Systems for Chemical Countermeasures

(HSARPA RA 03-01)

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Homeland Security

Outline

- Overview
- TTA-3: Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)
- TTA-4: Lightweight Autonomous Chemical Identification System (LACIS)
- TTA-5: Portable High-throughput Integrated Laboratory Identification System (PHILIS)

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White Paper Guidance

- Preliminary Description of System Concept
  - Provide Basis for Technology Selection
  - Identify Key Technical Challenges
  - Include Preliminary Description of System Characteristics
- Preliminary Estimates of Performance Relative to Goals
  - Preliminary Estimate of Sensitivity
    - Plan for Validating Sensitivity for Full Range of Potential Threats
- Preliminary Estimates of Cost of Ownership
  - Estimate of Unit Cost
  - Estimate for Operation Including Consumables

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Proposal Guidance

- Provide Description of System Concept
  - Provide Basis for Technology Selection
    - Include Technical Evaluation of Alternate Strategies
  - Provide Plan for Resolution of Key Technical Challenges
  - Provide Preliminary Description of the System Characteristics for both the Laboratory (Phase II) and Field (Phase III) Prototypes
- Provide Analysis of Performance Relative to Goals
  - Estimate of Sensitivity for Full Range of Potential Threats
    - Plan for Validating Sensitivity for Full Range of Potential Threats
  - Estimate of and Plan to Validate f_n and f_p Performance
  - Estimates of Cost of Ownership
    - Include Detailed Estimate for Operations Including Consumables
    - Enumerate Anticipated Differences in Laboratory (Phase II) and Field (Phase III) Prototypes

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Deliverables

- Phase I PDR for both Laboratory and Field Prototypes
  - Analysis of Performance Relative to Goals
  - Enumerate Differences in Performance for Laboratory (Phase II) and Field (Phase III) Prototypes
    - Provide Plan for Migration from Laboratory to Field Prototype
- Performance Targets
  - Validate Sensitivity
    - Include Validations/Calculations for full Range of Potential Threats
  - Provide Scientifically Credible Validation of P_{fa} Performance (TTA-3&4)
  - Provide Scientifically Credible Validation of Sample Throughput (TTA-5)
  - Provide Estimates of Cost of Ownership
    - Must Include Detailed Estimate for Operation Including Consumables

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Funding

- Multiple Phase I Awards Anticipated in each TTA
- Anticipated **Upper** Value of Phase I Awards
  - Proposals will be Evaluated for Cost Realism
  - Proposals will be Selected Based Upon Best Value to the Government
  - TTA-3 ARFCAM $ 1.0M / 9 months
  - TTA-4 LACIS $ 0.6M / 12 months
  - TTA-5 PHILIS $ 0.3M / 9 months
- Multiple Phase II/III Awards Possible in each TTA

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Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)

System Description

- "Detect-to-Warn" System
- Continuous Facility Monitoring
- Chemical Warfare Agents (CWAs) and high priority Toxic Industrial Chemicals (TICs)
- Fully autonomous, capable of detecting dangerous levels (IDHL & PEL) of these chemicals with a response time that provides sufficient warning to enable effective protection by limiting exposure

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ARFCAM Proposal Evaluation

System Characteristics

- Details for preventative maintenance, operational limits (time, temperature, vibration, and humidity), footprint, and utilities requirements must be provided
- Cost of ownership must be derived and defended with preliminary laboratory data

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ARFCAM Performance Goals

- Continuous, Fully Autonomous Operation
- Broad Compound Coverage: > 20 Analytes
  - TICs and CWAs
- Detection Range Spanning IDHL (≤ 1 min) and PEL (≤ 15 min)
- System False Alarm Rate
  - f_n < 5%
  - f_p < 1/year
- Preventative Maintenance Cycle > once/six months

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ARFCAM Proposal Evaluation

Performance Goals

Details must be provided for: sample collection, sample preparation, sample analysis protocol (including: standards – frequency and identity, sensitivity, accuracy, precision, and analyte capacity), waste handling, sample storage, **response times versus detection level plots**, and false positive and false negative performance against the target set of analytes supplied.

