

I. TEAM COMPOSITION

Cliff Kettemborough (Section 312 System Software Architect)

Vic Legerton (Navigation Subsystem Software Lead)

Ed Rinderle (Mission Analysis and Design Subsystem Software Lead)

April 3, 1997



II. AGENDA

- » Introduction/Background
- » Overview of Framework
- » Accomplishments for First Half of FY '97
- » Plans for Second Half of FY '97 (Future Directions)
- » Schedule/Staffing/Budget
- » Lessons-Learned/Conclusions/Summary
- » Back-up Materials
- » Discussions

III. INTRODUCTION, BACKGROUND (1 of 4)

- » Web site: <http://epic/nav/doc/sat>, for greater details (attached)
- » Background
 - SIT Phase I (started about 2 years ago)
 - SIT Phase II
 - > Recommendations
 - Hire a full-time Software System Architect
 - Set up the SAT (6 - 8 people)
 - Produce a Preliminary Design within six months after the SAT formation
 - Produce a Preliminary Design within six months after the SAT formation
 - n
 - e a Final Design within six months from the Preliminary Design
 - Final Design within six months from the Preliminary Design
 - thin six months from the Preliminary Design
 - the Preliminary Design

III. INTRODUCTION, BACKGROUND (2 of 4)

» Primary Objectives for FY '97

- C.I.P. characteristic (original task description is attached)
 - > Improvement
 - > R&D
 - > Technology exploration
- Goals/Scope
 - > Continuous Assessment
 - > Continuous Redefinition
- Deliverables/Products
 - > Produce/propose an Architecture
 - > Propose an Implementation Plan
 - > Use Prototyping techniques (RAD)
- Process
 - > Directions/guidelines established in a Master (Strategic) Plan
 - > Formal SAT
 - > Tap other resources as needed through connections and partnerships (lab-wide or beyond)

III. INTRODUCTION, BACKGROUND (3 of 4)

- Cost-Benefits and (continuous) Feasibility Analysis
- » Future Objectives
 - Elevation to “Mission Critical” characteristic
 - Incremental Approach
 - Goals/Scope
 - > Define it and stick to it
 - > Needs to be all comprehensive
 - > Needs to go beyond the “classical” navigation only
 - > Encompass Mission Analysis, SPICE, Ephemerides, Maneuver (end-to-end system)
 - > Provide balance between the larger scope (strategic) and smaller (tactical)
 - Deliverables/Products
 - > Very specific derived from the new scope
 - Process
 - > Through dedicated teams and resources

III. INTRODUCTION, BACKGROUND (4 of 4)

- Cost-Benefits and (continuous) Feasibility Analysis
 - > Next generation (end of this Century and beyond) Navigation system
 - > Provide both “manual” and autonomous capability
 - > Provide both “batch” and “real-time” capability
 - > Provide both radiometric and optical capability
 - > Maintain section’s and Lab’s World expertise

IV. OVERVIEW of FRAMEWORK (1 of 3)

- » Approach (key components)
 - Teamwork
 - Communication
 - Re-engineering (systems, software, processes, organization)
 - Architecting
 - Systems Engineering
 - Business Process Re-engineering
 - CMM (Capability Maturity Model)
 - > Elevate section and division to a “center of excellence”
 - > Elevate section, division and Lab to top 5% industry-wide
- » PSAT and derived experiences
- » Roles & Responsibilities

IV. OVERVIEW of FRAMEWORK (2 of 3)

» Master Plan

- Planning
- Definition
- Strategic vs. Tactical vs. Operational
- Measurements
- Continuous Risk Assessment
- Continuous Feasibility Assessment
- Cost-Benefit Analysis

» Continuous “education” provided via presentations and white papers

» SAT/Working Groups

- 14 working groups, all encompassing (see back-up material)
 - > functioning in parallel and coordinated priority
 - > lead by a domain “expert” and dedicated to the cause
 - > minimum resources required, but slow progress will be the result

IV. OVERVIEW of FRAMEWORK (3 of 3)

- The formal SAT was never set up due to resource constraints
 - In addition Software System Architect, only Vic Legerton and Ed Rinderle were able to work part-time on this project
 - Due to resources constraints, the initial scope of the project was continuously reduced, to actually MAS and TRAJ sub-systems
- » **Status/Progress Reporting**
 - » **Interfaces (MGSO, TMOD, EIS, Div. 31, Div. 35, etc.)**

V. ACCOMPLISHMENTS FOR FIRST HALF OF FY '97 (1 of 2)

» Preliminary Architecture

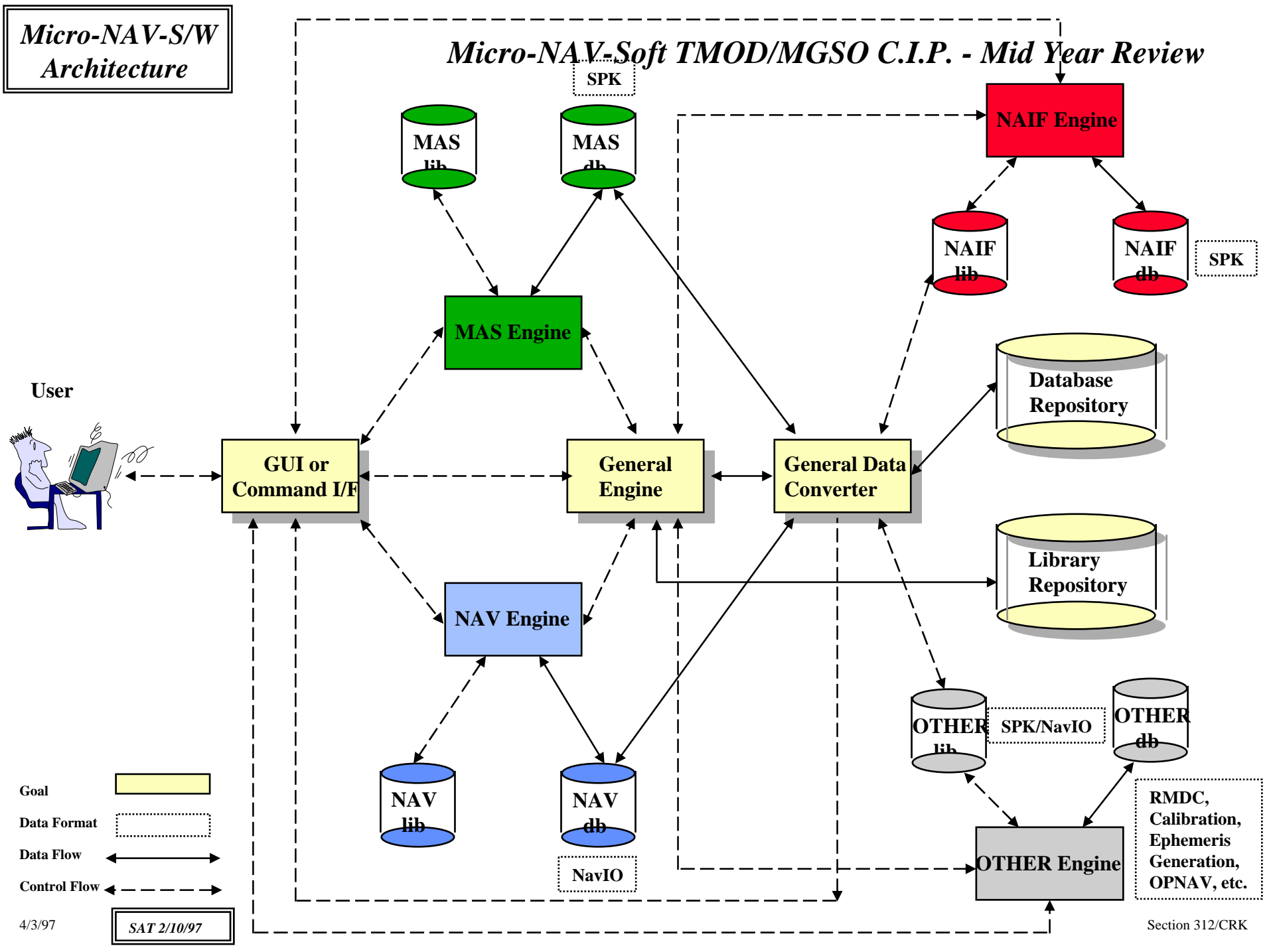
- System vs. Software View
- Partitioning
- Domain
- Layering
- Component and/or OO (Object-Oriented)
- Locality vs. Globality
- Enable transition to:
 - > OO technology
 - > Java (Internet) migration
- Pursue software quality capabilities:
 - > re-usability, portability, usability, plus other “-ities”

» Top Level

- Section 312
- In synch with re-engineering efforts under MGSO, TMOD and lab-wide

