MODELING AND ANALYSIS TOOLS

Gary Jongeward
S-Cubed Division of Maxwell Labs
3398 Carmel Mountain Road
San Diego, California

Modeling and Analysis Tools

The Objective

Help SEI Become Reality By Providing
Environment Interactions Information
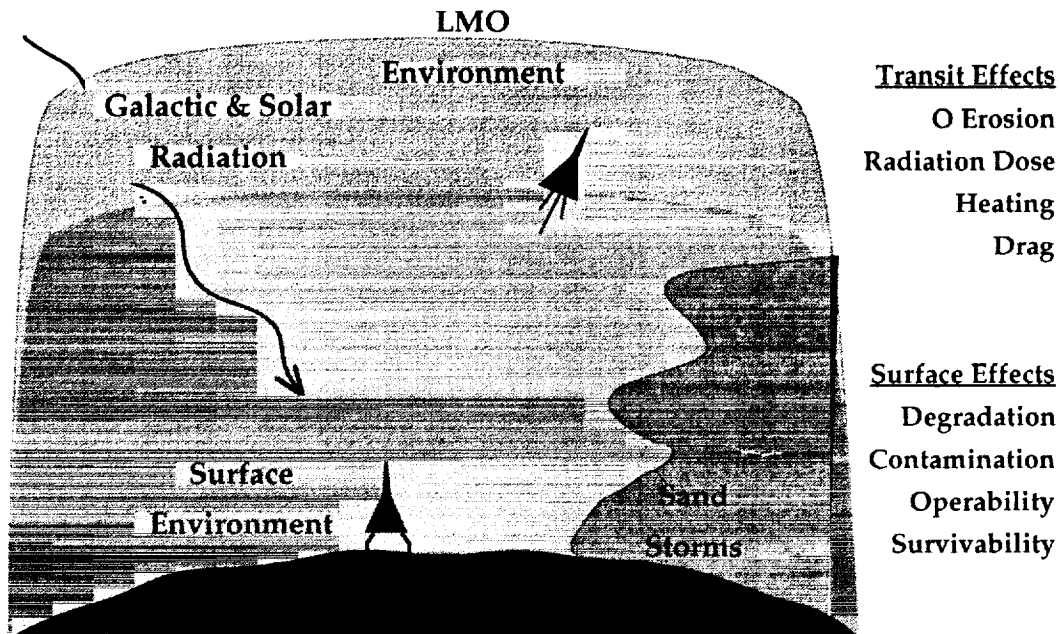To SEI Planners, Designers, & Engineers

The Reason

- SEI designers need information for preliminary designs
- SEI designers need the latest knowledge as early as possible
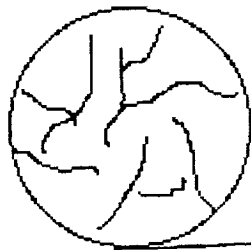- The legacy of SEI should be retained knowledge, not lost expertise

The Method

- Coordinate model development & identify gaps in the data
- Integrate models and data into a software package for SEI
- Develop the tool now in time to impact SEI conceptual designs

Mars Environments Will Affect Systems In Many Ways

LMO
Environment

Galactic & Solar
Radiation

Transit Effects
O Erosion
Radiation Dose
Heating
Drag

Surface
Environment

Sand Storms

Surface Effects
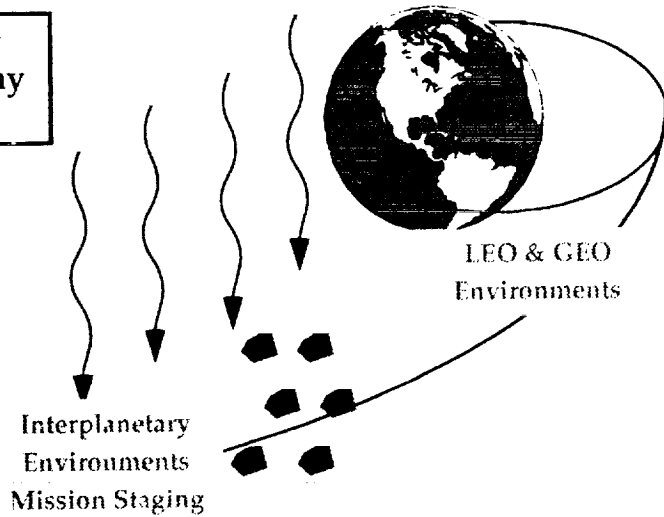Degradation
Contamination
Operability
Survivability

