1-1-1994

STRICOM Quarterly Review: TRDIS, VSL Agenda

University of Central Florida Institute for Simulation and Training

INSTITUTE FOR SIMULATION AND TRAINING

STRICOM Quarterly Review
14 December, 1994
- TRIDIS
- VSL A genda

IST

TRIDIS

STRICOM QUARTERLY REVIEW
14 DECEMBER 1994

IDEMO94 Testing	Cox
DIS Test Tools	Kearns
IDEMO94 Logging	Humphrey
Traffic Analysis	Goel
Laser Designator PDU	Giroux
SIMAN PDUs	Cox
PEGASUS	Smith
IST's STEALTH	Andrews
Live Device	Diaz

Test Procedures For IDEMO94

- Started with Test Procedures from last year (January 30, 1994 version)
- Added Laser/Designator and Simulation Management
- Didn't test for new PDUs
  - Acoustic
  - Stealth
- Added System Tests, specifically the Power-On test

Test Procedures (continued)

- Logistics tests and Receiver tests were excluded
- Updated the list of entities for this year's demo for Appearance tests
- Performed Adverse PDU tests and some Erroneous PDU tests
- Approx. 30% more tests this year than last year

Test Procedures (continued)

- 2 Methods for participants to get testing documentation
- IAC anonymous FTP node:
  - Test Procedure
  - Capabilities Statement
  - Logged Testing Document
- TRIDIS FTP node:
  - same documents
  - test tools, test script and binary files
  - account and password were issued for this node upon request

Testing Process for IDEMO94

- New test tools with some automated testing
- Extra personnel to help with testing:
  - STRICOM - Greg Schow
  - TRAC - Capt. Pat Hoyes
  - JITC - Jim Gustafson, Jana Gallatin, Steve Matsura
  - NAWC-TSD - Larry Smith and Rodney Long
  - DIS Standards Project - Jeff Wicks
- Tested Methods:
  - In-House
  - Long Haul via Breeze
  - Logged Testing

Organizations Tested

- 50 organizations tested
- 91 systems were tested
- In-House - 10 organizations
- Long Haul via Breeze - 23 organizations
- Logged Testing - 16 organizations (+ 5)
- 1 organization scheduled to test during rehearsal week
- More than 92 systems participated in demo

Testing Summary

- Average test time
  - Listen Only Devices - 4 hrs
  - Interactive Devices - 6 to 8 hrs
- Adverse tests took a long time
- Testing was not completed on at least 18 systems
  - changes in Capabilities Statements
  - previously failed tests that were not resolved
- 1 non-TRIDIS person helped test each week for Oct. to middle of Nov.

Testing (continued)

- At least 3 TRIDIS people scheduled to test at all times
- Feedback was given to organizations much more quickly this year
- Tried to enforce testing deadlines
  - 2 Organizations were turned down for participation for failure act in time
  - almost all systems tested by Nov. 17

Testing (continued)

- REHEARSAL WEEK
  - Delay in TRIDIS test system setup and in network connections postponed testing until Tuesday.
  - Approximately 15 organizations had tests to finish.
  - Finished testing on approx. 12 of those.
  - Testing was not performed for DOAC because they were in an isolated exercise.

Testing (continued)

- Some things could not be enforced
  - Non-zero values in padding fields
  - Valid entities for 2.0.3 but not on IDEMO94 entity list
- Some DIS packets on net still contained bad data
  - Systems could handle it better because of Adverse tests

DIS Test Tools

TRIDIS Task 3.2.5.3 - DATA ANALYSIS TOOLS

SCANNER

PDU EDITOR

SCANNER

An Offline, Automated, Analysis Tool

Manages Test Suite for each SUT

Performs Automated Tests

Facilitates Manual Tests

Automatically Logs results to report file

SCANNER - STATUS

- Used for IDEMO94 DIS Compliance Testing
- Recent Improvements suggested by Users
  - Direct Interface with Logger
  - More Specific Filtering
  - Shows Delta-Time between packets
- Highly Configurable
  - Text Based Configuration Files
  - PDU Description Language Defined
- Porting to SGI

PDU EDITOR

A PDU Creation Utility Program

Can create any of the 27 DIS PDUs

Highly Configurable

Used to create Adverse/Erroneous data for IDEMO94 testing

IDEMO94 Logging

- Hardware Setup
- Software Setup
- Datalog Format
- Status of Recorded Data
- FTP Availability

Logger Hardware Setup

Two MVME197 target boards per logger

Logging via target board Ethernet port

SCSI Disk drives using Motorola FFS

Logging spans multiple disks

Logger Software Setup

- Host board task with MOTIF GUI controls the logger
- Target board task records data using VME Exec Ethernet driver
- Files saved on target board file system
- Non-promiscuous mode
- 1000 pkt/sec. to disk sustained
- 1200 pkt/sec. peak

Datalog Format

Similar to IST Standard format but:

- File header identifies creation time
- Packet headers in Big-Endian order

Logged in chunks

- less than 16 MB and less than 1 hour

Data Structures

File Header

CTIME	32 bit int

PDU Header

Length	32 bit int
Seconds	32 bit int
Microseconds	32 bit int

Logged Data - Status

Data Logged on

- Part of Monday
- During Show hours Tuesday - Thursday

Only Broadcast Traffic

Average Rate ~300 pkt./sec.

~4.5 GB recorded

Distribution via FTP

Data currently in IST format on 4mm and 8mm DAT

Awaiting LORAL Tools for conversion to DLIF

Compressed TAR DLIF files to TRIDIS FTP Node

Traffic Analysis

User community surveyed
- DIS Working Groups
- IDEMO94 Planning Meetings

No responses received.....

Network Analysis and Filtering Tool
- Developed for IDEMO93
- Enhanced Filtering Capabilities

Analyses to be Performed

General DIS Metrics

- Number of PDUs per kind
- Distribution of types per unit time
- PDU kind distribution
- Packet size distribution
- Issuance rates
- Summary by ID
- Platform Distribution
- Munition Distribution

Analyses (continued)

EW Metrics

Radio Metrics

Flooding Metrics

Enhanced Filtering

- PDU Type
- Entity ID
- Entity Type
- Time Interval
- DIS/non-DIS
- Exclude IST Testbed PDUs
- Exercise ID
- Version
- UDP Port

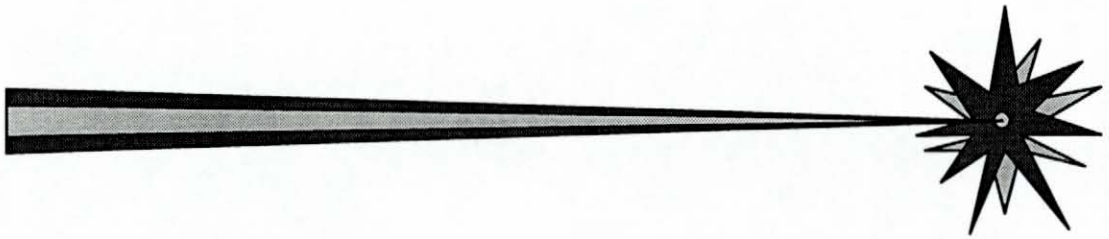
Schedule

Hybrid Package

(Network Analysis + Filters) complete 31 December 1994

IDEMO94 Analysis complete 31 January 1995

Laser Designator PDU



Additional CGF behavior

Additional Compliance Tests

Additions to SCANNER

Interaction with PEGASUS

L/D Behavior in CGF

Laser Designator Behavior

- Choose Target
- Acquire Target
- Lase Target

Laser Guided Missile Platform

- Choose Target
- Acquire Target
- Launch LGM

Summary

Demonstrated at IDEMO94

Changes recommended for PDU

Add ability to turn off laser behavior

Final Report

SIMAN PDUs

12 SIMAN PDUs added to IST CGF

Create Entity	Action Request
Remove Entity	Action Response
Start/Resume	Event Report
Stop/Freeze	Data Query
Acknowledge	Set Data
Message	Data

Functionality

DIS Testbed

CGF Simulator has limited functionality of a Simulation Manager to issue Create, Remove , Start/Resume, Stop/Freeze, Data Query, Set Data, and Message PDUs

CGF

CGF entities can be created, initialized, and managed according to action and request IDs

SIMAN Mini-Demo at I/ITSEC

Objective:

Multi-player exercise to demonstrate SIMAN protocols

Participants (12)

3 Simulation Managers

5 Manned Simulators

3 CGF Applications

1 scenario Preparation Tool

Coordinator

Ralph Whitney, Motorola

Mini-Demo (continued)