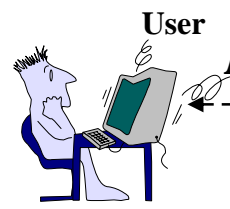
**Micro-NAV-S/W
Architecture**

Micro-NAV-Soft TMOD/MGSO C.I.P. - Mid Year Review

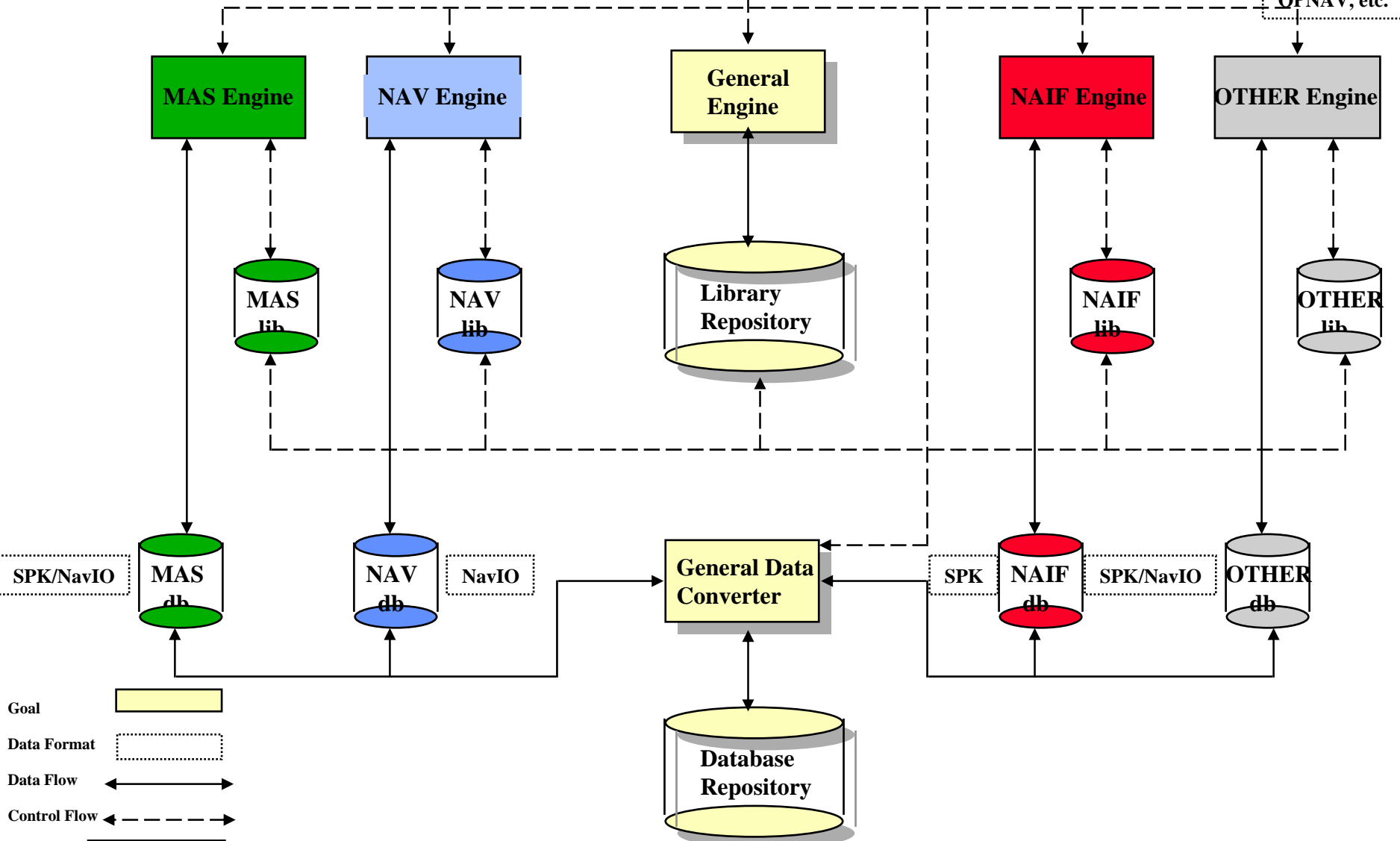


**Micro-NAV-S/W
Architecture
(Another View)**

Micro-NAV-S/W & TMOD/MGSO C.I.P. - Mid Year Review

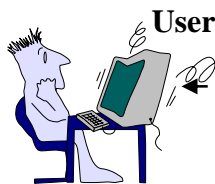


RMDC,
Calibration,
Ephemeris
Generation,
OPNAV, etc.

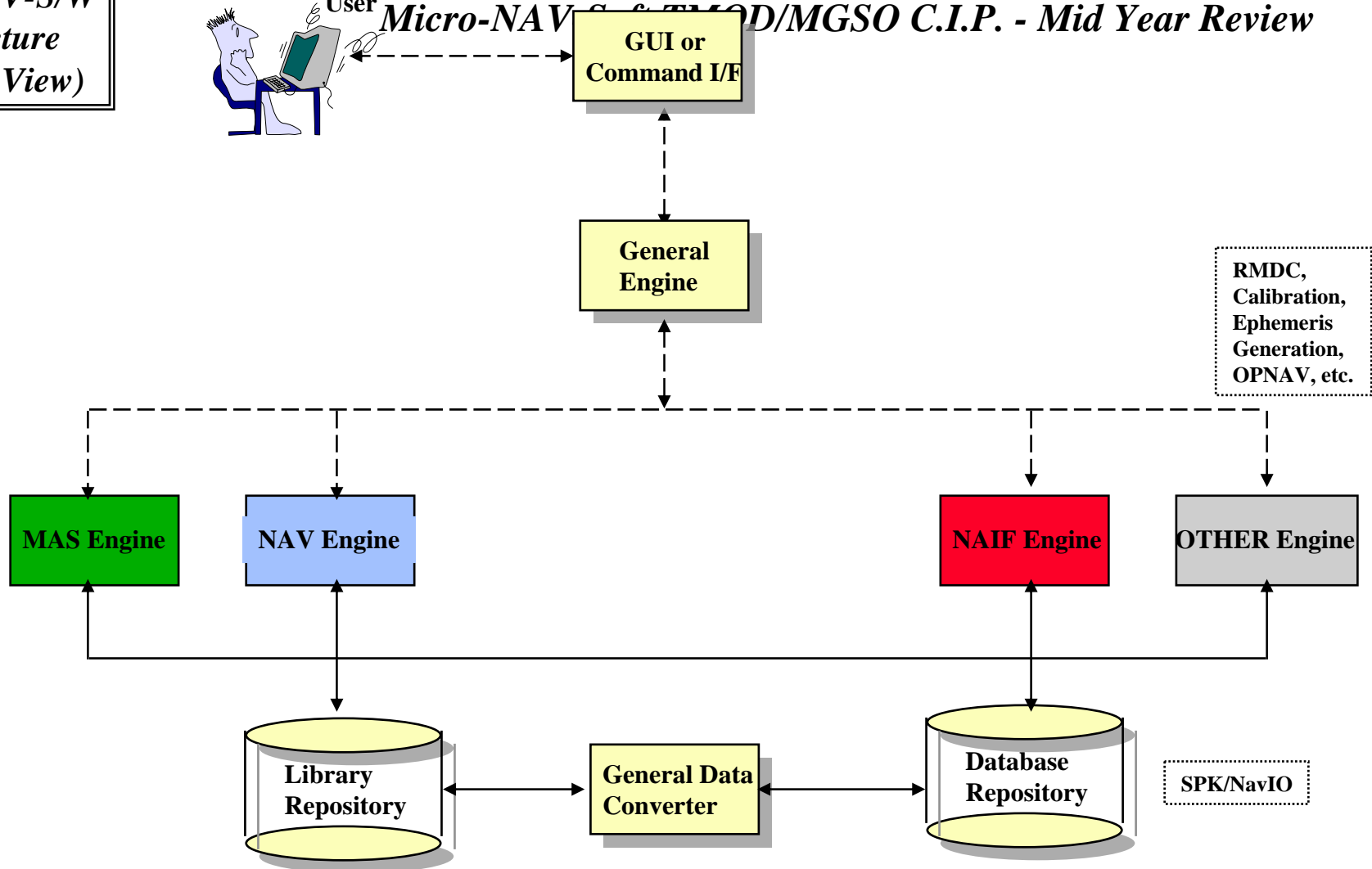


- Goal
- Data Format
- Data Flow
- Control Flow

**Micro-NAV-S/W
Architecture
(Another View)**



Micro-NAV-S/W & TMOD/MGSO C.I.P. - Mid Year Review



- Goal
- Data Format
- Data Flow
- Control Flow

V. ACCOMPLISHMENTS FOR FIRST HALF OF FY '97 (2 of 2)

- » Middle Level
- » Components and Capabilities
 - Service Paradigm
 - Data Flow-Orientation
 - Process Flow Orientation
 - Component-based
 - Object-Orientation
 - Repository-based
 - Web-based
- » Functionality
 - Flexibility
 - HCI (Human Computer Interaction)
 - Technology-enable

VI. PLANS FOR SECOND HALF OF FY '97 - FUTURE DIRECTIONS (1 of 2)

- » Low Level Architecture Development (see attached pictures)
 - Re-scope and derive precise requirements (redefine what needs to be done, a team effort with staff from the section and end-users/customers from outside the section)
 - Allocate requirements to sub-systems (formal document, D-4000/5000 like) with traceability capability
 - Derived from a redefined scope (version 1.0)
 - Form dedicated team and allocate resources (matrix)
 - A small preliminary team to precisely define tasks and resources allocation based on middle level proposed architecture
 - Bring in the same umbrella the MAS re-engineering
 - Deliver a first version at PDR
 - Deliver final version at CDR-like
 - Use Prototyping (as a proof of concept)
- » Details Descriptions are in back-up material

Front-End Domain

Micro-Nav-Soft View -

Back-End Domain

I MiddleWare Domain

Access Layer

User



Web
Browser

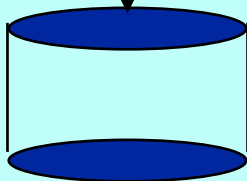
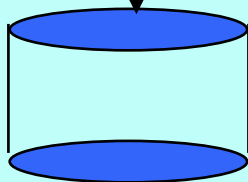
GUI/Command
Engine

