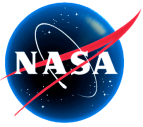# AIST Program Overview

Presented to:
AIST Technology Projections Workshop - 2002
January 9-10, 2002

Steven A. Smith

steven.a.smith@gsfc.nasa.gov
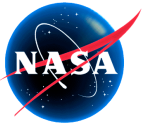
ESTO

Agenda

- AIST Background
- AIST Strategic Planning Process
  - First Cycle
    - Capability/Needs (CN) Database
    - AIST Investments & Analysis
  - Second Cycle
    - AIST Technology Projections
    - Key Ground\Space Investments & Themes
    - CN Weighting & Results
    - Investment Gap Analysis
  - Third Cycle
    - Technology Projections Workshop
    - AIST FY03 NRA
    - AIST Prototyping System (APS) Broad Agency Announcement (BAA)
- Summary
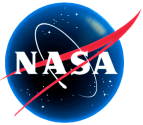
AIST Background

- AIST Request for Information and Workshop — June 1999
  - Produced a broad sweep of relevant information technologies for ESE
  - Results organized into AIST Capability/Need (CN) database

- AIST Space-based Technologies NRA Selections — April 2000
  - By Dec. 2000, all awards were in place
  - Just completing first Annual Reviews for all 30 activities

- AIST Technology Projections Workshop — August 2000
  - Resulted in AIST Key Ground and Space-Based Investment Themes