Land Battle Participants

VEDA	-	Simulation Manager
IST	-	CGF
DRA	-	Manned Simulator
MARCONI	-	Manned Simulator

Scenario

VEDA creates & initializes participants.
IST engages DRA and Marconi

Mini-Demo (continued)

Demos emphasized use of SIMAN protocol for exercise management

Diverse applications under centralized 'control'

Interaction among participants both before and during demo provided valuable insights for improving and refining the standard

PEGASUS

- Dynamically configurable Manned Simulator
- Provides DIS Testbed with a variety of entities
- All aspects of design are accessible
- Many contributors
- Developed in 4 weeks

PEGASUS Components

- F16 stick and throttle from ASAT
- Cobra stick, collective, pedals from surplus
- Video Monitor from TSI Stealth
- Seat, amplifiers, speakers, cables, A/D hardware from ASATs
- F16 flight dynamics derived from ASAT
- 3D wireframe display from outside efforts at IST
- PC CGF provides structure, network interface
- Coupled with IST STEALTH for OTW display

Purpose/Usage

- TRIDIS Task 3.2.2.1 'FAST AND SIMPLE ADDITIONS'
- Manned DIS simulator in each domain
- Investigate Dead-reckoning/Dynamics interactions
- Example for use of FDDI
- Additional source of interaction for testing

IST's STEALTH

Components:

- EasyScene/ SGI Performer
- Designer's Workbench
- MultiGen
- Viewpoint Models
- Marconi/SGI TDB
- Crystal River Sound System

Capabilities

Fire, Detonation, and Visual Appearance Support

Multiple Attach Modes

Eyepoint Control

STEALTH PDU

Problems

- Initial System Loading
  - Database Size
  - File Loaders (FLT, FPF, DWB)
  - Runtime Entity Modules
- Runtime Entity and Effect Loading
  - Load times
  - Terrain Correlation
- STEALTH PDU Attempts
  - Latency Mismatch jitter
  - Offset Stacking
  - Alternatives (SIMAN)