Application
Engine

Visualization
Engine

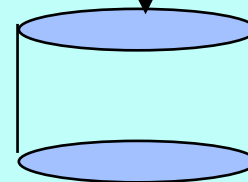
Application Layer

COTS Base



Knowledge/
Model Base

Data Base



Component/Object-based Repository

Data/Tools Layer

Front-End Domain

Micro-Nav-Soft View -

Back-End Domain

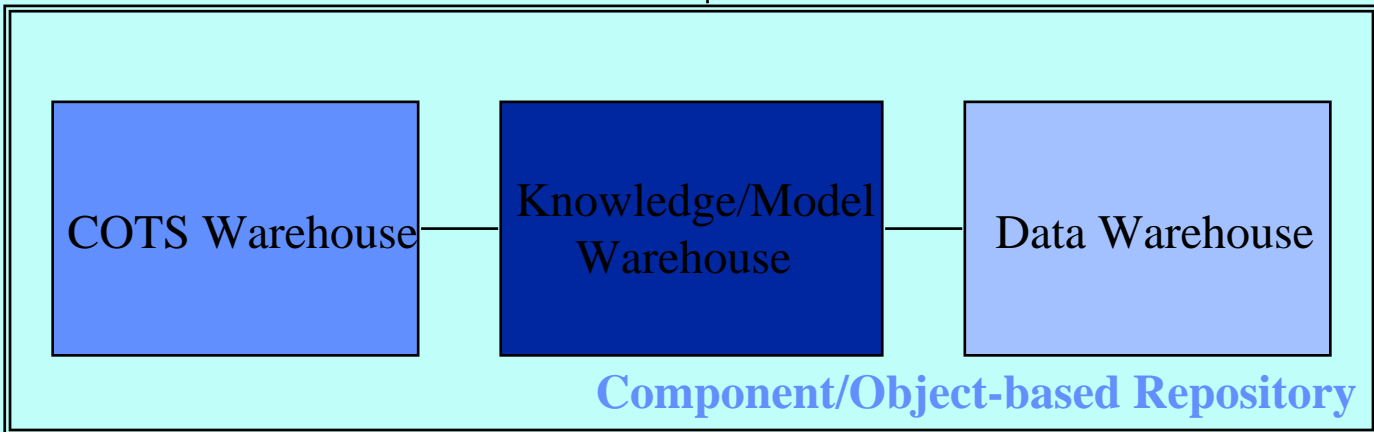
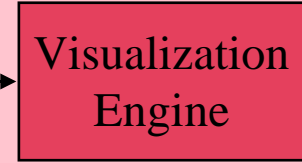
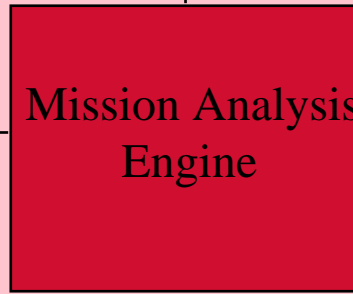
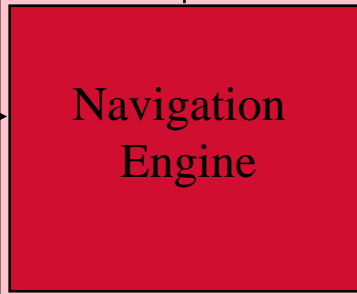
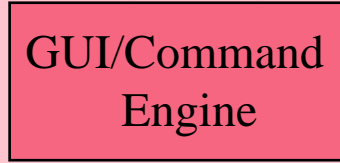
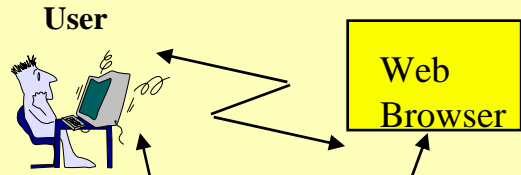
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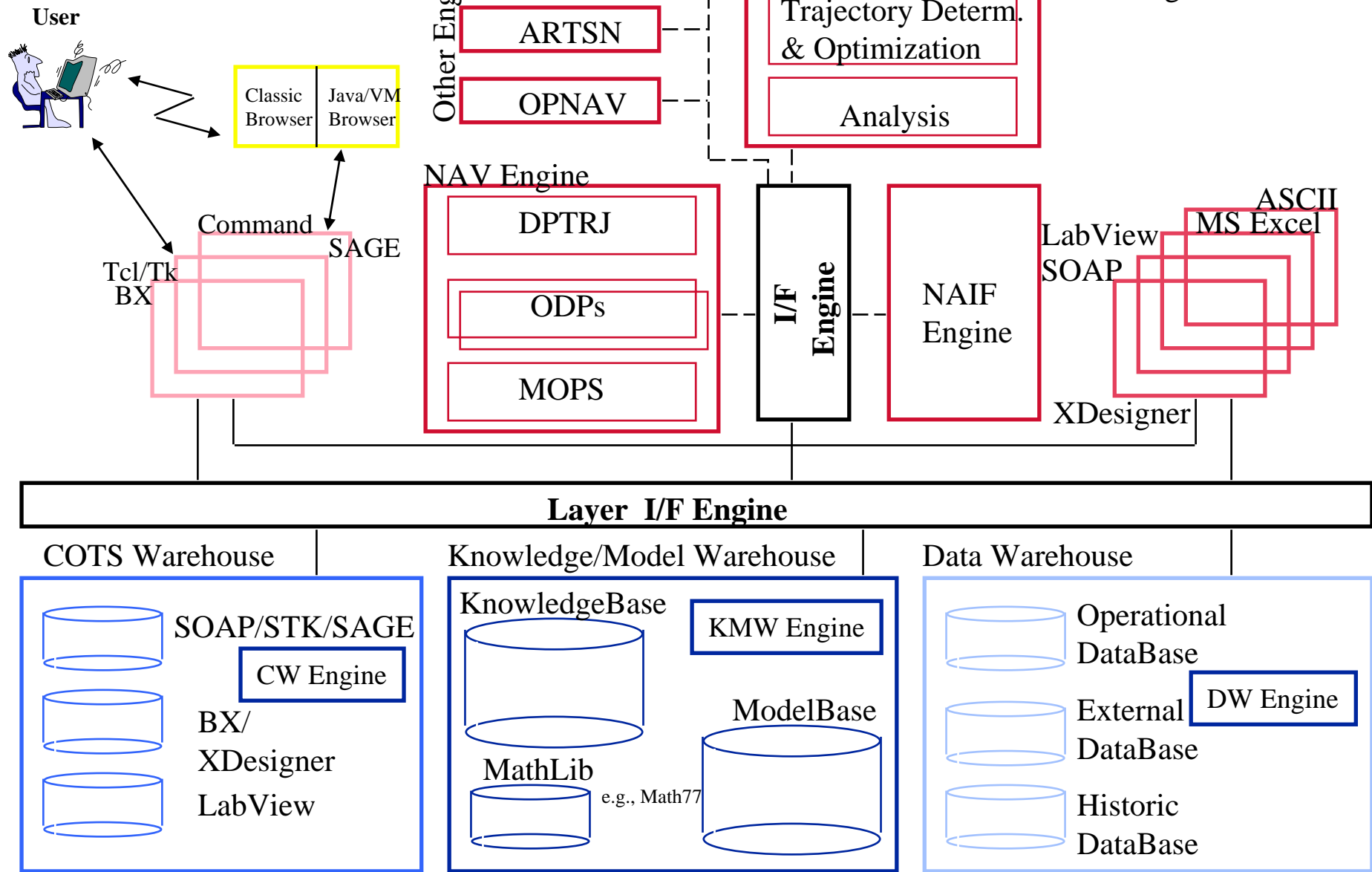
MiddleWare Domain

Access Layer

Application Layer

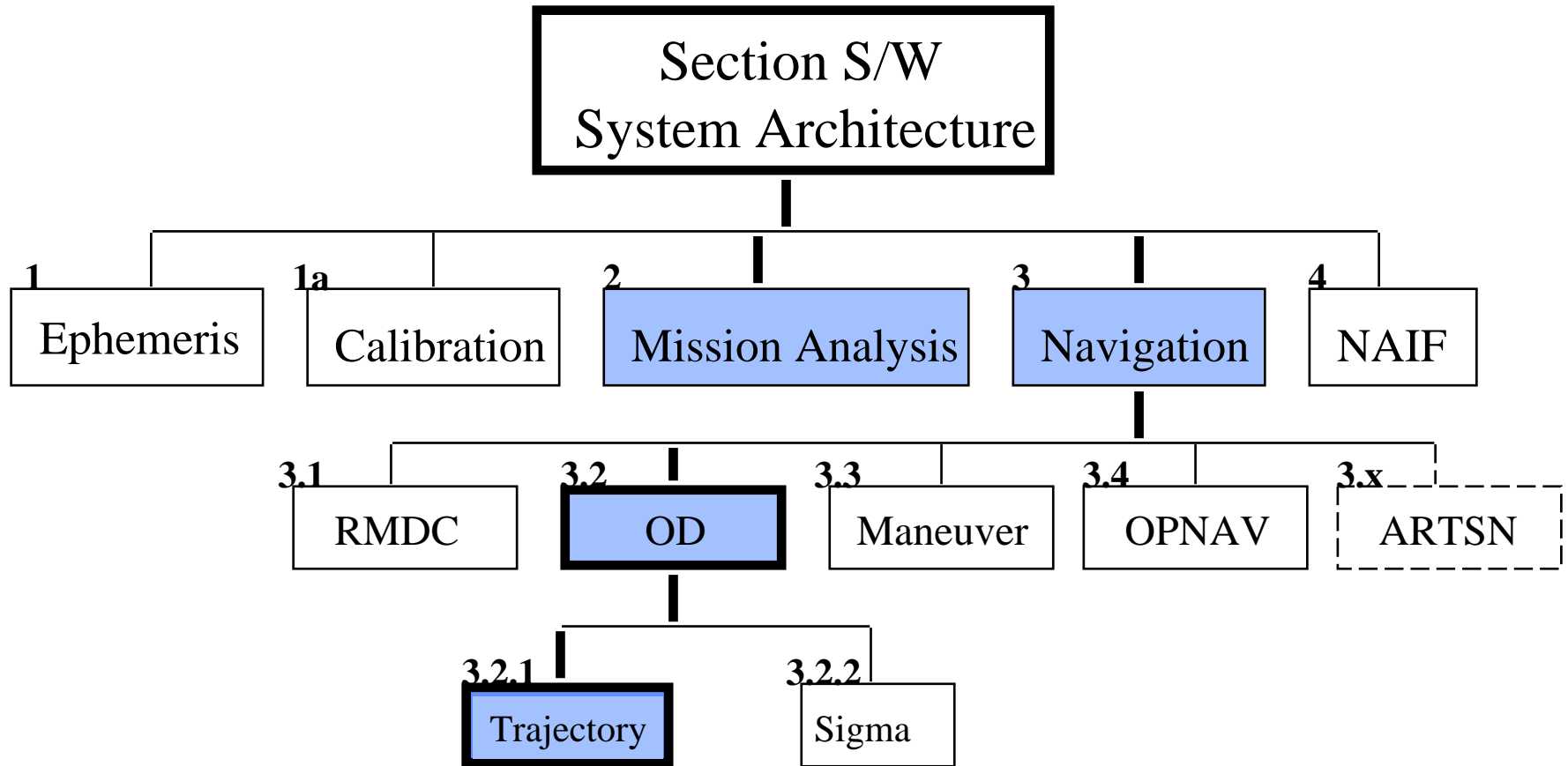
Data/Tools Layer





VI. PLANS FOR SECOND HALF OF FY '97 - FUTURE DIRECTIONS (2of 2)

- » Use of RMDC, ARTSN, CATO, SIGMA, etc., re-engineering parallel efforts, as experiences
- » Utilize both existing and cutting edge technologies as part of the proposed architecture
- » Descope (see attached picture)



“What I see is many people in this industry pushing technology - and not solutions.”