- AIST Technology Investments and Gap Analyses
  - Mapped investment themes to CN database to weight technology needs
  - Mapped Baseline Measurement Profile Study ("Easton Report" modulated by the Centers) to CN database to weight technology needs
  - Mapped NRA and Prototyping investments to the CN database to identify initial technology investment gaps
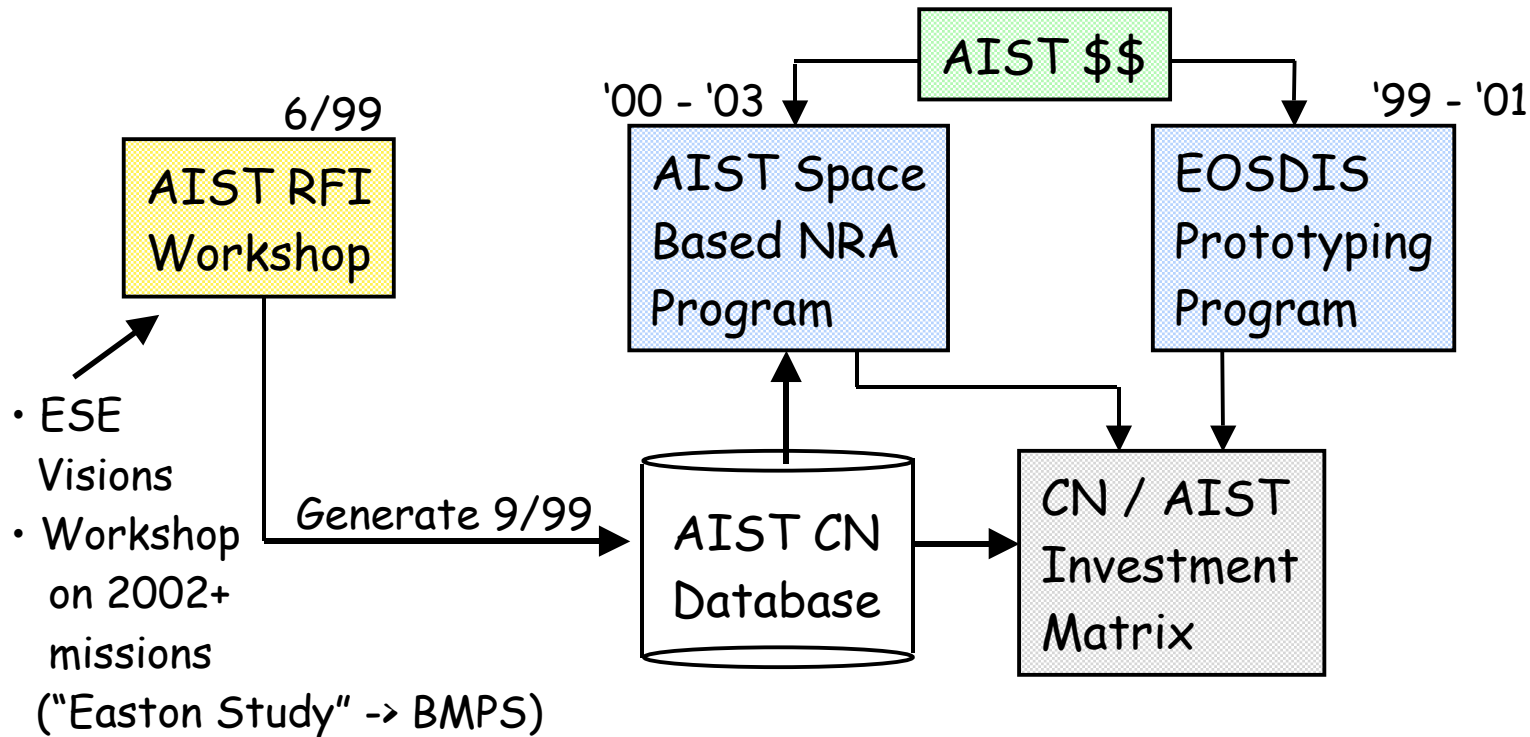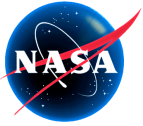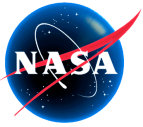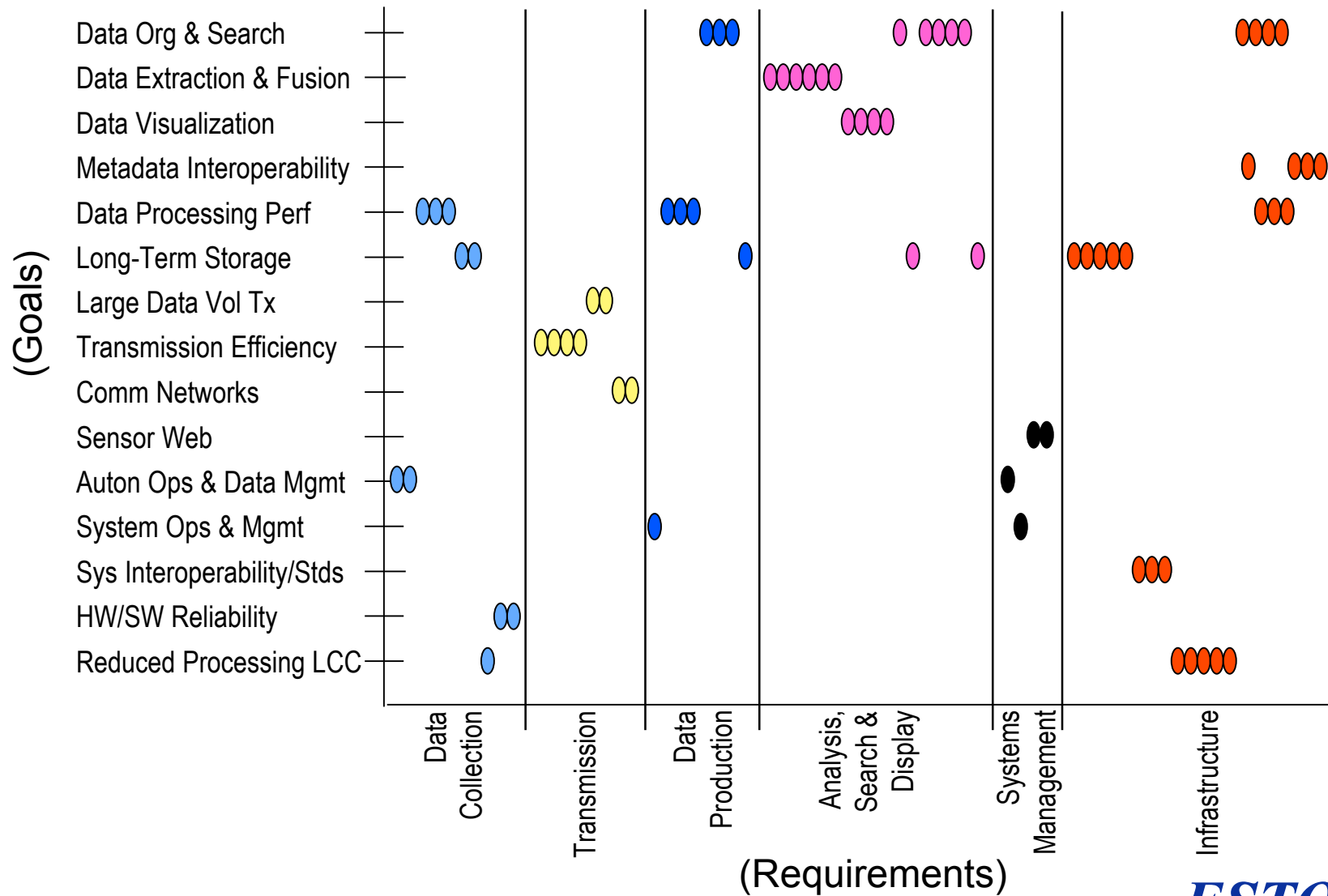
Capabilities/Needs Database