Joint Activities with Corporate Sponsors

ASTI

CORYPHAEUS

CRYSTAL RIVER

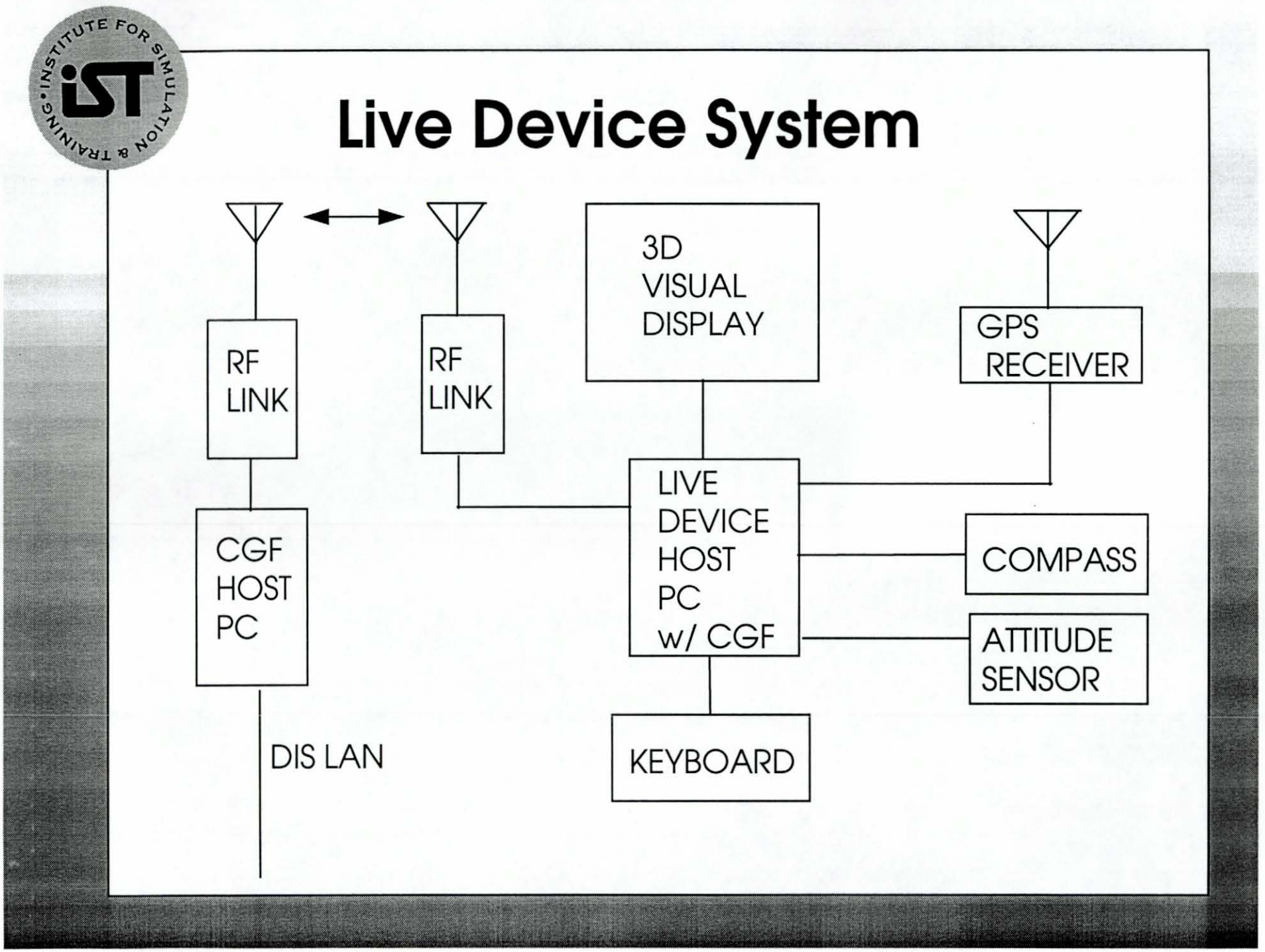
SILICON GRAPHICS

VEDA

VIEWPOINT

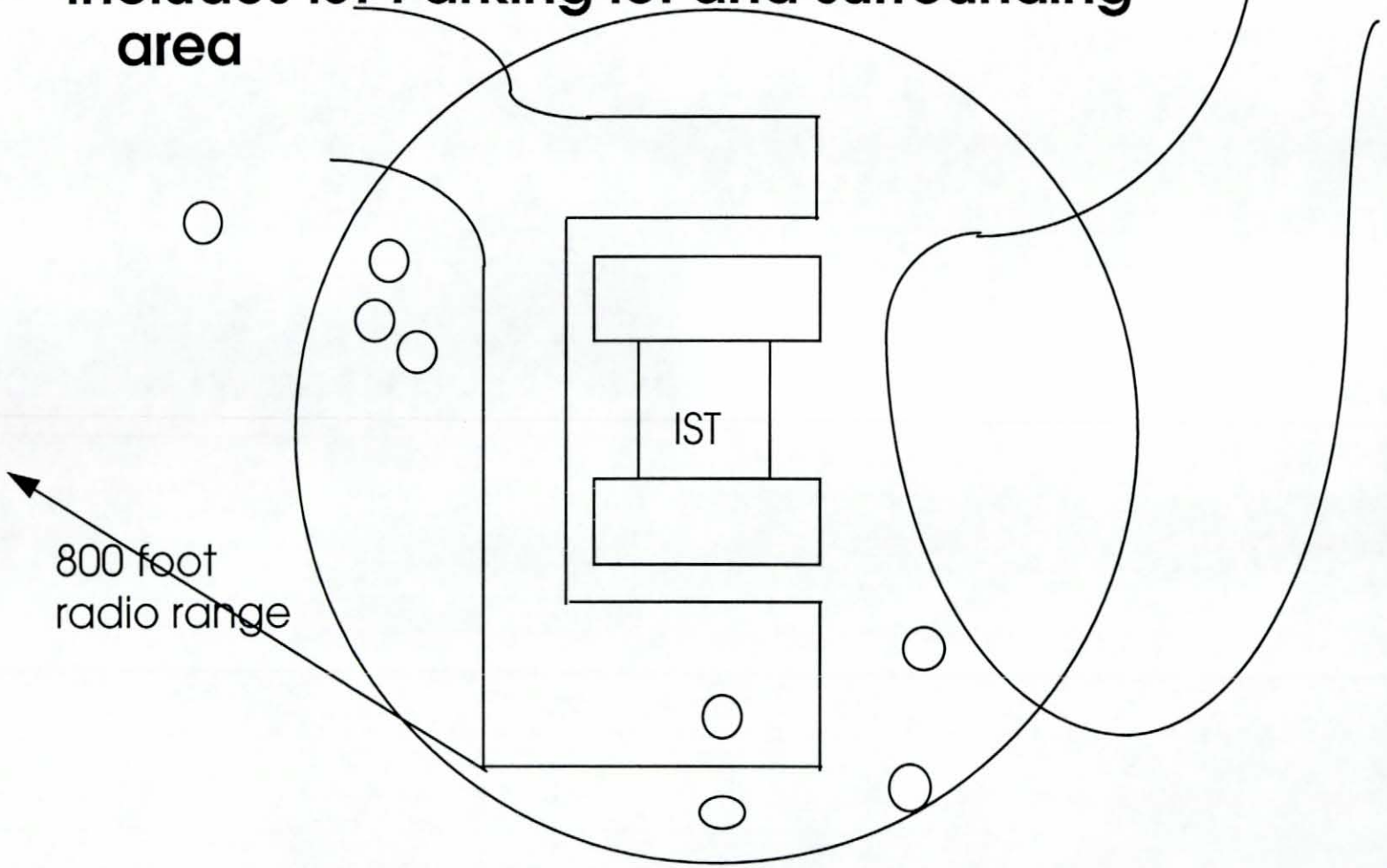
'Live' Device

- Real world entity
- Real World sensors
- Represented in Virtual world
- Influenced by events in both worlds
- Linked into DIS via RF link using DIS Protocol


Live Device System
3D
VISUAL
DISPLAY
RF
LINK
RF
LINK
GPS
RECEIVER
LIVE
DEVICE
HOST
PC
w/ CGF
CGF
HOST
PC
COMPASS
ATTITUDE
SENSOR
DIS LAN
KEYBOARD

Real World Database

Includes IST Parking lot and surrounding area



Testing

- GPS measurement accuracies
- Display resolution/matching
- Latency issues
- Players vs Bandwidth

UCF/IST
Visual Systems
Laboratory

STRICOM Quarterly Review
VSL Agenda

- Dynamic Terrain (DT)	Mark Kilby
- Dynamic Virtual Environments	Mark Kilby
- PolyShop	Kimberly Abel

UCF/IST
Visual Systems
Laboratory

Rapid Construction of Model Building for Urban Combat Environments

-- PolyShop --

PolyShop is a networked, multi-user 3D Virtual Environment (VE) CAD system designed to build 3D VE databases.

Key Features

- Immersive 3D CAD Package
- Networked Environment
- Unique Intuitive User Interface
- Rapid Database Construction

Progress in Last Quarter

- October Demonstration at AUSA Conference - Washington D. C.
- November Demonstration at I/ITSEC Conference R&D Rodeo - Orlando
- User Interface Performance Testing Continued
- Rigourous Functionality Testing and Evaluation Performed

Progress in Last Quarter

- Lack of Personnel Resulted in Minimal Work Load
- New PolyShop Personnel Started in November
- No Cost Extension Requested to Complete Current Contract
- White Paper Submitted to Propose Follow On Work For PolyShop

Next Quarter Focus

- Complete Networking Development and Testing
- Complete Enhancement Development and Testing
- Continue with Complex Database Construction
- Application Documentation and Final Reports
- New Proposal Work

UCF/IST
Visual Systems
Laboratory

Dynamic Terrain Project

Mark Kilby

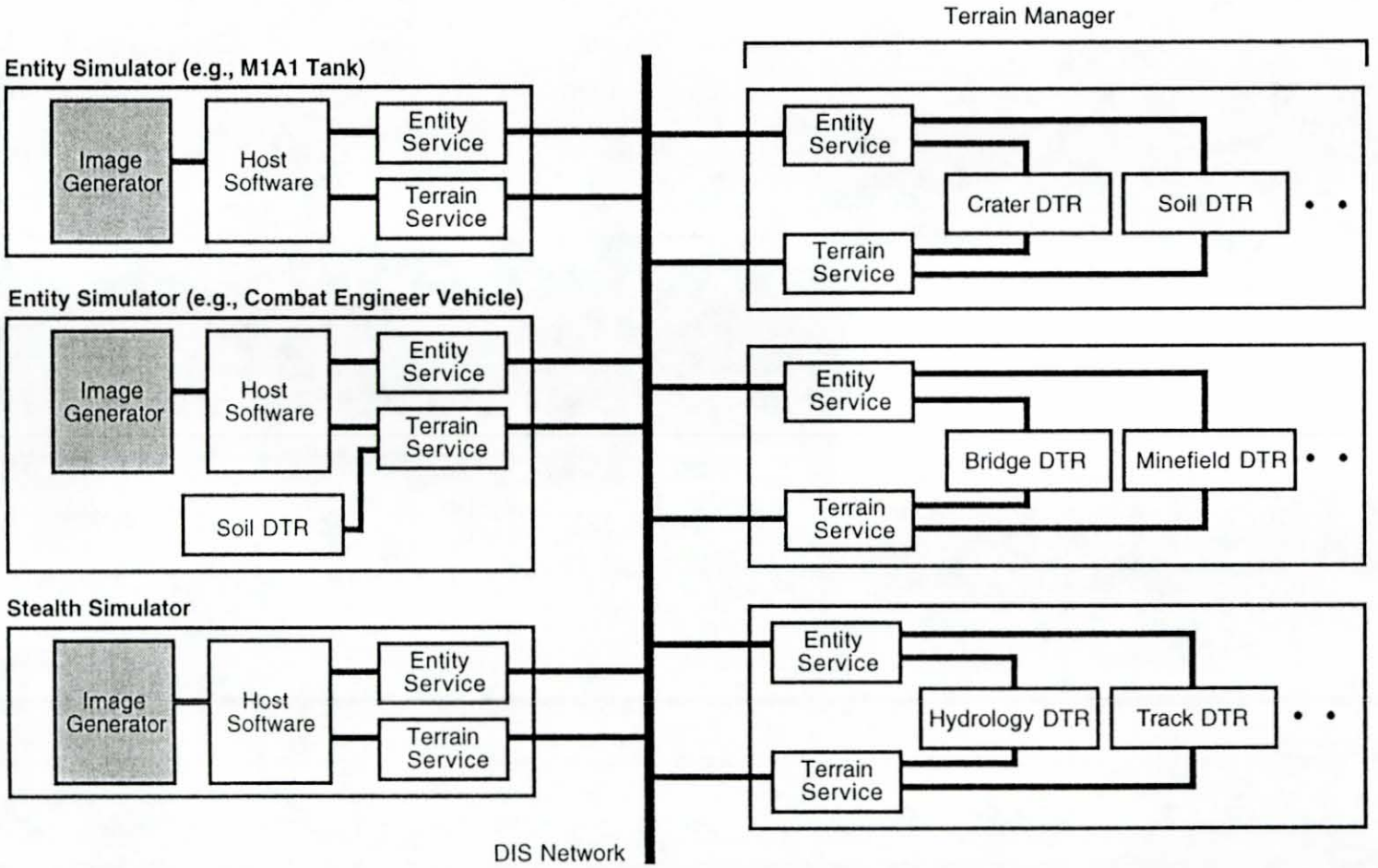
Visual Systems Laboratory

Institute for Simulation and Training

Dynamic Terrain
Progress in Last Quarter

- Vehicle Track Resource currently being integrated with DT Testbed
- Fluid flow model integrated with soil model
- Minefield DTR development started
- General Soil Model completed (awaiting integration)
- Dynamic Culture studies continue
- Papers presented at:
  - I/ITSEC 94
  - 11th DIS Workshop
  - 5th ARPA Conference on AI, Simulation, and Planning in High Autonomy systems
- Demonstration at I/ITSEC 94