VII. SCHEDULE, STAFFING, BUDGET (1 of 2)

» Allocated Staff (Proposed Resource Matrix)

- Not far from the SIT phase II recommended effort (6 to 8 people, half time, in addition to Software System Architect) - for the “micro-nav-soft” task alone
- We recommend that the larger project (Section 312 Software Re-engineering and Architecting, a superset of the “micro-nav-soft”) to be carried on in parallel. A larger team (as suggested) is needed for this project.
- Schedule Status
- behind, but still feasible for a reduced scope (to be defined)
- milestones for rest of FY ‘97

» Budget/Staffing

- Anywhere from “on mark” to underspent depending on interpretation
- Cliff Kettemborough allocated effort 1.0
- Vic Legerton allocated effort .5

VII. SCHEDULE, STAFFING, BUDGET (2 of 2)

- Ed Rinderle allocated effort .25
- Rest of “team members” less than an average of 1 hour per week
- See attached Gantt Chart and associated WBS

» **Impact**

- Derived from Schedule and Budget Status
- May become serious if not immediate action will follow based on recommendations

VIII. LESSONS-LEARNED, CONCLUSIONS, SUMMARY (1 of 3)

» Lessons-Learned

- Many; all of the above
- “Expectations Management”

» Concerns, Challenges

- Almost everybody is “dealing” with software, but not admitting it; it complicates our task: for instance, “would you like to get an oil change to your (new) car while running on the freeway?...”
- (Apparent) lack of understanding (by many people) of the critically (in a strategic sense) of this task and project
- Lack of resources allocation and priority (... needless to say)
- “It must be broken before needs fixing?...” syndrome
- We should not reach a “Crisis Management” level; we should be in a proactive rather and reactive mode
- We are an R&D facility of World-class unique expertise and reputation. And we (may) want to keep it like that (“...being at the top of the pyramid is not a piece of pie!...”)

VIII. LESSONS-LEARNED, CONCLUSIONS, SUMMARY (2 of 3)

» Summary, Conclusions

- As seen, the original CIP scope and wording proved to be due for a rescoping exercise
- Identify what can be “carved out” as “outsouceable” and “to be contracted out;” keep the core unique expertise in house
- It has to be a System level view and approach; just isolating and working on the Navigation sub-system re-engineering only, it won’t buy us much mileage
- There is strong relationship between individual sub-systems, and also beyond section 312!
- We should have a larger, system wide (MGSO, TMOD should have keen interests in) CIP to address all of the above proposals
- “Micro-nav-soft” should be a sub-CIP within the larger one
- Consequently we should have individual (sub-)CIPs for other sub-systems: Mission Analysis, (now former) NAIF, etc., along with proper allocation of resources and priority

VIII. LESSONS-LEARNED, CONCLUSIONS, SUMMARY (3 of 3)

- Coordination is needed System-wide: re-engineering efforts under ARTSN, Autonomous Navigation, RMDS, Low-Thrust-Soft, etc., are (and should be) related
- Very good Planning and Definition of what needs to be done is required! This should be a CIP (and the one to start with) by itself
- The so called “cleaning job” or “re-engineering” as perceived for Section 312 is not peculiar to it: the entire Lab has the same “problem.” Section 312 is no better nor worse than the (known) large majority of all other sections! It should be MGSO’s and TMOD’s concern, too.
- Elevate this very large “task” at the Project or even Program level. Make it “Mission Critical”!

XI. BACK-UP MATERIALS

- » Please visit our Web site or contact me for further details
 - Feedback is encouraged
- » Proposed Resources Matrix
- » Working Groups (List, Charter, Accomplishments and Plans)
- » Re-Engineering and Architecture Guidelines
- » TMOD's Service Paradigm
- » Detail Description of Low Level Architecture (Micro-Nav-Soft Architecture Principles)

WORKING GROUPS (WG) PRIORITIES (1 of 2)

| <u>Level</u> | <u>WG Name</u> | <u>WG Number</u> |
|---|--|------------------|
| * | Master Plan | 1 |
| * | Risk Analysis/Management | 14 |
| 1 | Requirements Engineering | 3 |
| 1 | Analysis of Existing Systems (and Modeling) | 2 |
| (This activity is, for time being, is performed in parallel with the Requirements Engineering) | | |
| 2 | Organization of Libraries and Programs | 7 |
| 2 | Data Management (Database Technology) | 4 |
| 2 | Configuration and Change Management | 8 |
| 3 | Documentation Guidelines/ Standards | 9 |

WORKING GROUPS (WG) PRIORITIES (2 of 2)

| | | |
|---|--|----|
| 4 | User Interface (HCI - Human Computer Interaction) | 5 |
| 4 | H/W, S/W Tools, COTS, GOTS | 11 |
| 4 | Design Guidelines/ Technology Exploration | 12 |
| 4 | Software Development Guidelines/Standards | 10 |
| 4 | Impact on Operations | 6 |
| 5 | Communication Guidelines/ Standards | 13 |

N.B. Same priority level means they go in parallel.

* - no special priority assigned; work is being done, as needed.

REQUIREMENTS ENGINEERING AND ANALYSIS OF EXISTING SYSTEM (1 of 2)

» **MEMBERSHIP**

- Vic Legerton/ Ed Rinderle, co-chairs
- John Ekelund
- Jennie Johannesen
- Cliff Kettemborough
- Rick Sunseri
- Robin Vaughan
- Mission Analysis User Group

URL: <http://epic1/nav/doc/sat/wg2/>

» **PURPOSE**

- To recommend to the SAT the set of grouped and prioritized requirements to be satisfied within the new System Architecture
- To provide information on the existing Section 312 software system

Start date: November

Number of meetings to date: Roughly weekly

REQUIREMENTS ENGINEERING AND ANALYSIS OF EXISTING SYSTEM (2 of 2)

» STATUS

- Initial focus on Mission Analysis and Trajectory Analysis Subsystems
- Draft Requirements Specification document completed
 - > Includes feedback from user community
- Extensive Requirements Reference List assembled
- Initial categorization of existing system completed

» FUTURE PLANS

- To continue to evolve the Requirements Specification as needed
- To expand the Requirements Specification to include other subsystems as resources become available
- To continue to refine the categorization of existing software as needed

ORGANIZATION OF LIBRARIES AND PROGRAMS WORKING GROUP (1 of 4)

» **MEMBERSHIP**

- Ed Rinderle (chair)
- Cliff Kettemborough
- Vic Legerton
- Steve Schlaifer
- Rick Sunseri
- Ted Sweetser
- Aron Wolf

URL: <http://epic1/nav/doc/sat/wg7/>

<http://epic1/nav/doc/sat/wg3/>

» **PURPOSE**

- To recommend to the SAT the following:
- A plan for the organization of library and program sets, including the merging of libraries as feasible
- A process for the continued maintenance of that organization

ORGANIZATION OF LIBRARIES AND PROGRAMS WORKING GROUP (2 of 4)

- A plan for the disposition of orphaned programs
- A plan for the filling of gaps in the existing software set

Start date: 29 January 1997

Number of meetings to date: 4

» STATUS

- Initial focus on Mission Analysis and Trajectory Analysis Subsystems
- Decision to tackle some specific short-term problems to provide focus and gain experience
- Investigated completing the merging of Vector and SpiceLib
- Discussed setting up an “infostructure” on AFS and began:
 - > implementing that infostructure
 - > work on short-term recommendations from the "Report of Investigative Group on 312/314 S/W Libraries"
 - > a distribution list that contains e-mail addresses for all users and other persons interested in the development of the libraries and programs.

ORGANIZATION OF LIBRARIES AND PROGRAMS WORKING GROUP (3 of 4)

> an annotated external reference list that contains all external references in Vector, Spicelib, and the libraries used by DPTRAJ/ODP, including a brief description of each.

> FUTURE PLANS

- To continue to implement the infostructure (ongoing)
- To complete the distribution list
- To complete the annotated external reference list
- To provide an entry point status file that contains information on known problems, e.g., in mixing the libraries.
- To begin work on deliverables
- To expand the infostructure and deliverables to include other subsystems as resources become available

» SCHEDULE (tentative)

- Move information to AFS as appropriate: (ongoing)
- Distribution list: 1 March, 1997
- Annotated external reference list on AFS: 15 April, 1997