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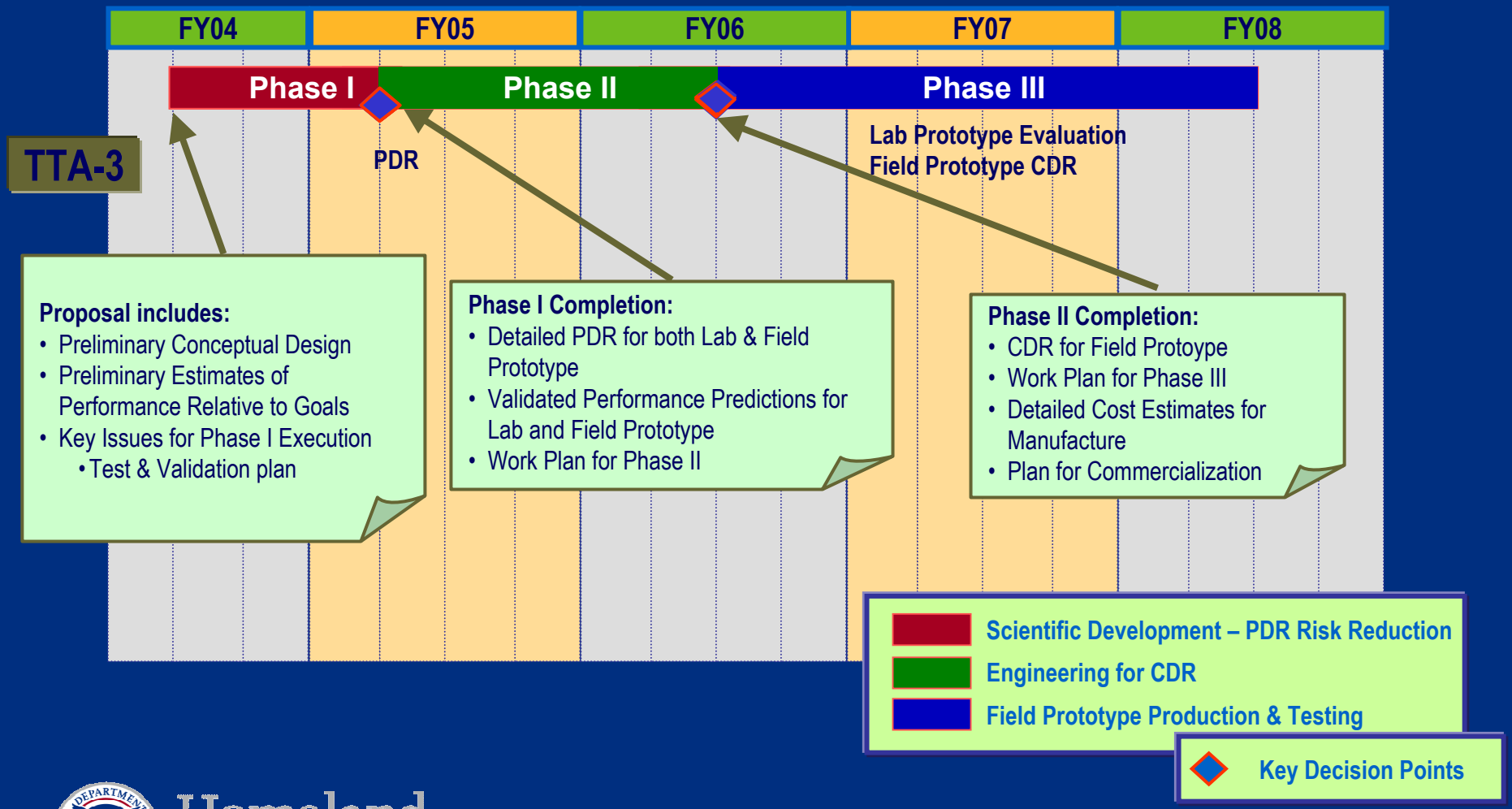
Notional Program Schedule



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Lightweight Autonomous Chemical Identification System (LACIS)

System Description

- Fully Autonomous
- Hand Portable
- CWAs and High Priority TICs Analytes
- LOD ~ 1 PEL w/in 2 minutes
- Scene Control Unit (SCU)
  - Robust wireless reporting
  - ≥ 10 LACIS / SCU

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LACIS Notional View

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LACIS - System Characteristics

The unit should have a robust wireless network capability to a central scene control unit (SCU) which simultaneously provides operational state and system status for a minimum of ten detectors

- Consumables: only commercial batteries
- Cold start: fully operational in < 10 min
- Unit size
  - Mass - 5.0 lbs. or less
  - Volume - 0.50 cubic feet or less

LACIS System Goals

Proposal

- Details for preventative maintenance, operational limits (time, temperature, vibration, and humidity), footprint, and utilities requirements must be provided. Detailed list of all consumables required by the system, including suggested lifetimes for each. Details related to the interface of the sensor unit with the wireless SCU, including full specifications for spectrum, protocol, and likely interferences
- Cost of ownership must be derived and defended with preliminary laboratory data

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LACIS Performance Goals

Proposal

- Details must be provided for: sample collection, sample preparation, sample analysis protocol (including: standards – frequency and identity, sensitivity, accuracy, precision, range, and analyte capacity), waste handling, sample storage, response times versus detection level plots, and false positive and false negative performance against the target set of analytes supplied.