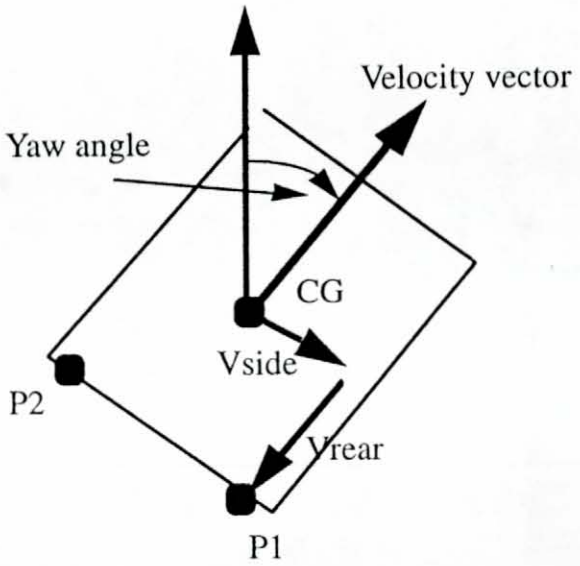
Review: Architecture Number Three

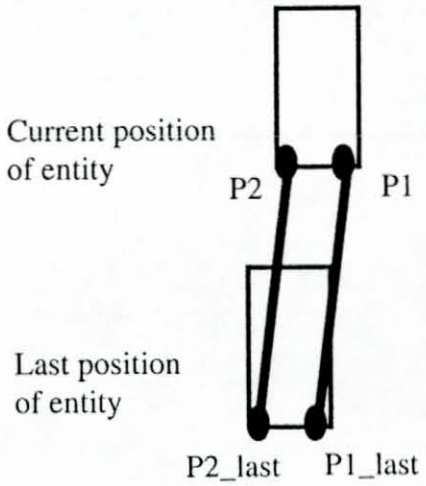


Vehicle Tracks

Used for:
- **Visual Cues***
- **Vehicle Mobility effects**

Based on Instantaneous Track Points
- **P1 and P2 are developed from vehicle CG**
  - ***P1 = M(Vrear) + M(Vside) + CG***
  - ***P2 = M(Vrear) - M(Vside) + CG***
- **Vrear & Vside user-specified parameters**
- **CG determined from ES PDU**
  - **current position**
  - **vehicle type**
- **Tracks laid on path prescribed by P1,P2**

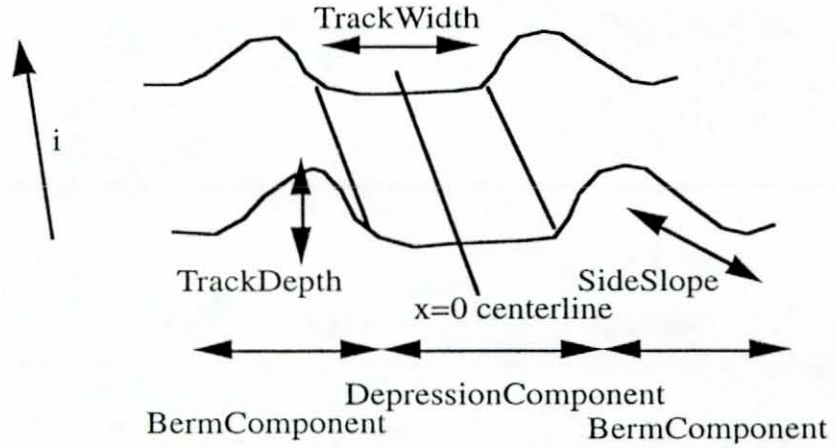




Vehicle Tracks

Either the Depression or Berm component will be active at any given position, x, in the track profile

- ***ElevationOffset(x) = [Depression(x) + Berm(x)] (1 -NormalizedSoilStrength)***
  - **NormalizedSoilStrength: can be derived from DTDB soil parameters**
  - **Track Width: User-specified, vehicle dependent**
  - **Side Slope, Track Depth: User specified**



Vehicle Tracks
Possible Future Extensions

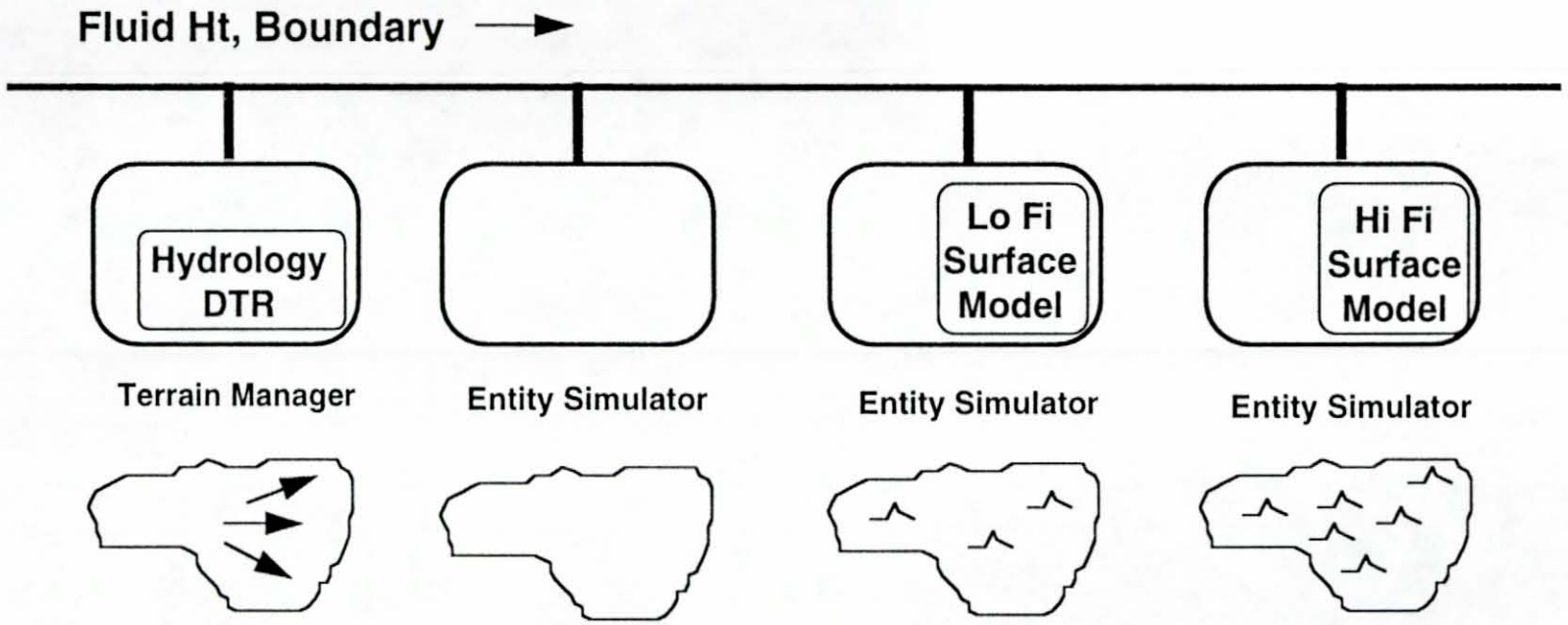
- **Modify Track Depth calculation with more accurate algorithm (i.e., from USAWES)**
- **Can be extended to affect other soil attributes**
  - **Soil Strength**
    - **each vehicle compresses the soil it drives over**
    - **Can change navigable terrain into a NOGO area**
  - **Temperature**
    - **Vehicle passing over terrain can affect soil temperature**
    - **Detected by IR sensors**

Hydrology - Key Attributes

- fluid boundary
- net transport of water
- height
- surface movement
  - wave refraction and reflection
  - more realistic visual cues
  - possible support for sensor effects (EM backscatter)
  - computationally expensive

Hydrology - Approach

- Fluid boundary and general motion calculated by Environment Manager
- Fluid height and boundary information broadcast
- Surface effects calculated locally at each node



Hydrology - Models

- **Fluid flow**
  - Determines general fluid motion and height
  - Based on terrain (dynamic/static)
- **Surface Movement - Low Fidelity**
  - Assumes shallow water
  - Determines fluid surface motion
  - Can calculate boundary changes
- **Surface Movement - High Fidelity**
  - More general (no depth information)
  - Affected by objects in water
  - Can change parameters to represent other fluids (i.e., oil)

Minefields

- **Support multiple types of mines**
  - AT or AP
  - Multiple triggers and warheads
- **Allow for multiple deployments within minefield**
  - Hasty or deliberate pattern
  - Random placement
- **Allow interaction with countermine equipment**
  - Mine Movement: rake, scoop, plow (full or track width)
  - Mine Detonation: flail, chain, rollers