Derivation

- September 1999, initial version of the ESE Information systems needs were developed for the ESTO Capability/Needs (CN) Database based on the AIST RFI Workshop (June 1999) results report and embellishments from
    - ES Vision technology workshops of Spring 1999
    - AIST sponsored NewDISS technology study interim results
    - High level considerations for Digital Earth

- 6 functional "Needs" (from the AIST RFI categories)
    - Data Collection
    - Transmission
    - Data & Information Production
    - Analysis, Search and Display
    - Systems Management
    - Infrastructure

Capabilities/Needs Database Summary

(Goals)

- Data Org & Search
- Data Extraction & Fusion
- Data Visualization
- Metadata Interoperability
- Data Processing Perf
- Long-Term Storage
- Large Data Vol Tx
- Transmission Efficiency
- Comm Networks
- Sensor Web
- Auton Ops & Data Mgmt
- System Ops & Mgmt
- Sys Interoperability/Stds
- HW/SW Reliability
- Reduced Processing LCC

(Requirements)

- Data Collection
- Transmission
- Data Production
- Analysis, Search & Display
- Systems Management
- Infrastructure

AIST TECHNOLOGY INVESTMENT MAP
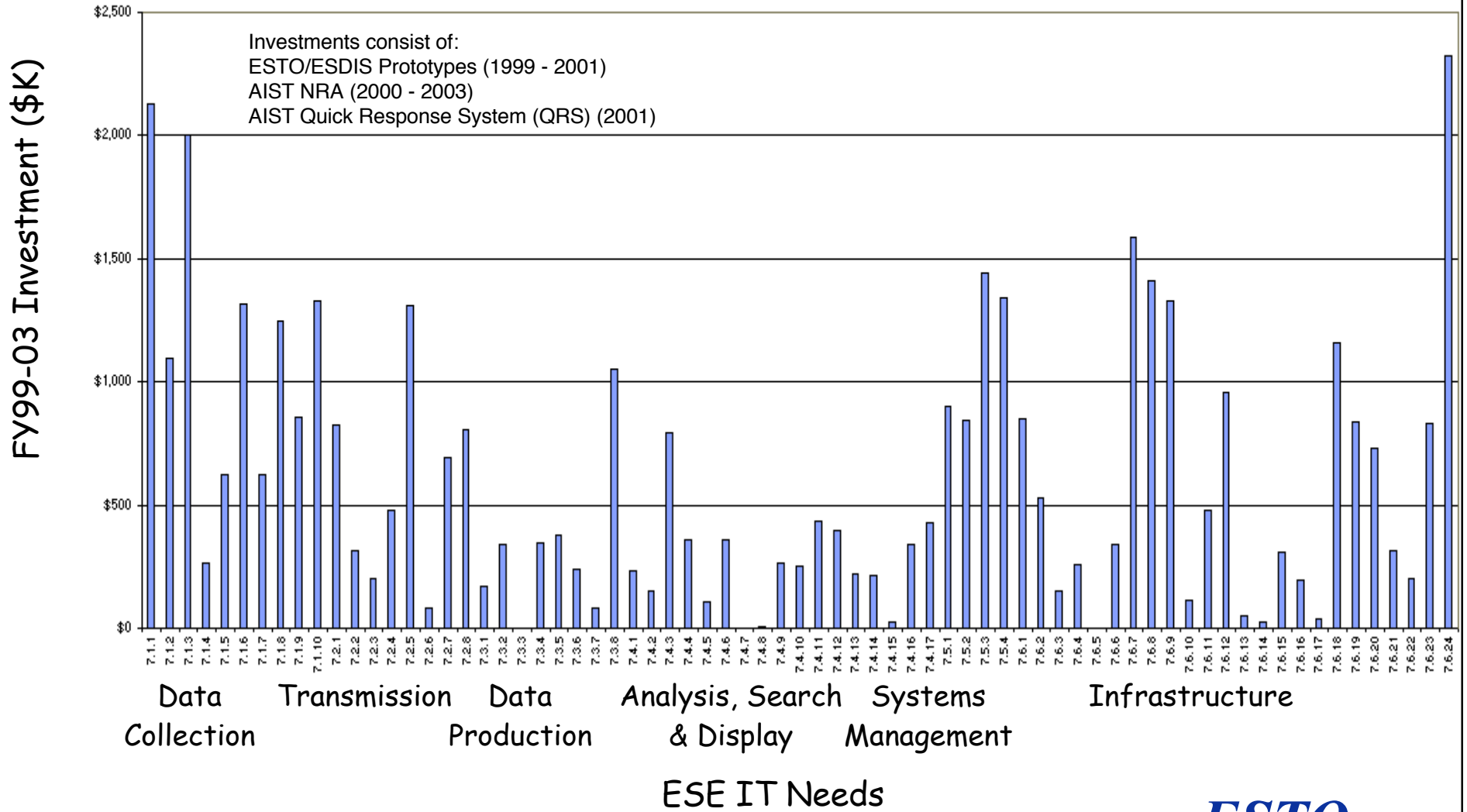
Investments consist of:
ESTO/ESDIS Prototypes (1999 - 2001)
AIST NRA (2000 - 2003)
AIST Quick Response System (QRS) (2001)