Models and Modeling Tools Must Be Designed
With the Entire SEI Mission in Mind

Models will be developed by
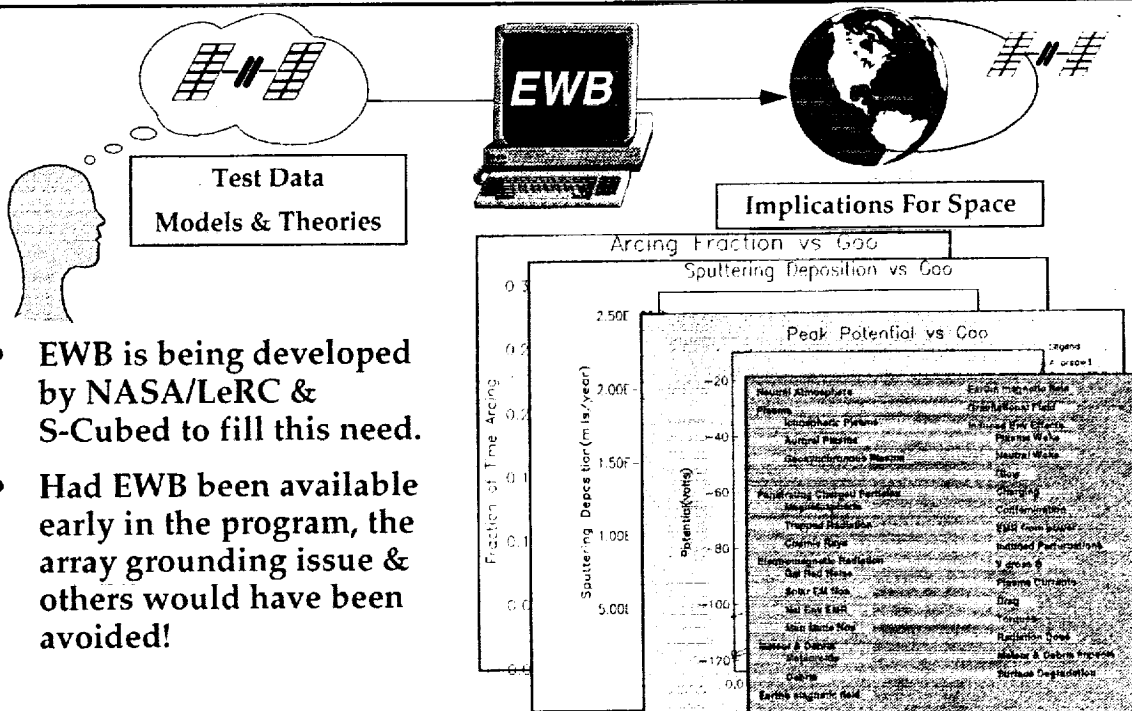scattered researchers from many
disciplines

LEO & GEO
Environments

Interplanetary
Environments

Mission Staging

LMO &
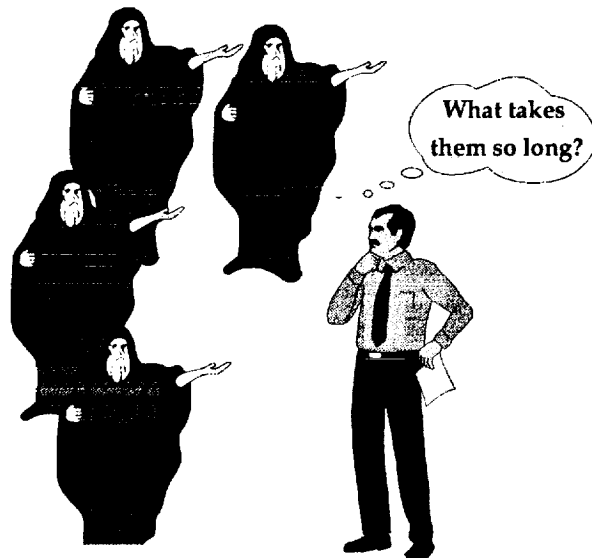Mars Surface
Environments

30 year program requires modeling
codes be complimentary by adhering
to standards

Space Station Designers Did Not
Have Integrated Environment Interaction Tools

EWB

Test Data

Models & Theories

Implications For Space

Arcing Fraction vs Goo

Sputtering Deposition vs Goo

Peak Potential vs Goo

- EWB is being developed
  by NASA/LeRC &
  S-Cubed to fill this need.

- Had EWB been available
  early in the program, the
  array grounding issue &
  others would have been
  avoided!