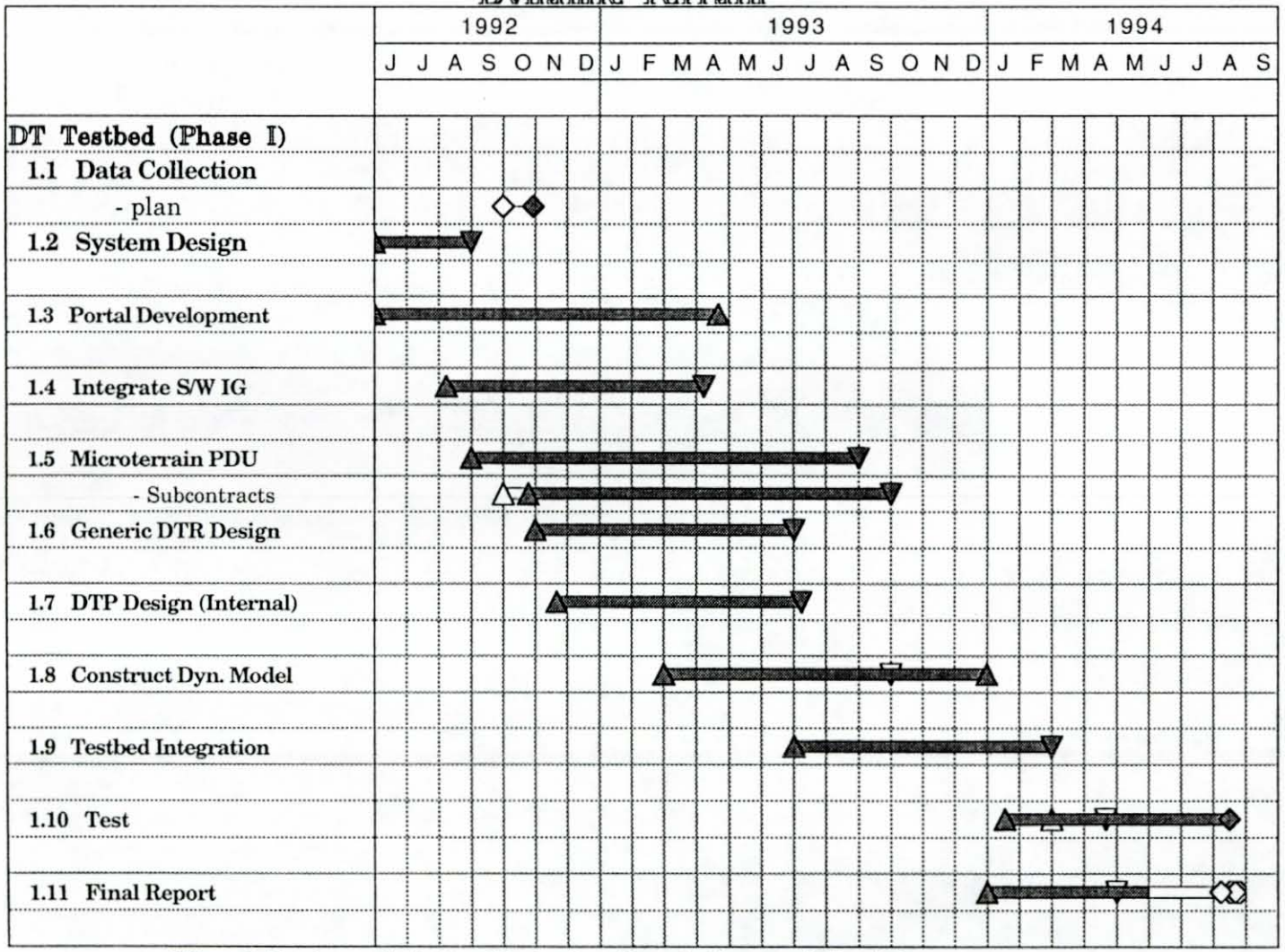
Minefield DTR

- Tracks Vehicles entering minefield
- If mine triggered
  - Send Detonation PDU
  - Generate Crater
- Sends ES PDU (for mine) if
  - Mine moved by countermine device, and
  - Above terrain surface

Dynamic Terrain
Next Quarter Focus

- Complete Vehicle Track Resource Integration
- Develop Hydrology Models into DTR
- Integrate Enhanced Soil Model into DT Testbed
- Complete Minefield DTR
- Continue Dynamic Culture studies
- Begin discussions with Evans & Sutherland to bring DT research into CCTT & CATT
- Submit Papers at 12th DIS Workshop

Dynamic Terrain



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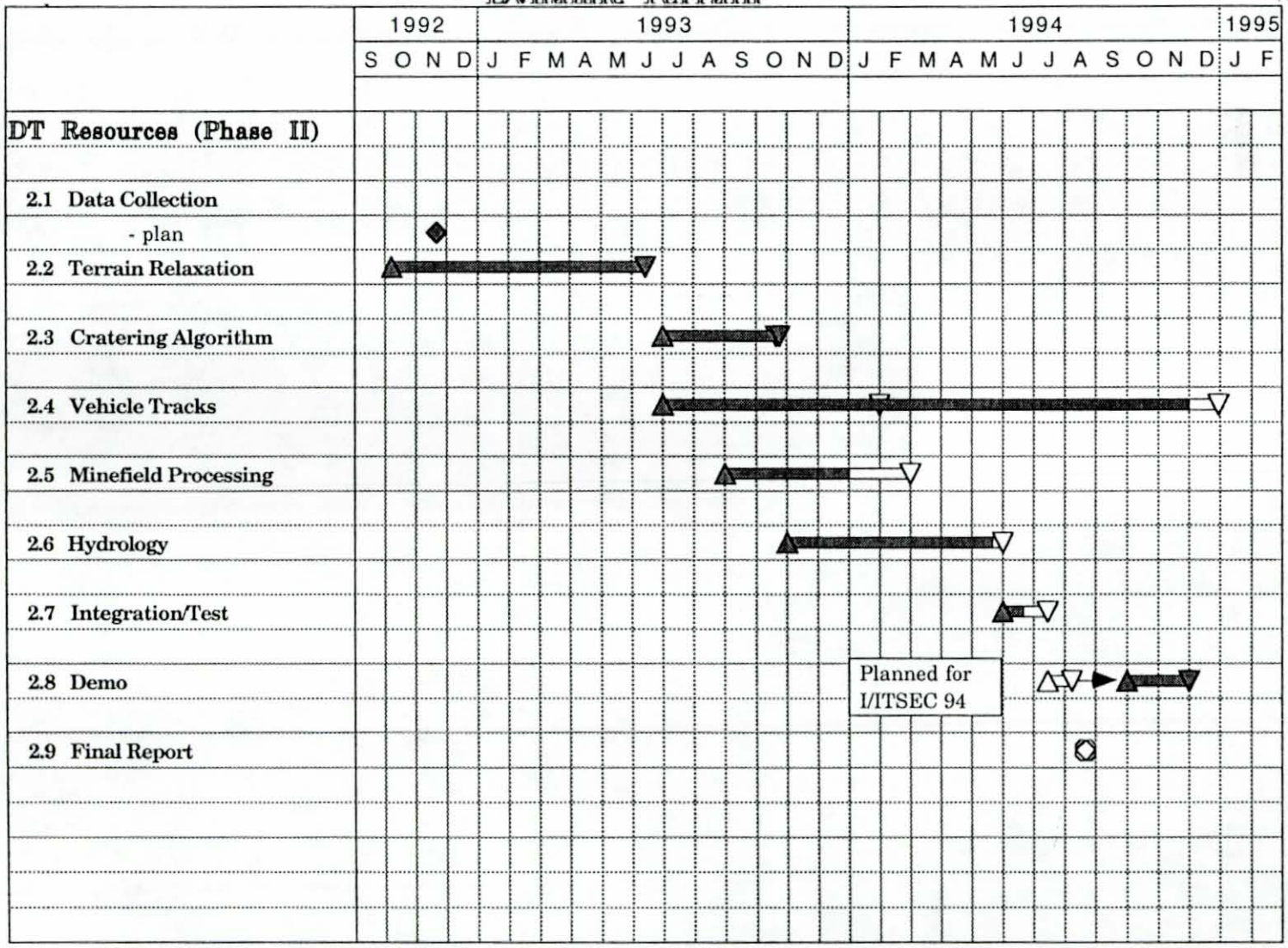
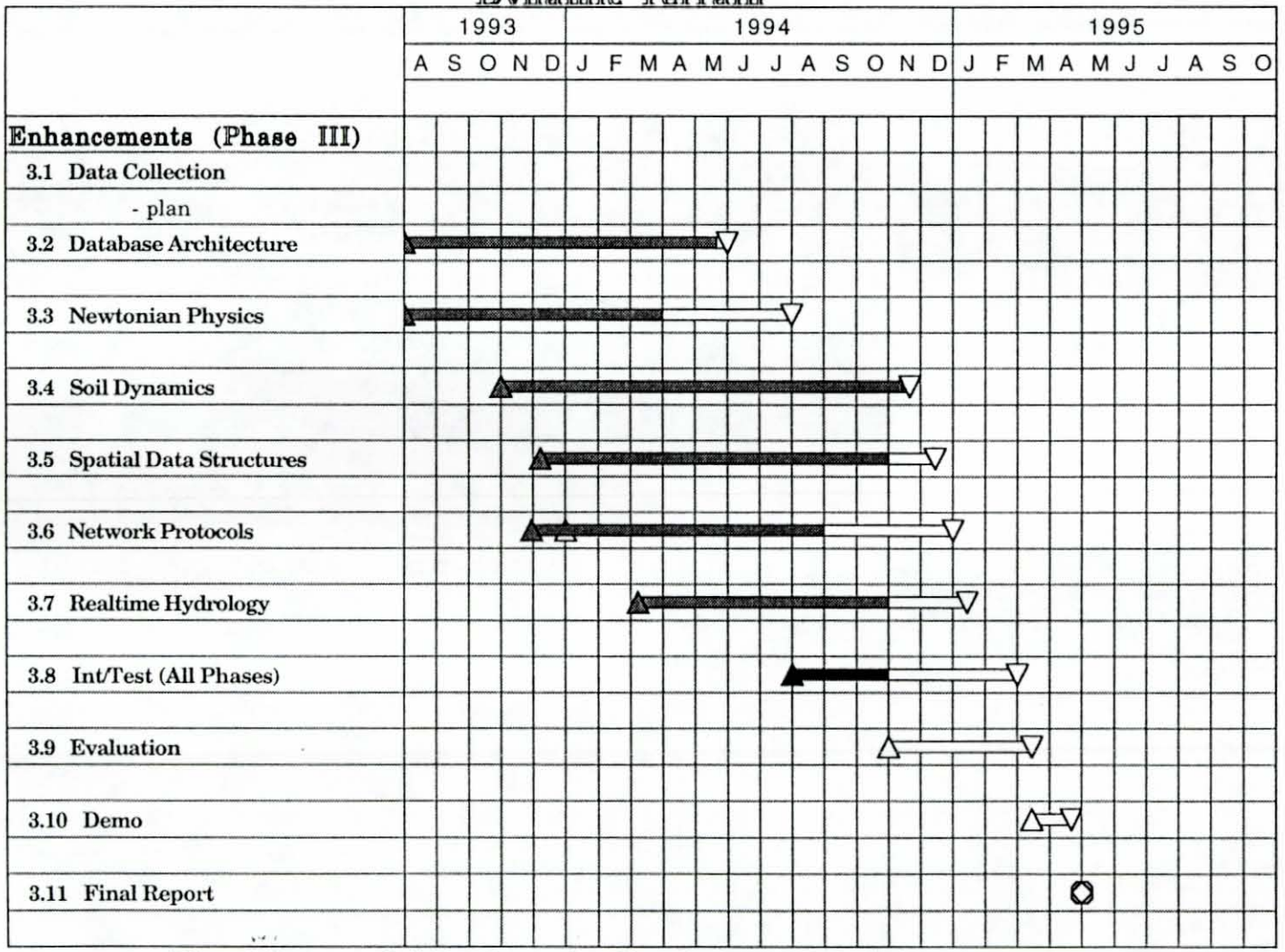
Dynamic Terrain