ESE IT Needs

Data Collection   Transmission   Data Production   Analysis, Search & Display   Systems Management   Infrastructure

AIST Strategic Planning Process - 2nd Cycle

AIST $$

'00 - '03

'99 - '01

6/99

AIST RFI Workshop

AIST Space Based NRA Program

EOSDIS Prototyping Program

Community Input
- **ESE Visions**
- **New Missions**
- **NewDISS**
- **Etc.**

Generate 9/99

Refine 12/00

AIST CN Database

CN / AIST Investment Matrix

- Next NRA
- Quick Response Calls

AIST Technology Gap Analysis

8/00

Technology Projections Workshop

Ground

Space Investment Roadmaps

CN / BMPS Weighting Matrix

Generate 2/01

- Stakeholder Reviews

- New Mission Formulation

AIST Technology Projections

- AIST Technology Projections Workshop held August 2000

  - Purpose was to identify relevant IT technologies that are the most important for ESE to fund

  - Workshop structured to develop informed projections for 8 critical   technology areas:

  - Technical and ESE program specialists brought together to assess scope of projections, and technology "need" summary (some performance, cost and schedule data collected)

- Large Archival Storage	- Space Based Computing Architecture
- Data Discovery	- Data Compression and Storage
- Data Exploitation	- Intelligent Platform and Sensor Control
- Data Architectures	- High Speed Data Delivery

Ground-based Technologies   Space-based Technologies

AIST Key "Ground" Investment Themes

2001   2002   2003   2004   2005   2006   2007   2008   2009   2010   2011

Earth Science Data & Services Representation

- Research Code for Limited Semantic Extraction
- OGC Participation

Basic Earth Science Information Representation

"Living" Data Lineage Technique

Effective Knowledge Representation

Earth Science Interoperable Data & Services Framework

Independent Tool Sets

Component-based Framework with Pilot Tool Sets

Component-based Framework with Comprehensive Open Tool Sets

Knowledge Extraction

Research Code for Limited Knowledge Extraction / Change Detection

Pilot Extraction Tool Set

Automatic Change Detection & Task Initiation for Sensor Webs

Information Access and Delivery

Independent Subscriptions/ OGC-WMT participation

Partner on URN Technology

Real-time Event Recognition & Products on Demand

Adaptive / Customized Subscription / Advertising Services

High-Performance Evolvable Archives

- Proprietary FSMS
- ANSI MS66 Metadata Interoperability Standard

Swath DBMS

Advanced Media Benchmarks
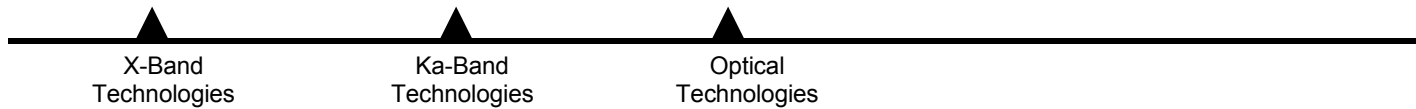
High-Performance Evolvable FSMS

Data Product Planning & Scheduling

Stand-Alone Tools

Dynamic Representation of Resource Capabilities (archives, processors, networks)

Unified Scheduling Architecture

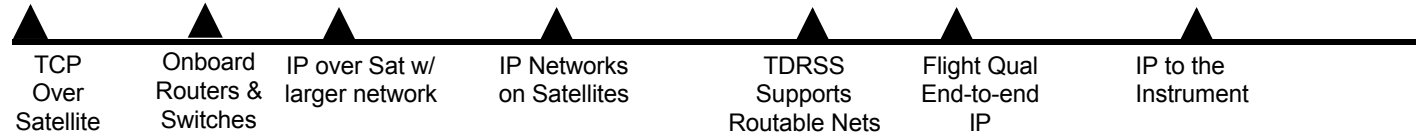Resource Manager Learns and Improves on Performance Estimates (predict & manage)

AIST Key "Space" Investment Themes
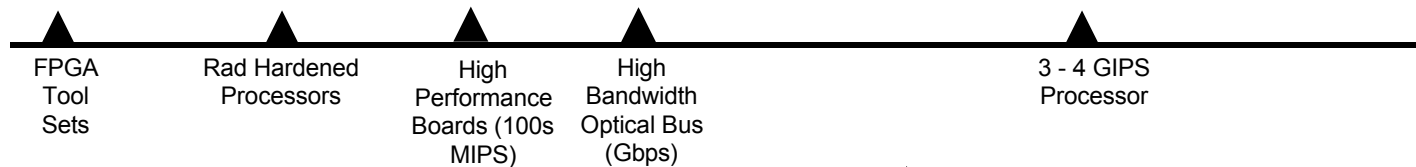
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