Environment Interactions Information Must Be Provided To SEI Planners, Designers, And Analysts In A Timely Fashion
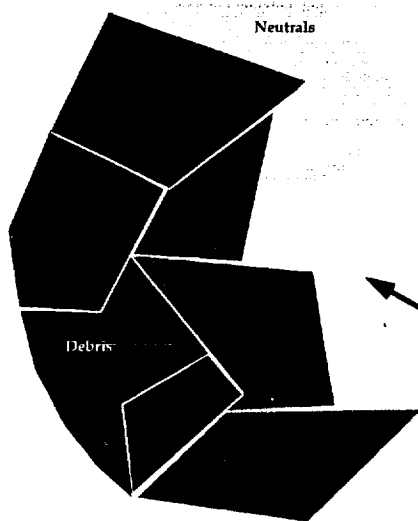
Presently, integral knowledge is scattered among a few Gurus and is inaccessible, incomplete, and unreliable.

This knowledge and expertise can be transferred to mission planners through models, databases, and tools.

Tools Are Needed To Aid In The Development And Validation Of Models

Each model is one piece of the puzzle

- **Environments & systems interact**
- **Validation of physics models requires relevant input to produce relevant output**
- **Output from models must be available as input to other models**
- **Embedding of new models in existing knowledge is necessary for development and validation**

Neutrals

Debris

SEI Workbench Builds On Proven Technology

Flexible Display Module
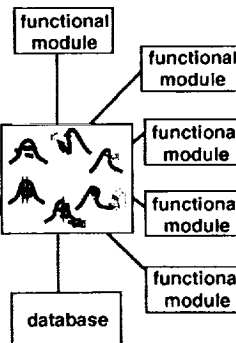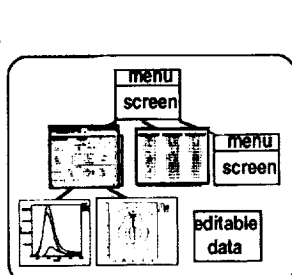same commands for all functions
- data entry screens
- tables
- line graphs
- contour plots

Non-Procedural Process Controller
does only the calculations necessary
for the desired result

Software "Expansion Slots"
plug in new or additional
environment & system
models

Workstation Independent
- UNIX
- Fortran & C
- Sun 3, 4 Sparc
- Compaq
- Celerity
- IBM 6000
- Decstation

Designed For Change
- editable screens
- text based data item dictionary
- coding standards
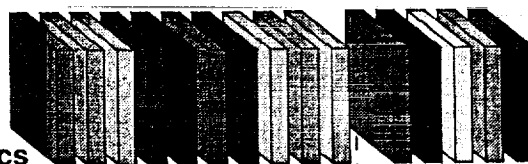- all source government owned

Object Oriented
message passing between modules

An SEI Workbench Based On The EWB Will Satisfy Both The Needs Of Researchers And SEI Mission Planners

Library of models & databases
Environments
Interactions
Systems
Orbital mechanics