Dynamic Terrain



Visual Systems Lab/Institute for Simulation and Training

Dynamic Virtual Environments Project

Mark Kilby

Visual Systems Laboratory

Institute for Simulation and Training

Dynamic Virtual Environments Project

Mark Kilby

Visual Systems Laboratory

Institute for Simulation and Training

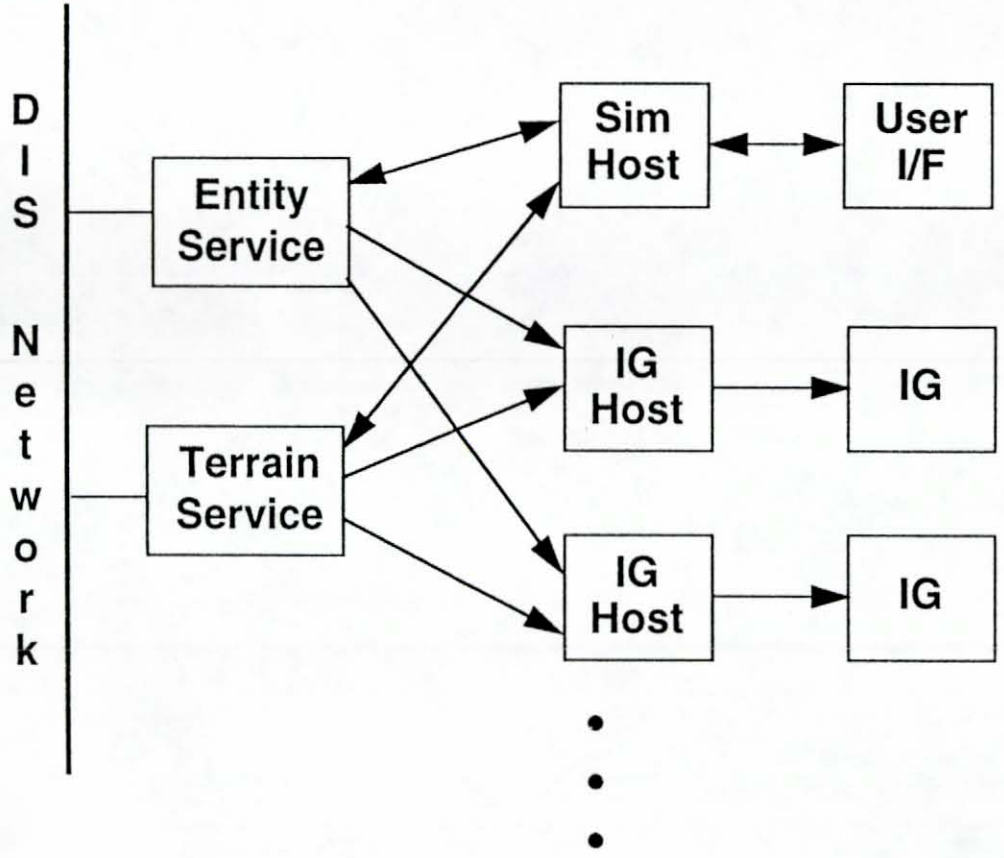
Dynamic Virtual Environments Project
Breacher/Vehicle Simulation

- Goal: Provide a tool to USAES to evaluate simulator requirements for minefield clearing using the Minefield Breacher (i.e., Grizzly with full-width mine plow)
- **Technical Approach:**
  - Modify WES models for real-time simulation
    - Enhanced mobility model
    - Soil Plowing
    - Rut Depth
  - Develop workstation-based simulation of Breacher using these models

Breacher/Vehicle Simulation Design

- Objective: Maintain tight component coupling required by vehicle dynamics while maintaining a modular software design
- Allows greater flexibility in:
  - types and number of visualization systems used
  - types of user interfaces
  - types of vehicle simulated with the same software in future

Breacher/Vehicle Simulation Design

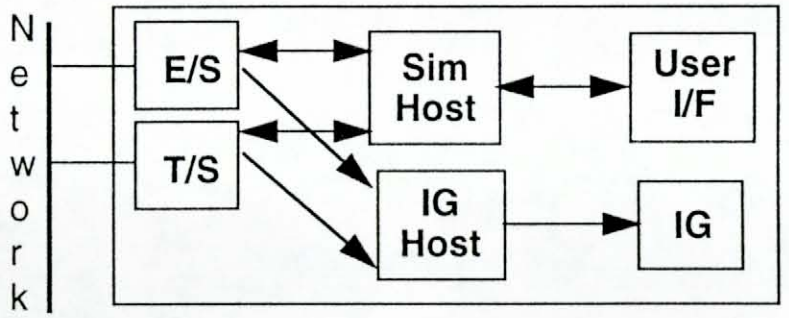


Sim Host
- computes vehicle dynamics and vehicle/environment interactions

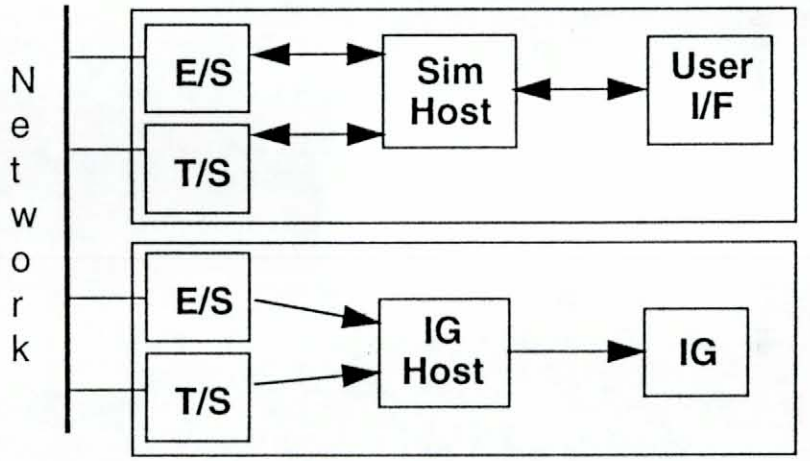
User Interface (I/F)
- support a variety of interfaces
- Graphical, cockpit mockup