High Data Rate Communication

- X-Band Technologies
- Ka-Band Technologies
- Optical Technologies

Satellite IP Network

- TCP Over Satellite
- Onboard Routers & Switches
- IP over Sat w/ larger network
- IP Networks on Satellites
- TDRSS Supports Routable Nets
- Flight Qual End-to-end IP
- IP to the Instrument

Microprocessor, Board and Bus Technology

- FPGA Tool Sets
- Rad Hardened Processors
- High Performance Boards (100s MIPS)
- High Bandwidth Optical Bus (Gbps)
- 3 - 4 GIPS Processor

Lossless & Lossy Data Compression

- 20 Msps ~ 2:1 Comp Ratio
- JPEG Lossy Comp
- 80 Msps 2:1 Comp Ratio
- ROI Lossy Comp
- 80 Msps 3:1 Comp Ratio
- High Performance Feature Identification for Preferential Compression
- 220 Msps 5:1 Comp Ratio
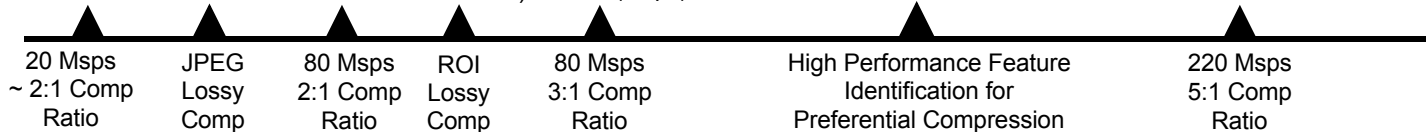
Onboard Storage Architecture

- Solid State
- Magnetic/Optical Hybrid Planar 0.002 bits/μm^3 300 Mbits/sec
- Volumetric/Optical 1st Generation 0.05 bits/μm^3 500 Mbits/sec
- Volumetric/Optical 2nd Generation 0.1 bits/μm^3 1 Gbits/sec
- Volumetric/Optical 3rd Generation 0.2 bits/μm^3 2 Gbits/sec
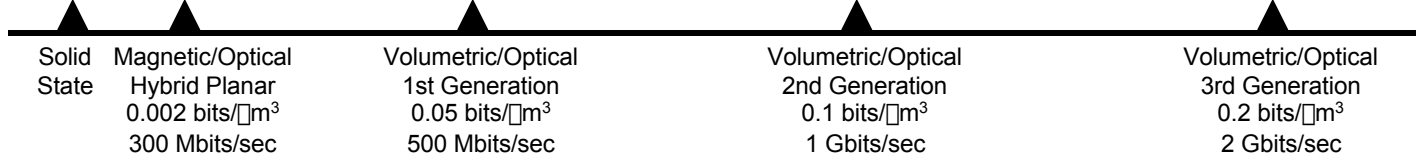
Intelligent Platform & Sensor Control

- Remote Agent Arch for single autonomous spacecraft
- Experimental Arch for multiple autonomous spacecraft (~3)
- Experimental Reference Arch for multiple autonomous spacecraft (~5)
- Agent-based Reference Arch for multiple autonomous spacecraft (~50)