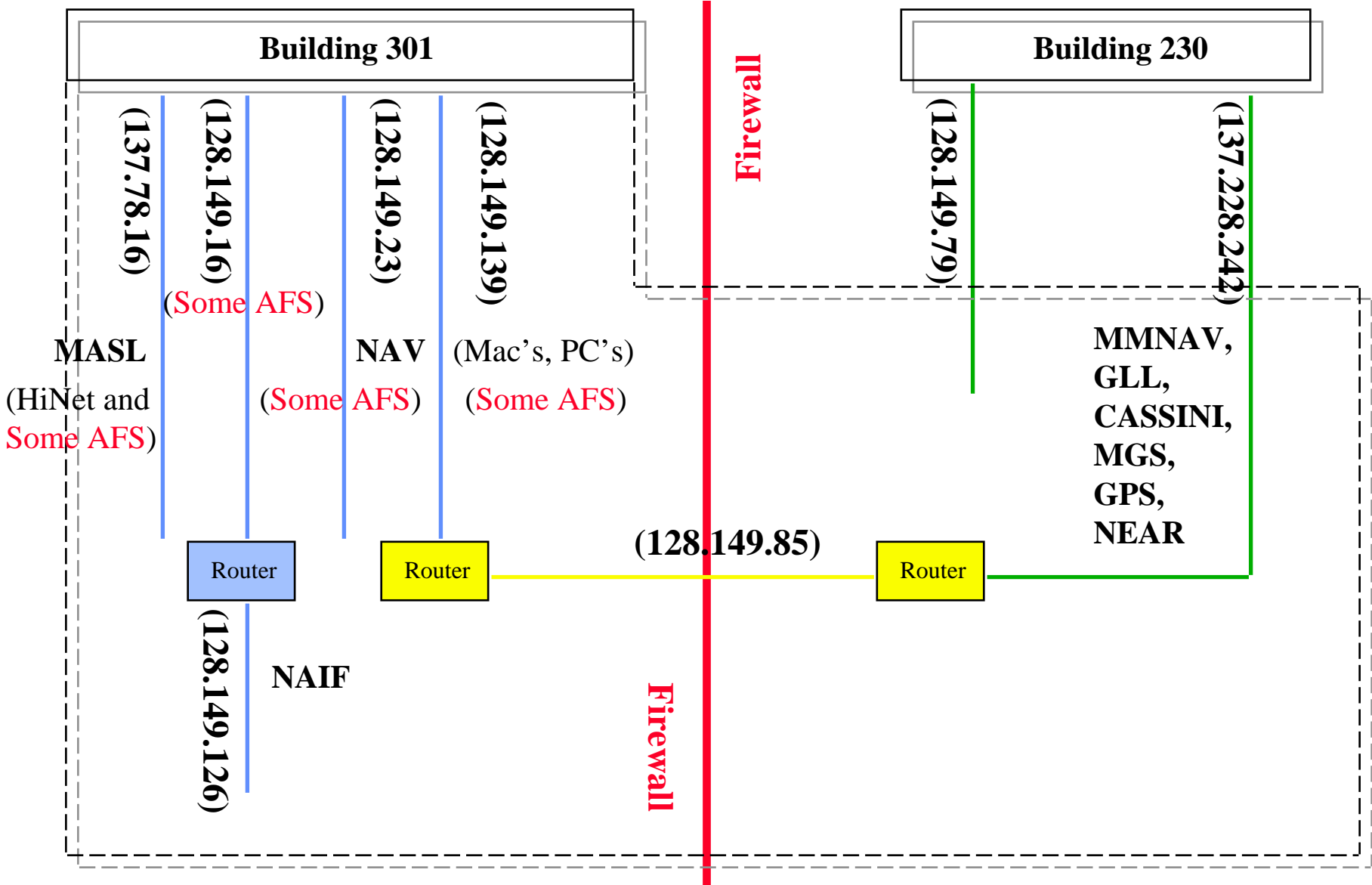
ORGANIZATION OF LIBRARIES AND PROGRAMS WORKING GROUP (4 of 4)

- Entry point status file on AFS: 1 May, 1997
- Preliminary plan for organizing libraries and programs. 1 June, 1997
- Preliminary process for maintaining the organization: 1 June, 1997
- Plan for disposition of orphaned programs: 1 July, 1997
- Final plan for organizing libraries and programs: 1 Sept., 1997
- Final process for maintaining the organization: 1 Sept., 1997
- Preliminary plan for filling gaps in software set: 1 Sept., 1997

» **ISSUES/CONCERNS**

- Work force. Additional resources needed to cover all software subsystems.
- AFS. Wide-spread access needed.

SECTION 312 NETWORK DOMAIN TOPOLOGY



DATABASE MANAGEMENT WORKING GROUP (1 of 5)**» MEMBERSHIP**

- Cliff Kettemborough (chair)
- Dave Skinner
- Rick Sunseri
- Ed Rinderle
- NAIF representative (needed)
- Ephemerides representative (needed)
- (Chet Borden/Sil Zendejas, and Mark Garcia, section 311, and Steve Williams invited as needed)

URL: <http://epic1/nav/doc/sat/wg4/>

» PURPOSE/CHARTER

- To recommend to the SAT the following:
- Analysis of the existing data structures, formats and associated files used within and outside the section

DATABASE MANAGEMENT WORKING GROUP (2 of 5)

- Develop recommendations for database management system (DBMS) for the section
- Develop and recommend the associated infrastructure, training
- Provide for the continuous education of the section personnel in the DBMS technology
- Establish priorities, resources allocation as pertaining to a DBMS for the section
- Develop appropriate documentation for the above
- Bridge between section and outside efforts/activities as related to DBMS technology (e.g., section 311, EIS)
- Develop strategies and tactical approaches for above activities
- Report on the activities to the Master Plan working group

Start Date: January 27, 1997 (weekly meetings for about one hour)

Number of Meetings to date: 5 (see meetings minutes for details)

DATABASE MANAGEMENT WORKING GROUP (3 of 5)» **STATUS**

- Investigated various data structures, formats, and files used within the section as well as outside
- Closely analyzed the SPK and NAVIO formats conversion issue
- Developed a "strawman" approach to cope with numerous data formats within the section
- Effort of conversion of SPK to NAVIO format is underway (pending resources availability): Ed Rinderle (primarily) and Rick Sunseri are working on this task
- Disseminated appropriate information to the Master Plan working groups
- Develop partnerships with MADB (Mission Analysis DataBase, section 311) and in process to do the same with other JPL organizations
- Exchange of ideas and approaches to DBMS technology is underway with the MADB (section 311)

DATABASE MANAGEMENT WORKING GROUP (4 of 5)

- Provided "education" to section on the DBMS technology via a presentation/overview during Jim Larson's Programmer's Lunch on December 13, 1996 (available now on the web, too)
- Maintained all related information on our web site

» FUTURE PLANS

- Keep performing the above mentioned activities
- Concentrate on the SPK to NAVIO file formats conversion
- Develop and recommend a DBMS architecture and infrastructure for the section

» SCHEDULE (tentative)

- Complete the task of SPK to NAVIO conversion by end of May, 1997
- Develop and recommend a DBMS architecture and infrastructure for the section by end of May, 1997
- Establish a solid bridge between the section database and MADB

DATABASE MANAGEMENT WORKING GROUP (5 of 5)**» ISSUES/CONCERNS**

- The need of allocated resources in areas of needed expertise
- We need NAIF and Ephemerides representatives participation in our weekly meeting

DOCUMENTATION GUIDELINES/STANDARDS WORKING GROUP (1 of 4)

» **MEMBERSHIP**

- Vic Legerton (chair)
- Al Cangahuala
- Melissa Fehling
- Mike Humfreville (section 313)
- Cliff Kettemborough
- Ed Rinderle

URL: <http://epic/nav/doc/sat/wg9/products.html> and
<http://epic/nav/doc/sat/wg9/>

» **PURPOSE/CHARTER**

- To recommend to the SAT the following:
- Guidelines, standards and policies for the design, use, management and maintenance of Web Pages
- Guidelines and standards for the documentation of:

DOCUMENTATION GUIDELINES/STANDARDS WORKING GROUP (2 of 4)

- > Users Guides
- > Libraries
- > Technical Report Server
- > Reports, Articles, Papers, Memoranda
- > Software Design Documents
- > Program Model Description Documents
- > Interface Specifications
- > Tutorials

Start Date: 23 January 1997

Number of Meetings to date: 3

» STATUS

- Decided to centralize Section 312 documents and files on AFS
- Compiled draft of guidelines for User's Guides, Libraries and Technical Report Server
- Concurred on decision to prepare templates for various document types and assign creation and maintenance to responsible authors

DOCUMENTATION GUIDELINES/STANDARDS WORKING GROUP (3 of 4)

- Agreed to recommend the creation of a Documentation Management Team under the leadership of the Section Secretary (Melissa Fehling)
- FUTURE PLANS
- Create new Section Home Page and directory structure
- Document guidelines and standards for creation and submission of documents
- Complete templates for each document type
- Conduct seminar on use of AFS and documentation standards

» SCHEDULE (tentative)

- Redesign Section Home Page: 1 April 1997
- Complete documentation guidelines and templates for:
 - > Users Guides: 15 March 1997
 - > Libraries: 15 March 1997
 - > Technical Report Server: 15 March 1997
 - > Reports, Articles, Papers, Memoranda: 1 April 1997

DOCUMENTATION GUIDELINES/STANDARDS WORKING GROUP (4 of 4)

- > Software Design Documents: 1 May 1997
- > Program Model Description Documents: 1 May 1997
- > Interface Specifications: 15 May 1997
- > Tutorials: 15 May 1997
- Section seminar: 1 June 1997

» **ISSUES/CONCERNS**

- Increased access and usage of AFS is needed
- Courses may be needed for some of the secretarial staff to assist as part of the Documentation Management Team.

CONFIGURATION and CHANGE MANAGEMENT WORKING GROUP (1 of 4)

» **MEMBERSHIP**

- Cliff Kettemborough (chair)
- Larry Bright
- John Ekelund
- Jaime Mantel
- Peter Wolff

URL: <http://epic/nav/doc/sat/wg8/>

» **PURPOSE/CHARTER**

- To recommend to the SAT the following:
- Analyze, develop and recommend section-wide requirements for a Configuration and Change Management (CM) system
- Develop formal recommendations for CM (includes processes, management, roles and responsibilities, and tools) for the section
- Develop and recommend the associated infrastructure, training
- Provide for the continuous education of the section personnel in the CM related topics

CONFIGURATION and CHANGE MANAGEMENT WORKING GROUP (2 of 4)

- Propose priorities and resources allocation as pertaining to a CM for the section
- Develop appropriate documentation for the above
- Bridge between section and outside efforts/activities as related to CM (e.g., MGSO, EIS)
- Develop strategies and tactical approaches for above activities
- Report on the activities to the Master Plan working group

Start Date: February 7, 1997 (bi-monthly meetings for about one hour)

Number of Meetings to date: 2 (see meetings minutes for details)

» STATUS

- Investigated AFS as a solution for parts of the CM problem/related concerns
- Develop a high-level system diagram with the existing AFS (initially known as Andrew File System) deployment within the section
- Developed a "strawman" approach to cope with CM related issues within the section

CONFIGURATION and CHANGE MANAGEMENT WORKING GROUP (3 of 4)

- Developed an effort estimate (time and cost) to have AFS installed on each machine within the section
- Disseminated appropriate information to the Master Plan working groups
- Analyzed a strategy of pilot-based, incremental deployment approach of AFS within the section
- Exchange of ideas and approaches to CM with other organizations (e.g., MGSO, EIS)
- Provided "education" to section on the CM via a presentation/overview of FireWalls during a MGSO presentation on August 5, 1996 (available now on the web, too)
- Maintained all related information on our web site