IG Host
- monitors changes to environment & entities and transfers to IG
- tailored for a specific IG
- multiple IG/IGHost pairs can be used for same vehicle simulation

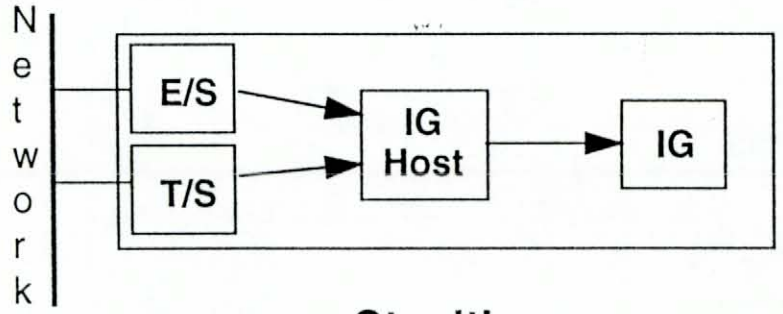
Breacher/Vehicle Simulation
Possible Configurations



Single Processor Vehicle Simulator



Multi-Processor Vehicle Simulator



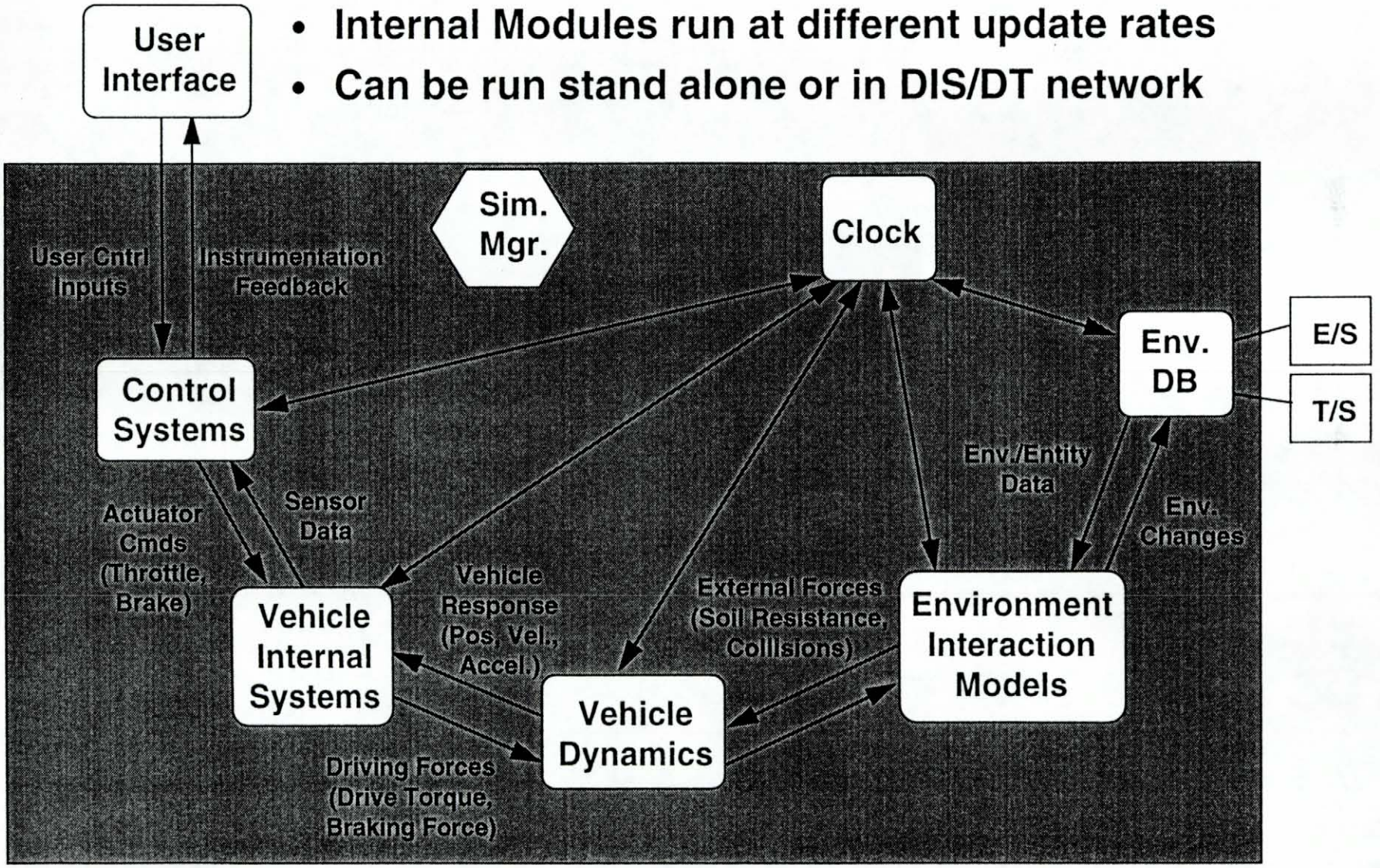
Stealth

T/S = Terrain Service

E/S = Entity Service

Sim Host

- Internal Modules run at different update rates
- Can be run stand alone or in DIS/DT network



Sim Host - Modules

- Control Systems
  - uses driver and sensor inputs for vehicle control models
  - All other control systems (Breacher Blade Control)
- Vehicle Internal Systems
  - Models for all systems that affect vehicle motion (engine, transmission)
  - Also actuators and sensors for driving and other tasks (plowing)
- Vehicle Dynamics
  - 6 DOF model
  - Uses
    - driving forces from Internal Systems
    - reaction forces from Entity and Environment Models