Navigation Technologies
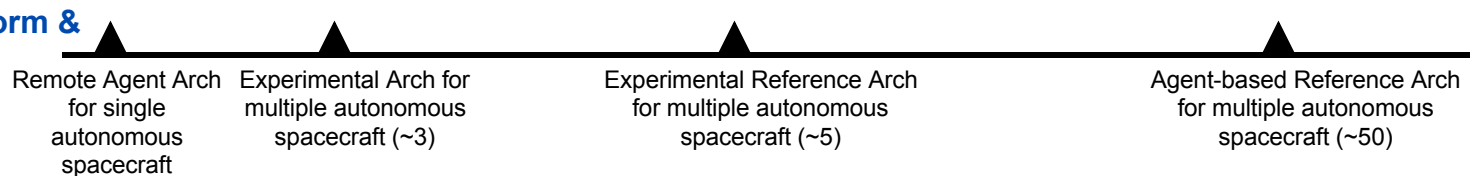
- Onboard GPS tracking
- Differential GPS and Lidar Systems
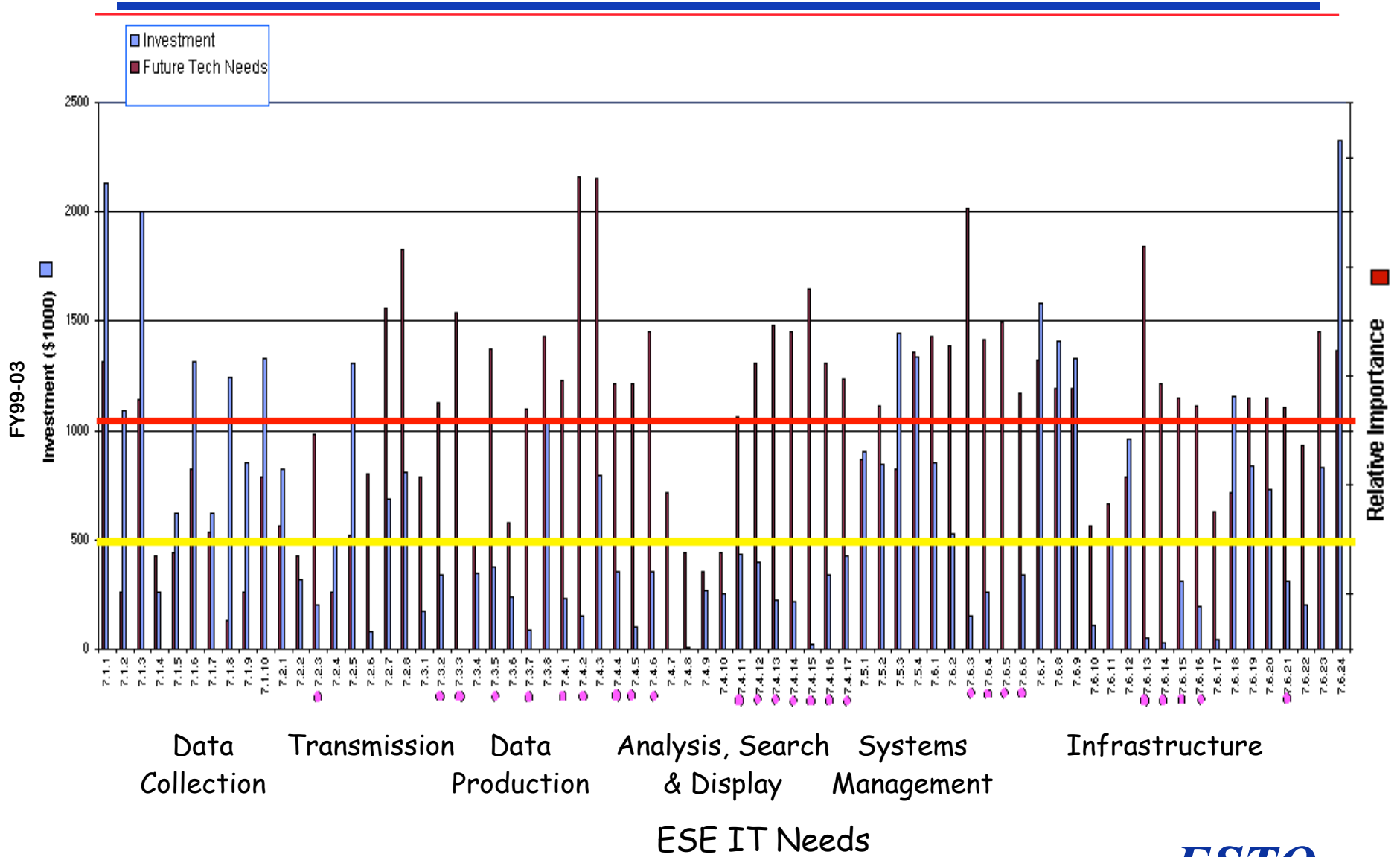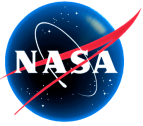- Self-calibrating nav systems
- High precision control of cluster satellites
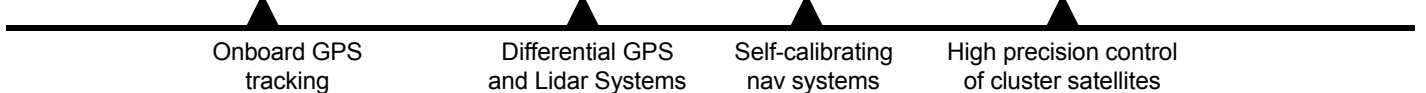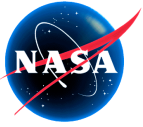
AIST CN Weighting Results

