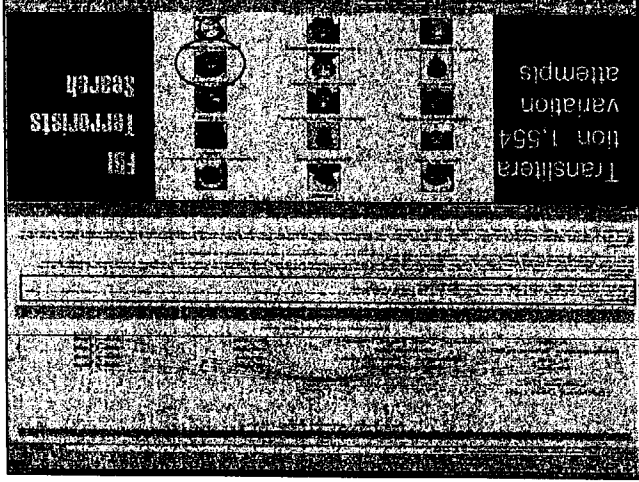
Re-editing: Document construct from disparate documents and fragments, paragraph, Tables, etc.



Search: Meta-Data Directory  
Identifying multiple data sources –  
5 federal agencies

Integrated Response  
highlighting information features

Actual relevant record(s)  
Highlighting matches



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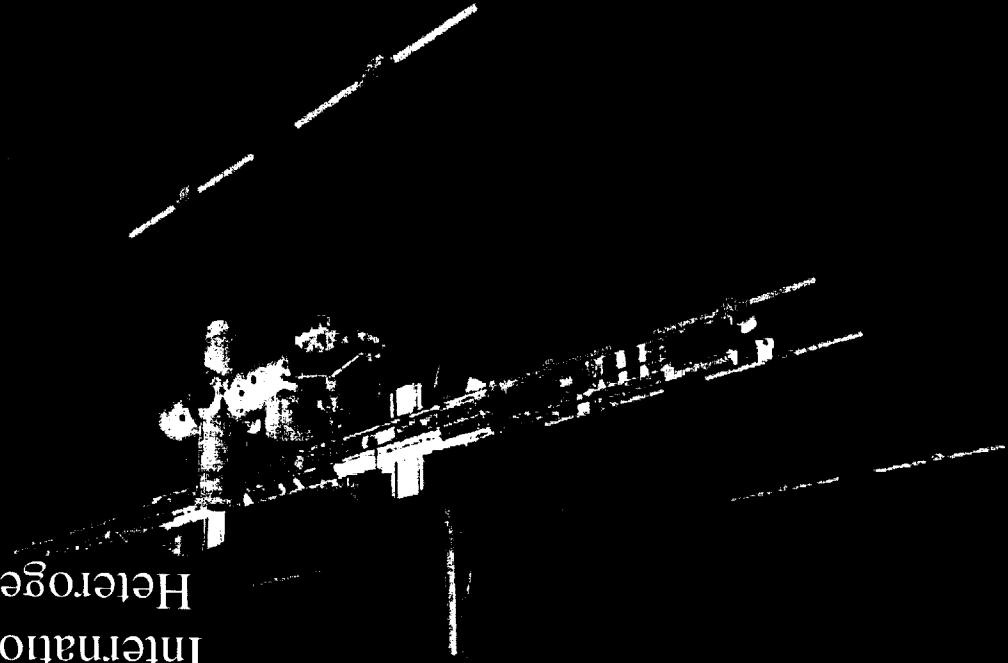
INTERNET

International Space Station  
Heterogeneous Integration

Integration of databases, heterogeneous in  
Provider plus content

Master vehicle database

Problem reporting corrective action database



Speed: 0.000 m/s

Open: 00:00:00  
FOV: 18.10 52.0°

Meta data capture of Mars 03 mission

Mars Exploration Rover - MER  
MER CIP HCC

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Mars  
Latitude: 1.225 N  
Radius: 3394.000 km  
Day length: 24.623 hours  
Temperature: 211 K

THE MARS

2002 10 25 19:44:02 UTC  
Real time

Real time integration

```

<XML>
  <source> Master database
    <access_method> RDBMS
    ...
  <source> PRACA
    <access_method> http://w...
  <preprocess_using>
    <query_template> style_sheet ..
  <postprocess_using>
    <Transliteration> ...
  