» FUTURE PLANS

- Keep performing the above mentioned activities
- Concentrate on the AFS deployment within the section
- Develop and recommend a CM architecture and infrastructure for the section

CONFIGURATION and CHANGE MANAGEMENT WORKING GROUP (4 of 4)

- Experiment, on a pilot-based, the use of a CM tool (e.g., CCC/Harvest) for one of the going on projects within the section (ARTSN, CATO, SIGMA, RMDC)
- SCHEDULE (tentative)
- Complete the task of deployment of AFS on some of section's projects (ARTSN, CATO, SIGMA, RMDC), by end of May, 1997
- Develop and recommend a CM architecture and infrastructure for the section by end of May, 1997
- Establish a solid bridge between the section CM system and outside related projects

» ISSUES/CONCERNS

- The need of allocated resources in areas of needed expertise
- We need more section groups/projects representative participation in our meetings

USER INTERFACE (HCI) WORKING GROUP (1 of 3)

» **MEMBERSHIP**

- Vic Legerton (chair)
- Bob Deen (section 388, consultant)
- Greg Garner
- Don Han
- Rick Kelly
- Elmain Martinez (section 388, consultant)
- Neil Mottinger
- Jody Rosas (section 395, consultant)
- Robin Vaughan

URL: <http://epic/nav/doc/sat/wg4/>

» **PURPOSE/CHARTER**

- To recommend to the SAT the following:
- Guidelines and standards for the design, use and maintenance of graphical user interfaces

USER INTERFACE (HCI) WORKING GROUP (2 of 3)

- A high level design for the Section 312 software graphical user interface

Start date: 15 January 1997

Number of meetings to date: 1

» STATUS

- Decided to use OSA's SAGE as a prototype - port to HP is progressing
- Investigation of industry capabilities is ongoing (STK, SOAP, etc.)

» FUTURE PLANS

- Use SAGE with DPTRAJ/ODP
- Compile guidelines and standards for the design, use and maintenance of Section 312 graphical user interfaces
- Create the high level design for the comprehensive Section 312 software graphical user interface
- Add "Help Desk" capability

USER INTERFACE (HCI) WORKING GROUP (3 of 3)

» **SCHEDULE (tentative)**

- Prototype SAGE with DPTRAJ/ODP: 1 April 1997
- Complete the guidelines and standards: 1 July 1997
- Complete the high level design: 15 August 1997

» **ISSUES/CONCERNS**

- Workforce needs to be expanded with concern for needed expertise
- Operations team personnel need to be involved in the design, and visioning of future operations needs to be encouraged

H/W, S/W TOOLS, COTS, GOTS WORKING GROUP (1 of 4)

» **MEMBERSHIP**

- Cliff Kettemborough (chair)
- Steve Schlaifer
- Martin Lo
- Al Cangahuala

URL: <http://epic/nav/doc/sat/wg11/>

» **PURPOSE/CHARTER**

- To recommend to the SAT the following:
- Analyze, develop and recommend section-wide requirements for various H/W, S/W, COTS, and GOTS tools
- Develop formal recommendations for specific tools for the section
- Develop and recommend the associated infrastructure, training
- Provide for the continuous education of the section personnel in the usage of such tools
- Propose priorities and resources allocation as pertaining to the deployment of proposed tools for the section

H/W, S/W TOOLS, COTS, GOTS WORKING GROUP (2 of 4)

- Develop appropriate documentation for the above
- Bridge between section and outside efforts/activities as related to various tools categories (e.g., MGSO, EIS)
- Develop strategies and tactical approaches for above activities
- Report on the activities to the Master Plan working group

Start Date: January 31, 1997 (weekly meetings for about one hour)

Number of Meetings to date: 4 (see meetings minutes for details)

» STATUS

- Developed a matrix-like on how to group/categorize H/S, S/W, COTS, and GOTS tools
- Developed a evaluation criteria for tools as applicable to the section
- Developed various Internet links to vendors and companies producing or using related tools
- Disseminated appropriate information to the Master Plan working groups
- Analyzed a strategy of pilot-based, incremental deployment approach of specific tools

H/W, S/W TOOLS, COTS, GOTS WORKING GROUP (3 of 4)

- Exchange of ideas and approaches to related tools with other organizations (e.g., MGSO, EIS)
- Maintained all related information on our web site

» FUTURE PLANS

- Keep performing the above mentioned activities
- "Populate" the developed matrix with tools names
- Develop and recommend a strategy for evaluation and implementation of specific tools for the section
- Experiment, on a pilot-based, the use of specific tools for one of the going on projects within the section

» SCHEDULE (tentative)

- Complete the task of tools matrix "population" by end of May, 1997
- Develop and recommend a S/W, COTS, and GOTS tools architecture and infrastructure for the section by end of May, 1997
- Establish a solid bridge between the section employed tools and outside related projects

H/W, S/W TOOLS, COTS, GOTS WORKING GROUP

(4 of 4)

» **ISSUES/CONCERNS**

- The need of allocated resources in areas of needed expertise
- We need more section groups/projects representative participation in our meetings

DESIGN GUIDELINES/TECHNOLOGY EXPLORATION WORKING GROUP (1 of 4)

» **MEMBERSHIP**

- Jim Larson (chair)
- Cliff Kettemborough
- Rick Kelly
- Vic Legerton
- Ed Rinderle

URL: <http://epic/nav/doc/sat/wg11/>

» **PURPOSE/CHARTER**

- To recommend to the SAT the following:
- Analyze, develop and recommend section-wide requirements for various Design Guidelines and Technology Exploration
- Develop formal recommendations for specific design guidelines or technology use for the section
- Develop and recommend the associated infrastructure, training

DESIGN GUIDELINES/TECHNOLOGY EXPLORATION WORKING GROUP (2 of 4)

- Provide for the continuous education of the section personnel in the usage of such guidelines and technology
- Propose priorities and resources allocation as pertaining to the deployment of proposed tools for the section
- Develop appropriate documentation for the above
- Bridge between section and outside efforts/activities as related to various design guidelines and technologies (e.g., MGSO, EIS)
- Develop strategies and tactical approaches for above activities
- Report on the activities to the Master Plan working group

Start Date: January 1, 1997 (no formal weekly meetings held, yet)

Number of Meetings to date: None (except for work being done under MAS vision group and Jim Larson's Programmer's Lunch series)

» STATUS

- Developed various Internet links to vendors and companies producing or using related design tools and technologies
- Disseminated appropriate information to the Master Plan working groups

DESIGN GUIDELINES/TECHNOLOGY EXPLORATION WORKING GROUP (3 of 4)

- Made a presentation to Jim Larson's Programmer's Lunch series on CMM (Capability Maturity Model) - available on the Web Page now
- Developed a White Paper on the five components of a successful approach to systems development - available on the Web Page now
- In MAS Rick Kelly and Greg Garner proposed a series of technologies and tools to be used within the MAS group - proposal available on the Web Page now
- Exchange of ideas and approaches to related technologies with other organizations (e.g., MGSO, EIS)
- Maintained all related information on our Web Page

» FUTURE PLANS

- Keep performing the above mentioned activities
- Develop and recommend a strategy for evaluation and implementation of specific design guidelines and technologies within the section
- Experiment, on a pilot-based, the use of specific technologies for one of the going on projects within the section

DESIGN GUIDELINES/TECHNOLOGY EXPLORATION WORKING GROUP (4 of 4)

» **SCHEDULE (tentative)**

- Complete the task of technologies recommendation and implementation schedule (priority) for the section by end of May, 1997
- Develop and recommend a technology architecture and infrastructure for the section by end of May, 1997
- Establish a solid bridge between the section employed technologies and outside related projects

» **ISSUES/CONCERNS**

- The need of allocated resources in areas of needed expertise
- We need more section groups/projects representative participation in our meetings

IMPACT ON OPERATIONS WORKING GROUP (1 of 1)**» MEMBERSHIP**

- Vic Legerton (chair)
- other TBD

URL: <http://epic1/nav/doc/sat/wg6/>

» PURPOSE/CHARTER

- To continuously assess and monitor what the re-engineering and architecture impact would be on the operations of various software components
- STATUS
- Not started yet

» FUTURE PLANS

- TBD

» SCHEDULE (tentative)

- N/A

» ISSUES/CONCERNS

- N/A

SOFTWARE DEVELOPMENT GUIDELINES/STANDARDS WORKING GROUP (1 of 1)

» **MEMBERSHIP**

- Cliff Kettemborough (chair)
- Ed Rinderle
- Vic Legerton

URL: <http://epic1/nav/doc/sat/wg10/>

» **PURPOSE/CHARTER**

- To recommend to the SAT the set of guidelines and standards for all phases of the software development process, and to propose a plan for their application
- STATUS
- Not started yet

» **FUTURE PLANS**

- TBD

» **SCHEDULE (tentative) and ISSUES/CONCERNS**

- N/A

COMMUNICATIONS GUIDELINES/STANDARDS WORKING GROUP (1 of 1)

» **MEMBERSHIP**

- Cliff Kетtemborough (chair)
- Ed Rinderle
- Vic Legerton

URL: <http://epic1/nav/doc/sat/wg13/>

» **PURPOSE/CHARTER**

- To recommend to the SAT a plan for customer focus, document development and dissemination, and communication among developers, users, customers, and management.
- STATUS
- Not started yet

» **FUTURE PLANS**

- TBD

» **SCHEDULE (tentative) and ISSUES/CONCERNS**

- N/A

RISK ASSESSMENT/MANAGEMENT WORKING GROUP (1 of 1)

» **MEMBERSHIP**

- Cliff Kettemborough (chair)
- Ed Rinderle
- Vic Legerton
- URL: <http://epic1/nav/doc/sat/wg14/>

» **PURPOSE/CHARTER**

- To develop and recommend to the SAT a Risk Management Plan including:
 - > a description of areas that introduce risk
 - > a determination of potential causes of risk and how to mitigate them
 - > an identification of ways to detect early failures and activate contingency plans

» **STATUS, FUTURE PLANS, SCHEDULE (tentative), and ISSUES/CONCERNS**

- See Master Plan Working Group

RE-ENGINEERING & ARCHITECTURE GUIDELINES (1 of 4)

- » Based on the “service” paradigm, i.e., a service request comes into the systems, like a request in an envelop. The information inside the envelop can be more or less richer. The system should be “smart” enough to pass the envelop content to the appropriate process(es) (or path) and ultimately provide an answer to the initial request.
- » This architecture is consistent with a layered view, as proposed some time ago. Also, it is consistent with similar developments within MGSO, TMOD, lab-, NASA- and industry-wide.
- » Advanced systems and software engineering methods, techniques and tools are planned to be employed to pursue the development of this architecture, as detailed below.
- » The architecture can be read in two ways:
 - A strategic view the ultimate goal, what is the “yellow” path, and
 - A tactical view, parts of it already in place, other to be developed, what are all the other paths.