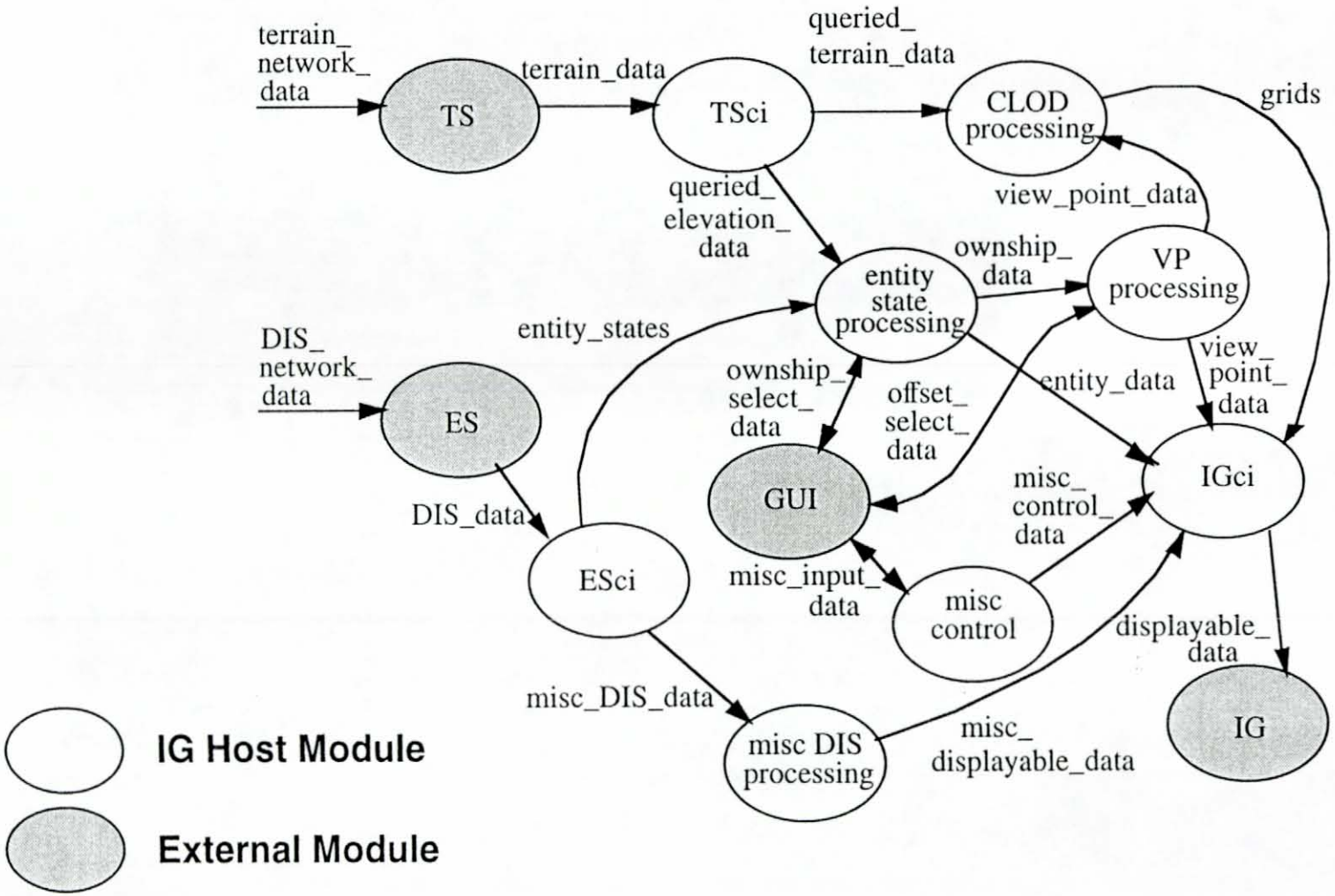
Sim Host - Modules

- Environment Interaction Models
  - Used for all interactions with environment
    - Terrain: Mobility use WES-derived models
    - Vehicles (i.e., Collisions)
- Environment Database
  - Maintains terrain and entity database during exercise
  - Interfaces to services
    - Receive other entity states and terrain changes
    - Transmit Ownship (Breacher) state and terrain changes
- Simulation Manager
  - Initializes other modules
  - Maintains scheduling of modules

Sim Host - Modules

- Clock
  - Allows modules to schedule their update rates
  - Permits higher fidelity modules to update at higher required rate
- User Interface
  - Graphical interface currently
  - Can be adapted to other interfaces (cockpit mockup)

IG Host


terrain_
network_
data
TS
terrain_data
TSci
queried_
terrain_data
CLOD
processing
grids
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elevation_
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ownship_
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VP
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entity
state
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entity_states
DIS_
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data
offset_
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entity_data
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GUI
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control_
data
DIS_data
ESci
misc_input_
data
misc
control
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data
misc_DIS_data
misc DIS
processing
misc_
displayable_data
IG
IG Host Module
External Module

IG Host - Modules

- **Terrain Service Client Interface (TSci)**
  - Interacts with Terrain Service
  - Receives terrain changes from DIS network
- **CLOD Processing**
  - Receives terrain change data from TSci
  - Generates new terrain surface for IG based on changes and current viewpoint location
- **Entity Service Client Interface (ESci)**
  - Interacts with Entity Service
  - Directs Entity State data to Entity State Processing
  - Directs non-entity DIS data for Misc. DIS Processing

IG Host - Modules

- **Entity State Processing**
  - Generates appropriate IG commands to visualize entities
  - Also generates ownship viewpoint information
  - Reads data from TSci for terrain clamping
- **IG Client Interface (IGci)**
  - Converts data and commands from other modules into IG-specific commands
- **Viewpoint (VP) Processing**
  - determines viewpoint for IG channel
  - Switch between multiple viewpoints (user defined)
    - Vehicle Driver
    - Commander
    - Stealth

IG Host - Modules

- **IG Graphical User Interface (GUI)**
  - Controls viewpoint, effects (fog, time of day)
  - Only visualization controls
- **Miscellaneous Control**
  - reads user inputs from GUI
  - converts commands for IGci
- **Miscellaneous DIS Processing**
  - Handles all non-entity events (collisions, detonations)

Dynamic Virtual Environments Project
Progress in Last Quarter

- **Design of Breacher Simulation Completed with Implementation near completion**
  - **Lack of vehicle characteristic and performance data restricted fidelity of design**
  - **Modular approach will permit simulation of other vehicles**
- **Integrated WES Mobility models**
  - **Vehicle (Grizzly) motion affected by**
    - **Soil type** — **- Slope**
    - **Soil Strength** — **- Depth of Plow Blade**

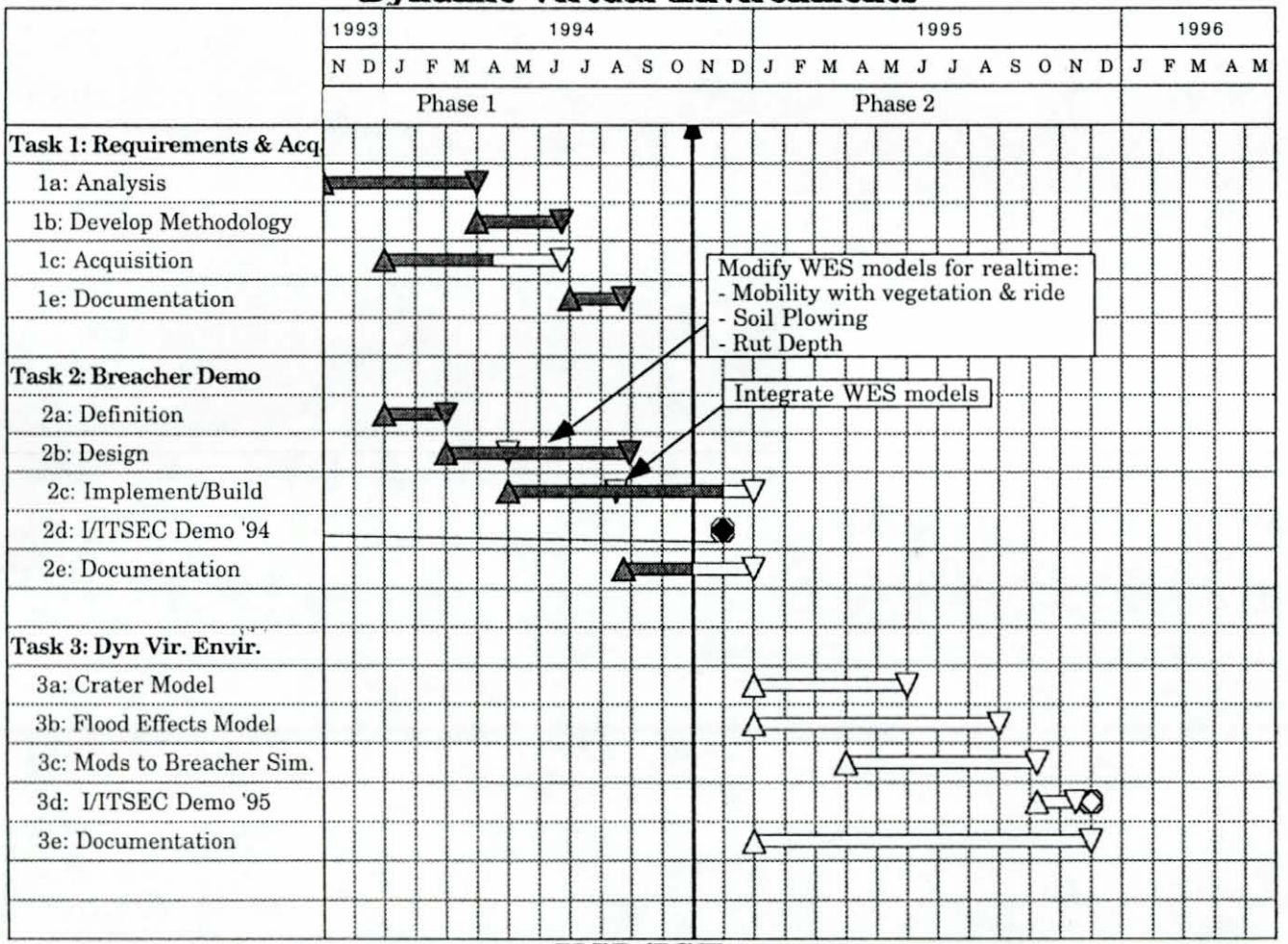
Dynamic Virtual Environments Project
Progress in Last Quarter

- Demonstration of Breacher Simulation at I/ITSEC 94
  - Mobility
  - Minefield Plowing
- Analysis of physical model portability completed by Dr. Moshell (under internal review)
- Discussion with WES Hydrology Lab on Phase II funding
- Discussion with WES Geotechnical Lab on Mobility Model development and validation

Dynamic Virtual Environments Project
Next Quarter Focus

- **Complete Implementation of Breacher Simulation**
- **Present work at 12th DIS Workshop**
- **Begin Phase II**
  - **WES Flood Effects Models**
  - **WES Crater Models**
  - **AWAITING PHASE II FUNDING**

Dynamic Virtual Environments



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