AIST Investment Gap Analysis

ESTO

Earth Science Technology Office 13
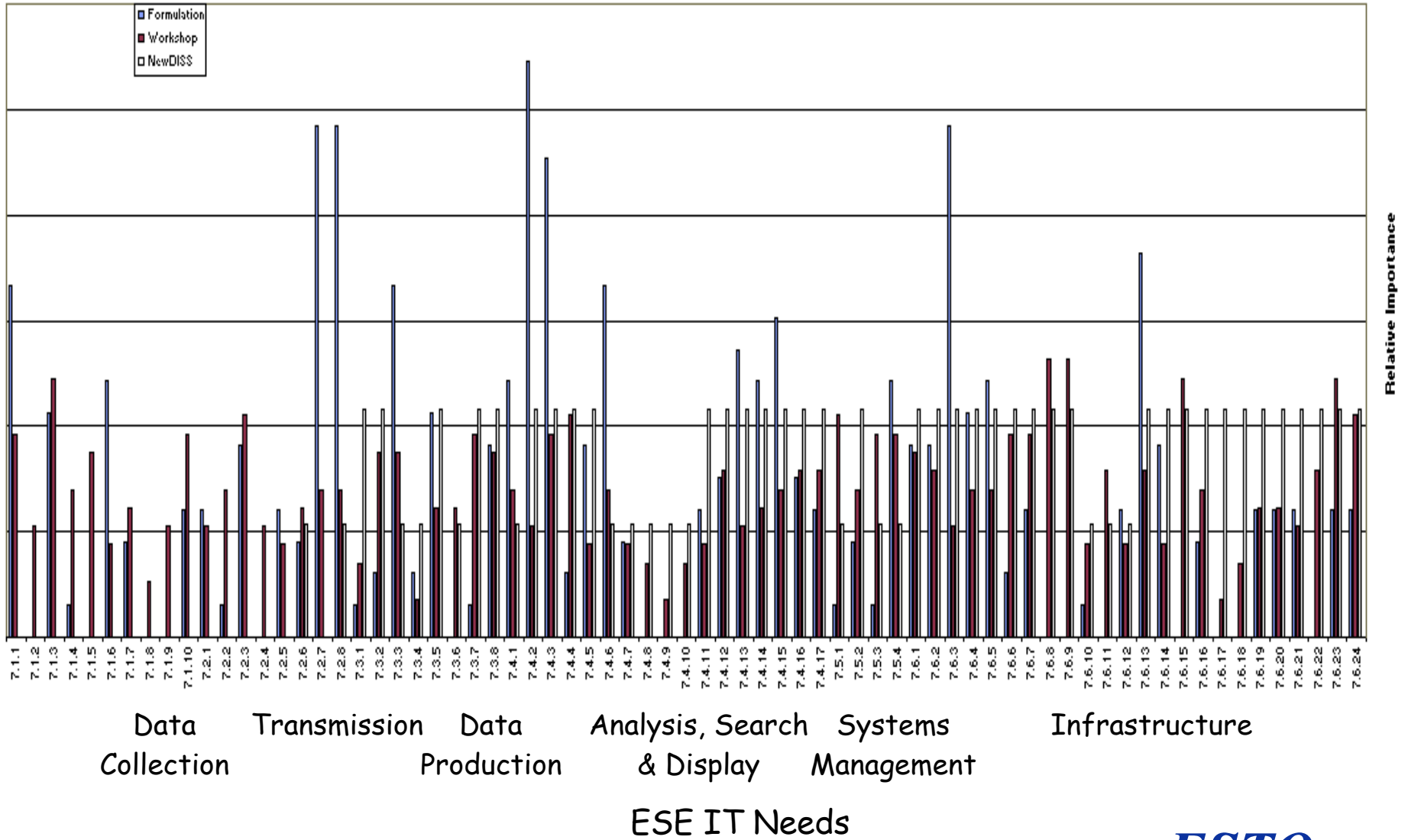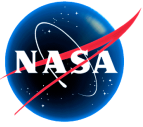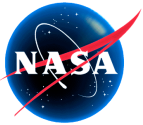
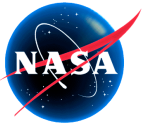# AIST Strategic Planning Process - 3rd Cycle
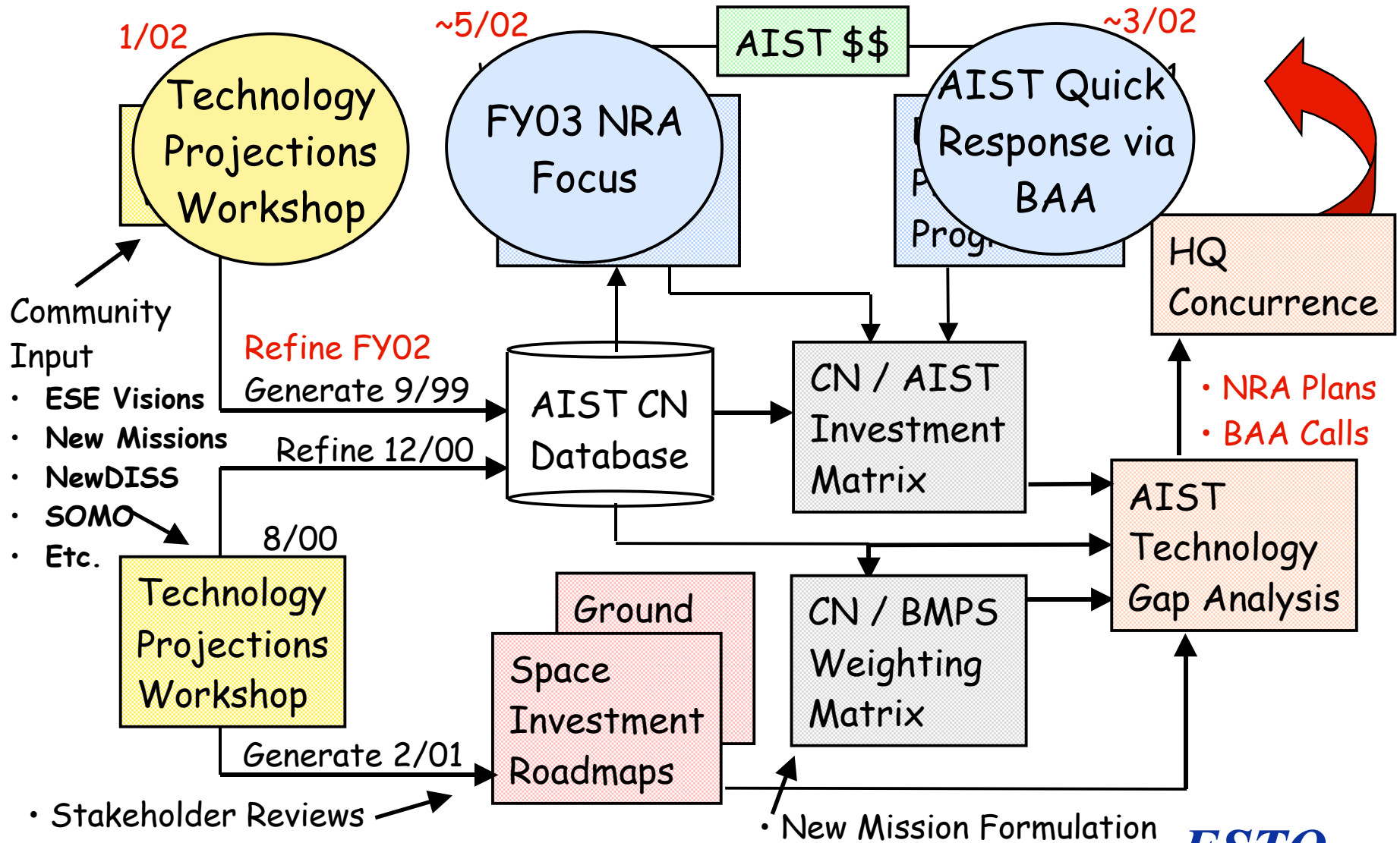
AIST Technology Projections Workshop