RE-ENGINEERING & ARCHITECTURE GUIDELINES (2 of 4)

- » This architecture should, in both tactical and strategic terms, provide a great level of flexibility, i.e., will accommodate various users with various needs and skills level.
- » The “migration” from the “blue”, “red”, “green”, or “gray” domains or system navigation paths toward the “yellow” domain/path should be an incremental, orderly process.
- »
- » Majority of the current working group activities are geared toward the identification of a set of library programs and data formats/structures that can be considered as core for the existing as well as future systems functionality.

“Each component has an architecture in its own right but must ‘fit’ within the architecture of the whole.” - John Zachman

“4 + 1 View of Architecture: Logical View, Developmental View, Process View, Physical View, plus Conceptual Test Cases” - Tibbettes & Bernstein

RE-ENGINEERING & ARCHITECTURE GUIDELINES (3 of 4)

- » Once this core programs and data structures will be identified then:
- domain specific (“blue”, “red”, “green”, or “gray”) tactical and strategic re-engineering and architecting processes will be planed, developed and implemented.
 - and, for instance, tactical plans may include adding “front-end” and “back-end” capabilities, such as GUI (Graphical User Interfaces) and plotting/visualization capabilities, respectively.
 - we should be able to architect the first release of what has been coined as “micro_nav_soft”:
 - > *“what can be taken from each (or some TBD) domain engines and combined altogether with a front-end (GUI) and a back-end (plotting/visualization) capabilities that will satisfy most of supported and future missions requirements, put on a CD ROM in a format portable on most supported machines, self-installing, and along with on-line documentation capability and delivered accordingly?”*

RE-ENGINEERING & ARCHITECTURE GUIDELINES (4 of 4)

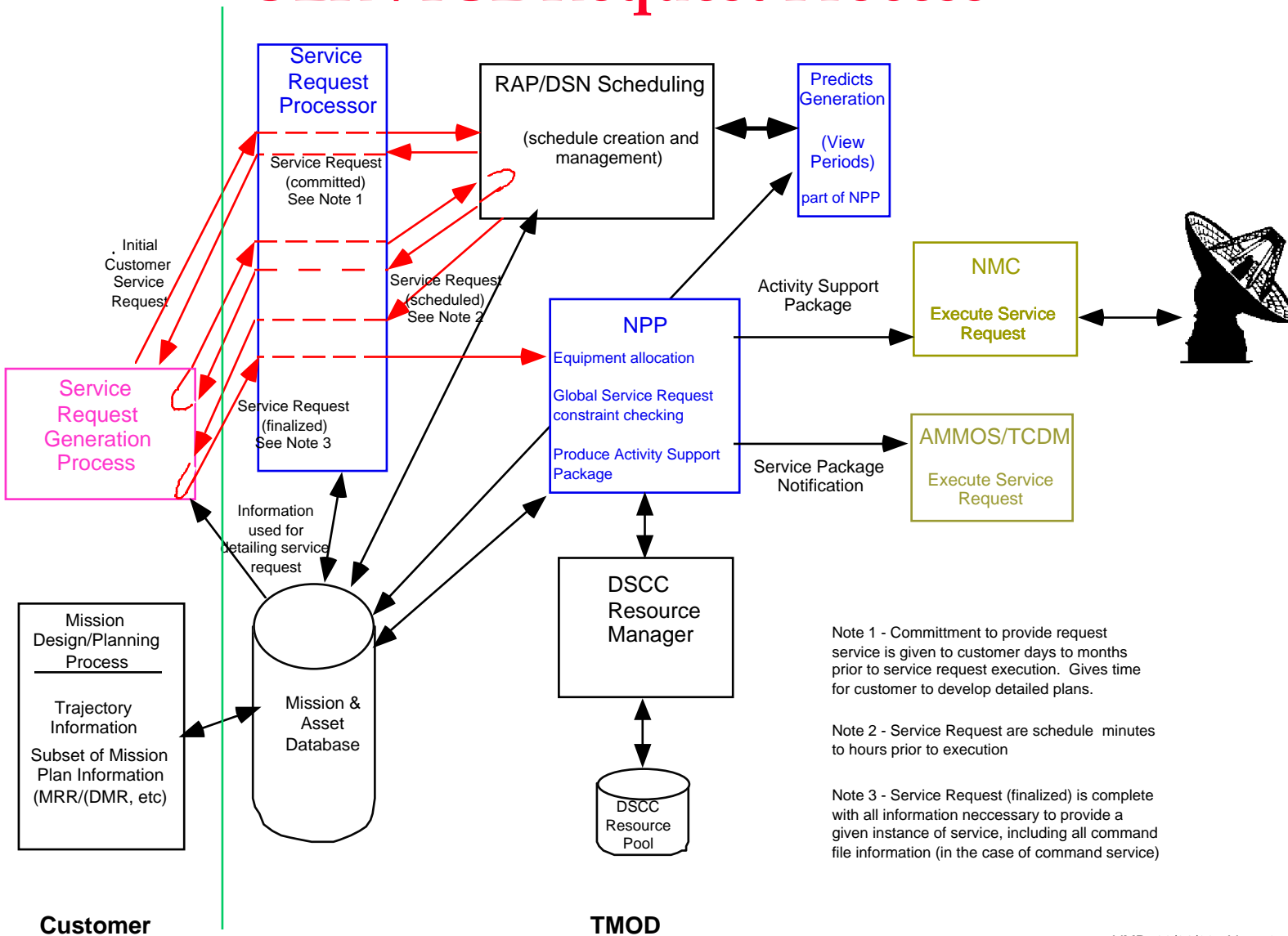
> *similarly to MS Office made analogy, on this package an end-user (scientist/engineer) should have all the tools, data structures and underneath engines that will allow him/her to do whatever job he/she wants: mission analysis and design, navigation, data plotting and visualization, data export and import between tools or outside of this environment for further manipulation.*

» **More of a strategic nature for the re-engineering and architecting approaches would be activities such as:**

- The above identified core capabilities (“application engines”), with or without above mentioned “front-end” and “back-end” specific layers should be re-engineered in another industry compliant language, perhaps, C++ or Java.
- The entire architecture should be, island by island (bottom up) or top-down re-designed as an large scale object-oriented architecture. For that purpose the developed of a class library should be the first step.
- *“Implementing new technology is a balancing act. Fast, cheap, reliable: Pick two.”*

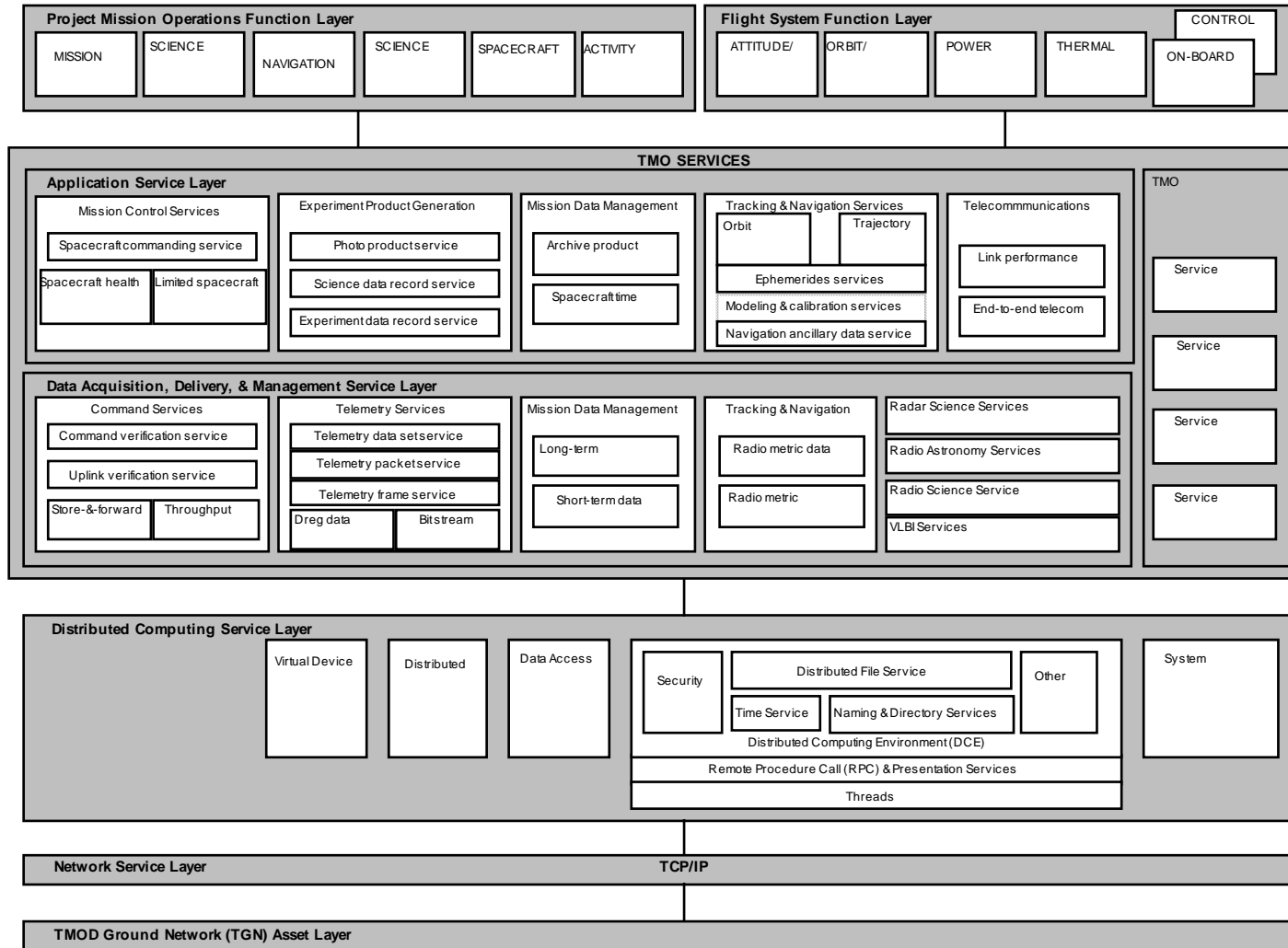
“The biggest challenge facing modern enterprise is ‘change’.” - Peter F. Drucker