Proven Technology

EPSAT
NASA/LeRC SDIO Space Systems

EWB
NASA/LeRC SSF

SSAM
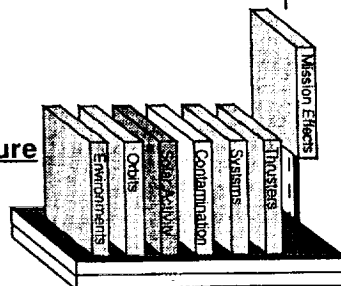Space Nuclear Power

LIWB

LDEF

SEISAT
SEI IR&D Prototype
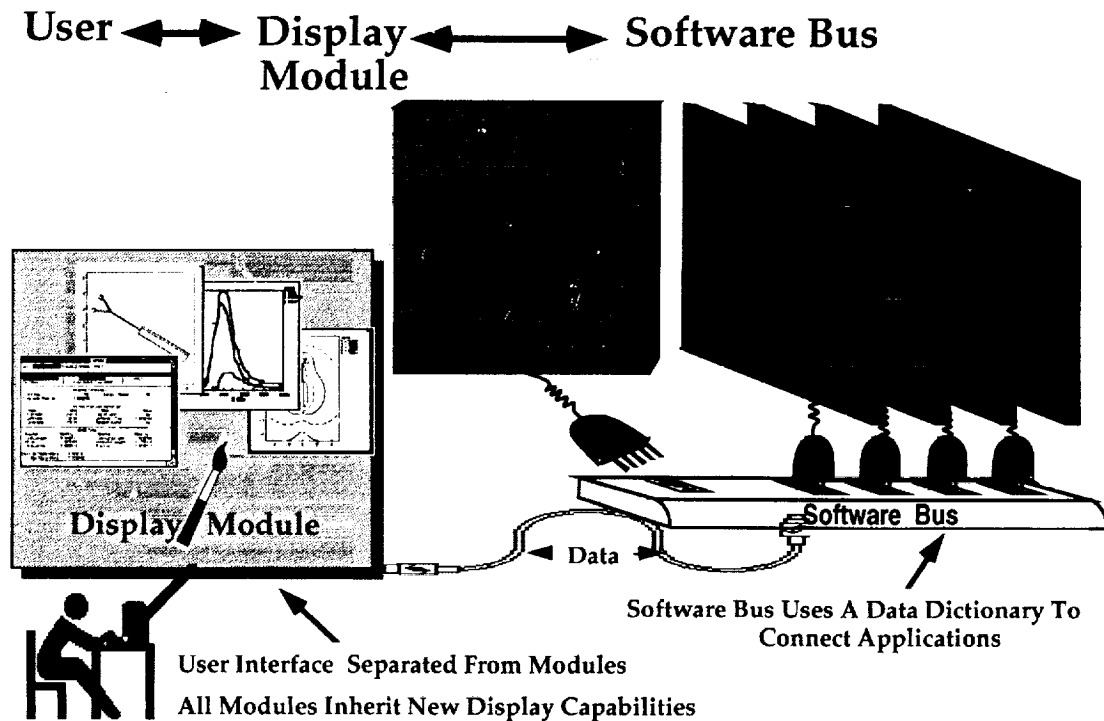
MIRIAD
Integrating Architecture
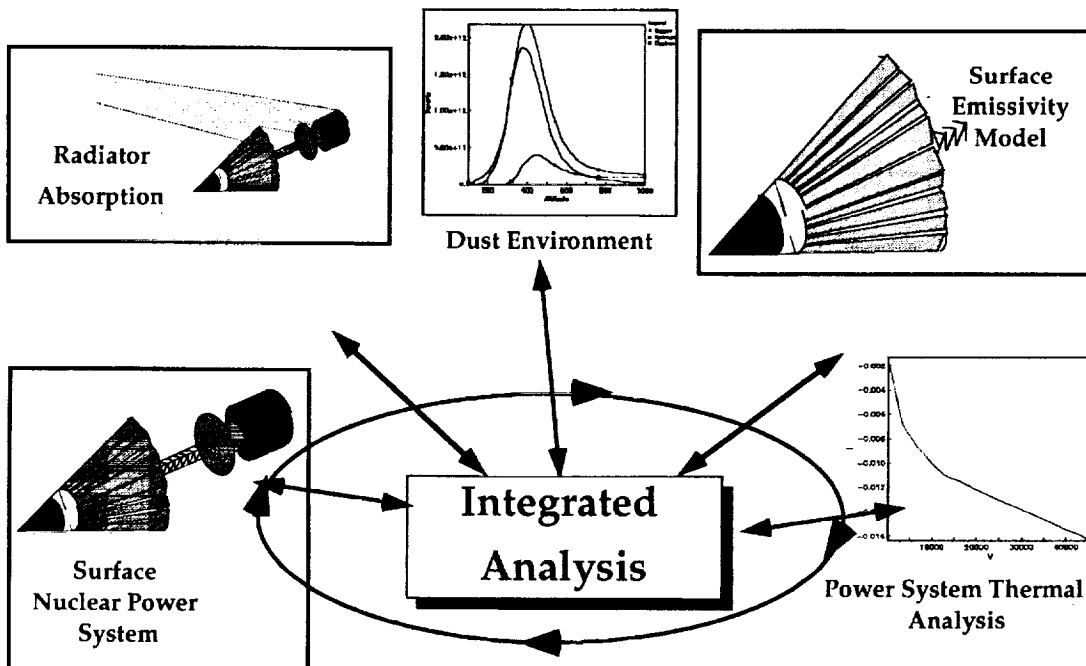Expandable
Tailorable to specific needs
Transfers knowledge & technology to the users

Miriad Architecture
The Core Of An Integrated SEI Workbench

User ⟷ Display Module ⟷ Software Bus

Display Module

Data

Software Bus

User Interface Separated From Modules

All Modules Inherit New Display Capabilities

Software Bus Uses A Data Dictionary To Connect Applications

SEI Mission Planning
Needs Integrated Assessment Tools

Radiator Absorption

Dust Environment

Surface Emissivity Model

Surface Nuclear Power System

Integrated Analysis

Power System Thermal Analysis

Summary
Modeling And Analysis Tools

- SEI mission will be the most intricate & longest running project ever attempted

  Over 30 years

  Moon, Mars, & interplanetary environments

- SEI designers must have mission design tools in time

  To impact the conceptual design

  To identify gaps in the knowledge

  To aid in the design of precursor missions

  To provide a vehicle to retain acquired knowledge

- The SEI workbench must be an integral part of the SEI

  Provides the vehicle for knowledge and technology transfer

  Is the nucleus for permanent retention of knowledge