- January 9-10, 2002 workshop to refine technology needs and projections using the products from previous workshops:
  - AIST Needs database
  - AIST Investment Themes

- Workshop divided into two panels:
  - Missions-User Driven Technology Panel
  - Data-User Driven Technology Panel

- Panel membership comprised of representation from:
  - ESE missions in formulation or planning
  - NewDISS
  - Current AIST funded PIs
  - Current SOMO funded PIs

- Output will consist of needs database, investment themes, and updated roadmaps with currently planned missions, SOMO, and NewDISS IT requirements considered.

ESTO
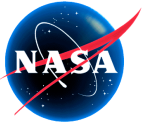
AIST FY03 NRA Highlights

- NRA will be issued at HQ

- Source selection official will be OES AA

- Solicitation planned to be released in May 2002
  - Earliest awards (NASA Centers) will occur in January 2003

- Awards anticipated to be in the $300-500K/year range, for up to three years

AIST Prototyping System (APS) BAA Highlights

- Goals
  - Complement the NRA process for filling technology gaps
  - Leverage dynamic information technology environment
  - Reduce acquisition time from 16 months (worst case AIST experience) to 4 months

- Approach
  - 5 year BAA sets the guidelines for competition issued at Center
  - Solicitations to fill technology gaps are presented to HQ for concurrence before release and award
  - Peer-review, selection & award managed at Center/ESTO

- Mechanics
  - Use ESTO e-Books to manage solicitation & award process
  - 2 to 4 solicitations per year
  - Period of performance < 24 months; awards from $50 - $300K/year
  - Yearly awards averaging < $1.5M/year (10% of AIST budget)

Summary

- AIST Technology Projections Workshop January 9-10, 2002

- BAA issued circa March 2002

- FY03 NRA solicitation to be released May 2002