```

Client Query is loaded from NETMARK (server)

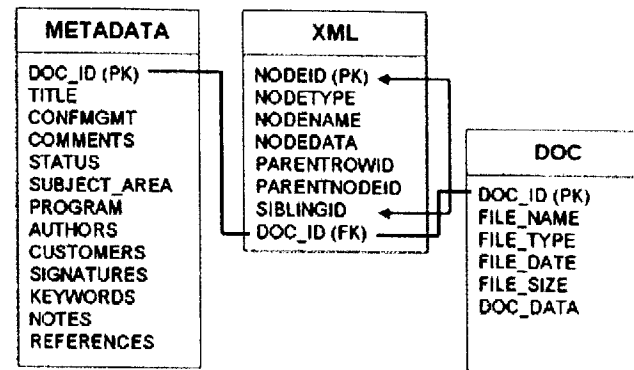


Figure 3: NETMARK Generated Schema

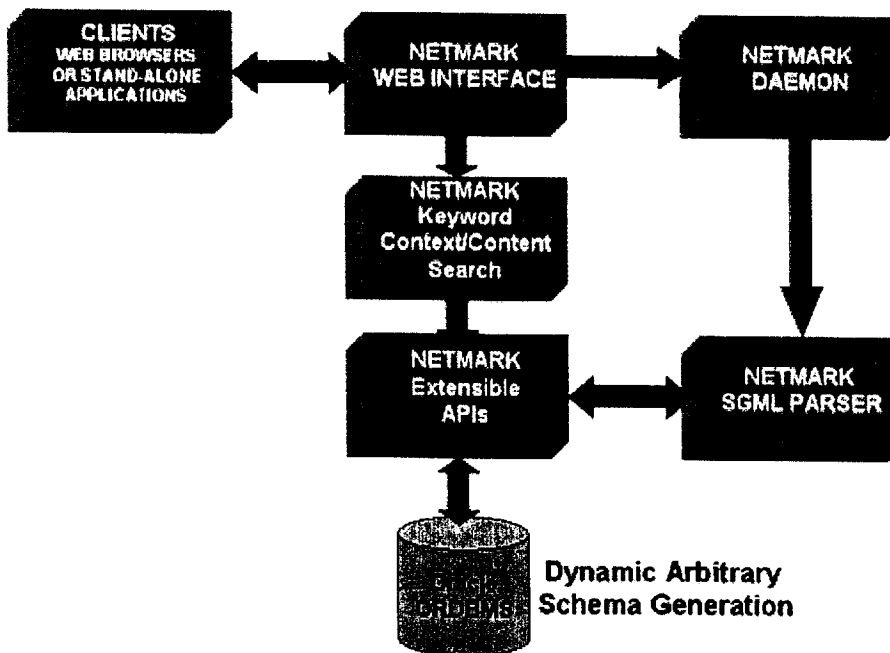
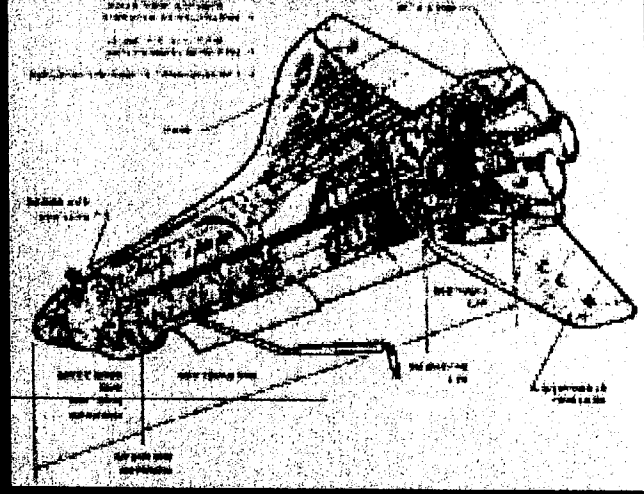