SERVICE Request Process

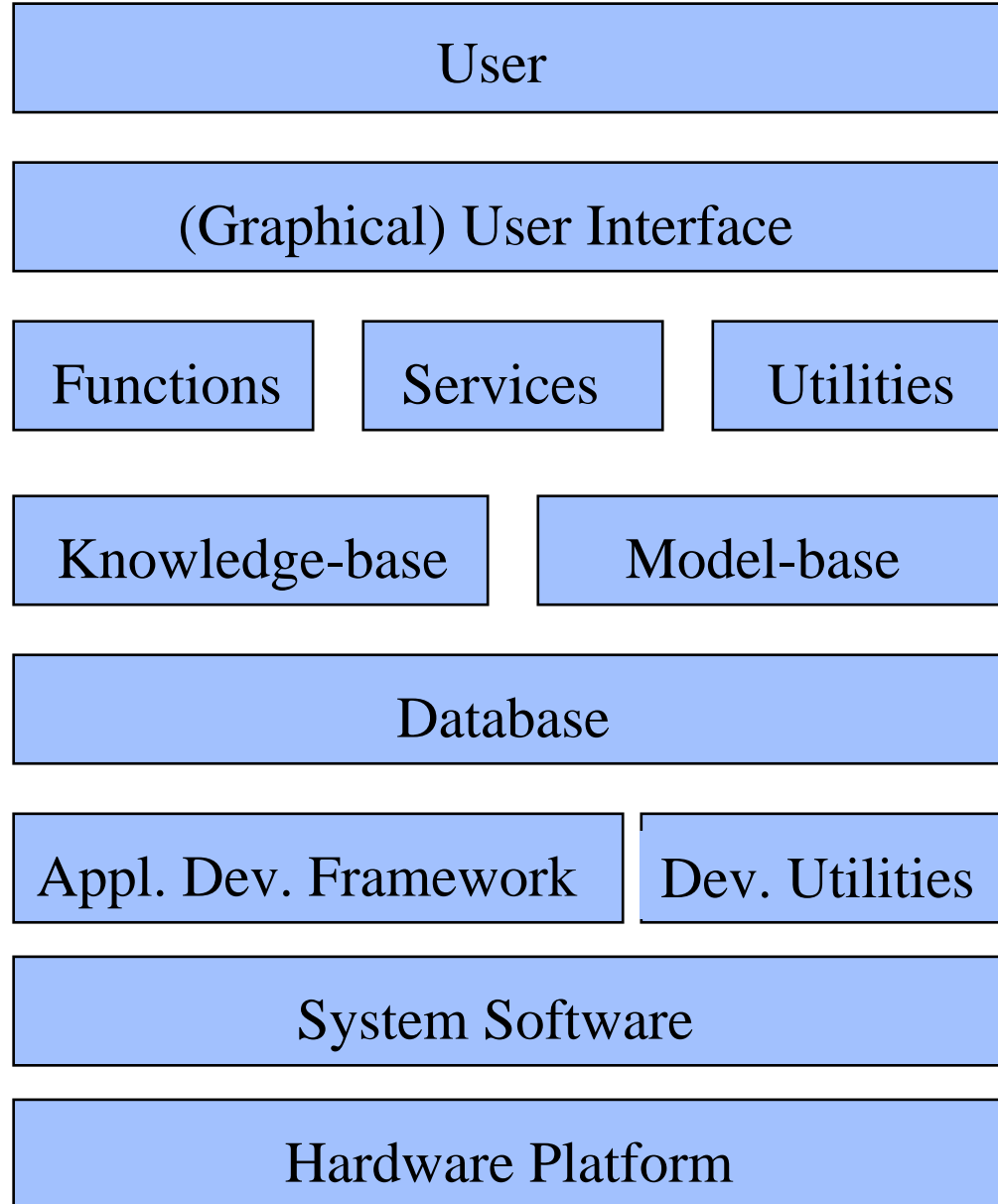


TMOD Service System

TMOD SERVICE SYSTEM - LAYERED VIEW



3/8/1996



Micro-NAV-Soft Architecture Principles

» **Characteristics (1 of 4)**

- 3 Tier Client-Server Architecture
 - > Front-End (client, presentation)
 - > MiddleWare (function, “business/science rules”)
 - > Back-End (server, data, presentation)
- Distributed Environment
 - > Phase I: DCE compliant
 - > Phase II: CORBA compliant

Micro-NAV-Soft Architecture Principles

» **Characteristics (2 of 4)**

- 3 Layer Framework
 - > Access
 - > Application
 - > Data/Toolbase
- Component-Based (DCE) and/or Object-Based (CORBA) Backbone
 - > Repository-based

Micro-NAV-Soft Architecture Principles

» **Characteristics (3 of 4)**

- End-to-End Architecture
- “Service” Paradigm
- Four Views
 - > Logic
 - > Process
 - > Component
 - > Deployment

Micro-NAV-Soft Architecture Principles

» **Characteristics (4 of 4)**

- Allows for co-existence of:
 - > “legacy” applications (FORTRAN-based)
 - > new applications (C, C++, Java-based)
 - > wrappers
- Key Issue:
 - > INTEGRATION
 - > GROWTH

Micro-NAV-Soft Architecture Principles

» **Components (1 of 8)**

- **BROWSERS**
 - > NetscapeServer
 - > MS ExplorerServer
 - > Java-based VM (Virtual Machine)
 - Java Applets
- **COTS/GOTS/NOTS/HOTS/ROTS/FOTS**
 - > SOAP
 - > STK

Micro-NAV-Soft Architecture Principles

» **Components (2 of 8)**

- GUI Builders
 - > Builder Xcessory (BX)
 - > XDesigner
 - > Tcl/Tk
 - > SAGE
 - > VisualBasic
 - > LabView

Micro-NAV-Soft Architecture Principles

» **Components (3 of 8)**

- **MISSION ANALYSIS and DESIGN**
 - > Early Design Trajectory Generators
 - Midas, Stour, Low-Thrust, Ltool, etc.
 - > Trajectory Determination & Optimization Tools
 - CATO, GRIST, etc.
 - > Analysis Tools
 - Events, GPost, Quick, etc.

Micro-NAV-Soft Architecture Principles

» **Components (4 of 8)**

- NAVIGATION
 - > DPTRJ
 - > ODP
 - > ARTSN
 - > MOPS
 - > OPNAV
 - > Sigma

Micro-NAV-Soft Architecture Principles

» **Components (5 of 8)**

- DATA GENERATION
 - > RMDC
 - > Ephemerides
 - > SPICE Toolkit
 - > Calibration (335)

Micro-NAV-Soft Architecture Principles

» **Components (6 of 8)**

- VISUALIZATION
 - > LabView
 - > KPlot
 - > POPPS

Micro-NAV-Soft Architecture Principles

» **Components (7 of 8)**

- > FastFlight
- > GPOST
- > MS Excel, ASCII
- **MATH LIBRARY**
 - > MathLab
- **END-TO-END MODELING**
 - > Foresight

Micro-NAV-Soft Architecture Principles

» **Components (8 of 8)**

- DBMS
 - > e.g., Oracle/System 2000
 - > MADB interface
 - > Other

Micro-NAV-Soft Architecture Principles

» Development Tools (1 of 2)

- PC-based
- Mac-based
- Unix-based
- CM
 - > CCC Harvest
- Testing

Micro-NAV-Soft Architecture Principles

» **Development Tools (2 of 2)**

- Metrics Development
 - > COCOMO-like
- Project Management (Planning)
 - > MS project

Micro-NAV-Soft Architecture Principles

» Guidelines (1 of 4)

“If you build it, they will come - lessons learned from modelers:

- **Seek user input**
 - > Poll users to determine their information needs
- **Analyze and consolidate feedback**
 - > Show prototype to users
 - > Make updates based on new feedback

Micro-NAV-Soft Architecture Principles

» Guidelines (2 of 4)

- **Think small**
 - > Don't bite off more than you can chew
- **Build incrementally**
 - > Be prepared to change the model
- **Stay open and flexible**

Micro-NAV-Soft Architecture Principles

» Guidelines (3 of 4)

- > Don't be afraid to adjust the process to reflect your organization's culture and politics
- **Be patient**
 - > And get commitment from users to be patient also
- **Don't look for perfection**
 - > A model should be constantly "tweaked"

Micro-NAV-Soft Architecture Principles

» **Guidelines (4 of 4)**

“When defining by decree, a company needs to designate somebody with the authority to say, ‘We’ve using five different terms, and we have to agree on one. This will be the one. Period.’”

“Architects will need to know not only technology and basic business issues but also organizational change, knowledge management and organizational structure and design.”

Micro-NAV-Soft Architecture Principles

» **Working Teams (1 of 2)**

- Large Team Charter
 - > Have a wide area approach, as specified in Master (Strategic) Plan document
 - > Concentrate on the Re-engineering and Architecture of section software at large
 - > Employ a top-down approach
 - > Continue with the activities under established Working Groups

Micro-NAV-Soft Architecture Principles

» **Working Teams (2 of 2)**

- Small Team Charter
 - > Concentrate on the micro-nav-soft architecture development
 - > Employ prototyping and RAD techniques
 - > Employ a rather bottom-up approach to Re-engineering and Architecture
- Some of the two teams activities/membership should overlap and converge in time