Figure 2: NETMARK Universal Process Flow

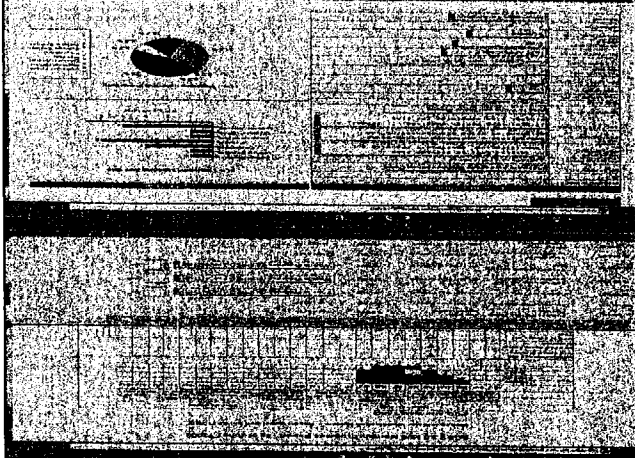
## Engineering for Complex Systems

Kennedy space center Digital Shuttle Project knowledge management system for a virtual space shuttle orbiter, including legacy data, engineering data, and 3D graphics models.



Engineering for Complex Systems Program management tool, a WYSIWG approach (designed as build)

- Zero database intervention



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Location Independent Information Power Grid

Integrated Results

Heterogeneous

Search

Intelligent Search

Agent Query System (Dialogue)

Universal  
Data Types

Intelligent  
Visualization

Information and Knowledge  
Management  
Processes  
Intelligent Data  
Understanding

Simulations  
Access

Universal Discovery  
Interfaces

POSTDOC  
VIB  
MCC  
VNAS  
MER  
Agent  
Technology

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Understanding the evolution of Information

"Streamline NASA IT Resources"



1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008





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1991-2008

"Streamline NASA IT Resources"



1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008

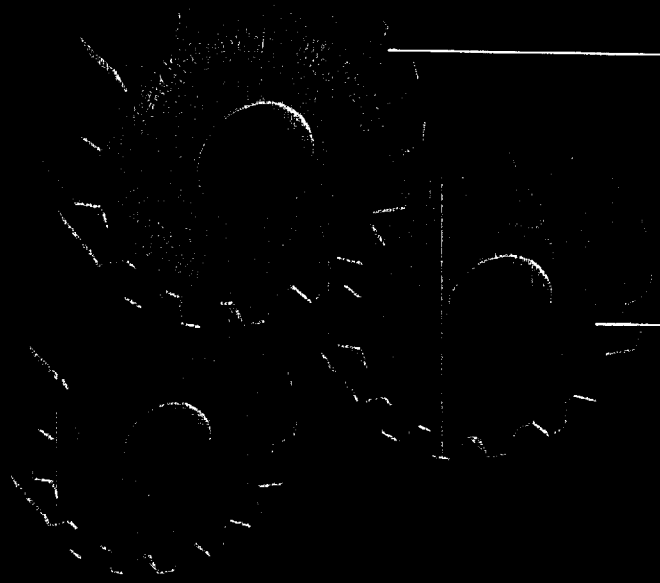
1991-2008

Faster & Better  
Cheaper  
Problem space

Problem space is exponential  
Solution space has been linear

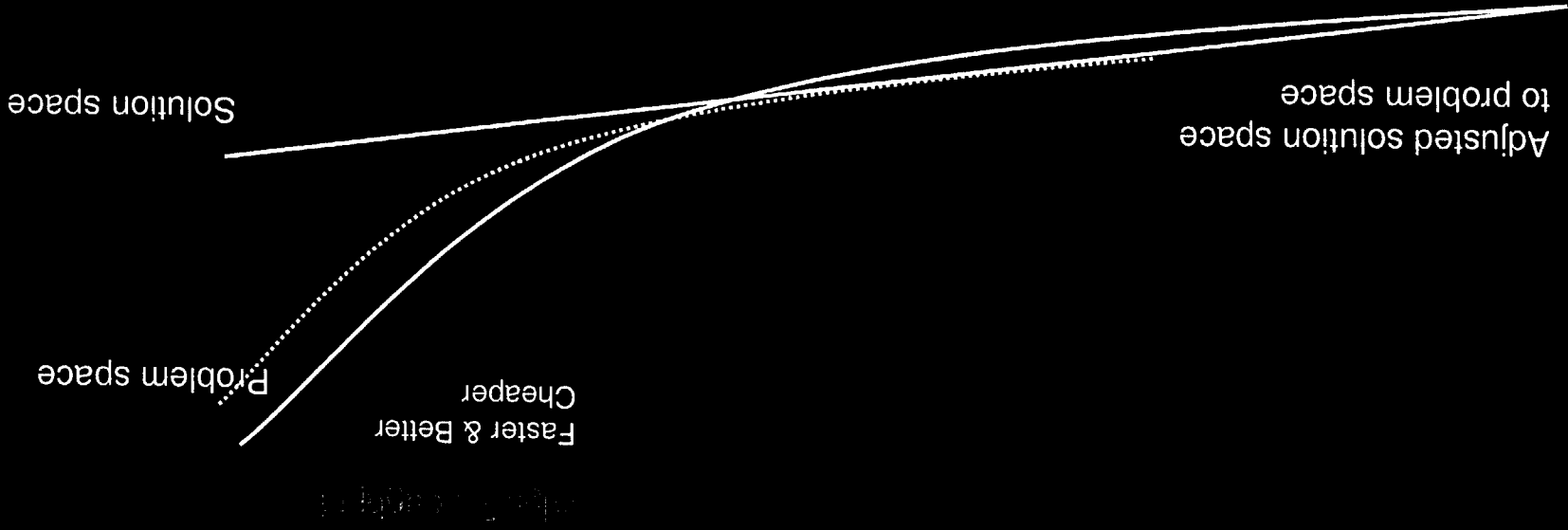
Solution space

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Current Solution Space

NASA investment



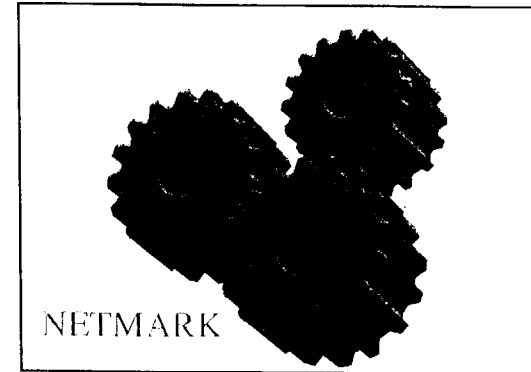
## **What is it to outside NASA**

- "Partial Spillovers" for the economics and conditions where third parties derive benefits which they do not pay initially for.
- "Market spillovers" is likely to be an efficiency gain to the end-users of the new technologies.
- "Knowledge spillovers" will happen when firms get cheap access to lessons learned in both technology and successful models.
- "Network spillovers" the synergy and having an open source architecture work on common problems and expand on related pieces in a coordinated way and according to a condensed time schedule.

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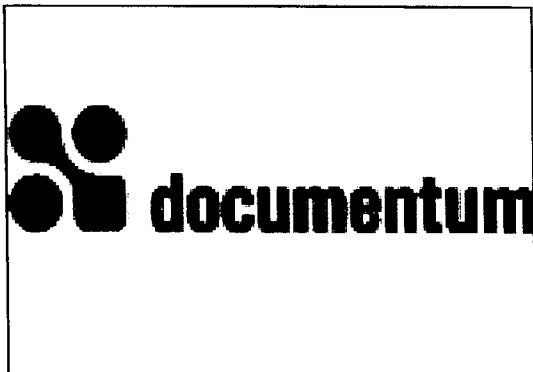
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Integration



Knowledge Management

Collaboration and Sharing



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July 2008