LACIS Performance Goals

- $N_a \geq 20$ *
- $T_d^{PEL} \leq 2$ min
- $f_n \leq 1$ in 1,000
- $f_p \leq 1$ in 100

* TICs and CWAs

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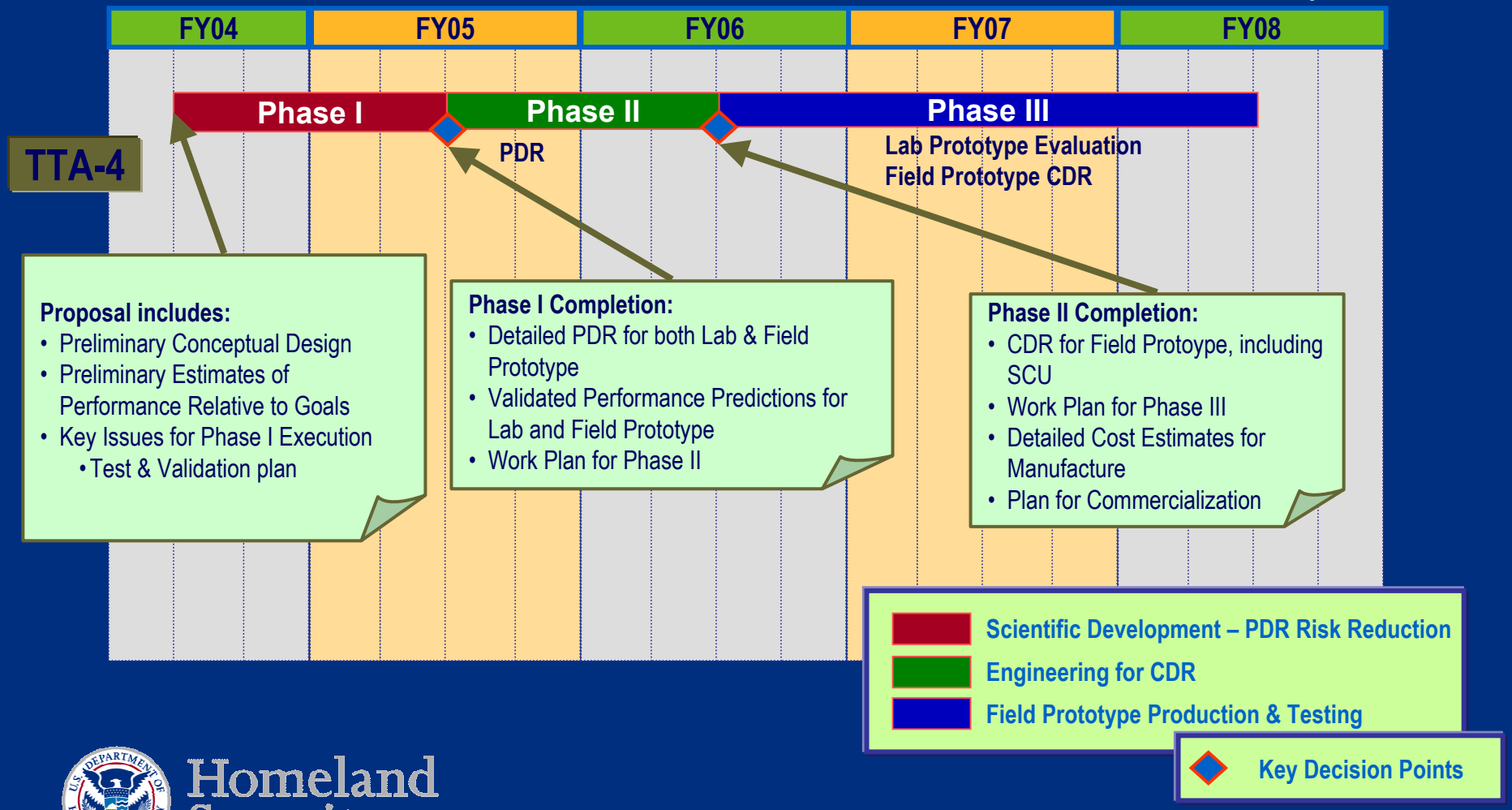
Notional Program Schedule

Bidders are encouraged to provide accelerated schedule if possible



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"The most important mission for the Science and Technology Directorate is to develop and deploy cutting edge technologies and ***new capabilities****, so that the dedicated men and women who serve to secure our homeland can perform their jobs more effectively and efficiently (now and in the future)."*

Under Secretary for S&T, McQueary

May 21, 2003

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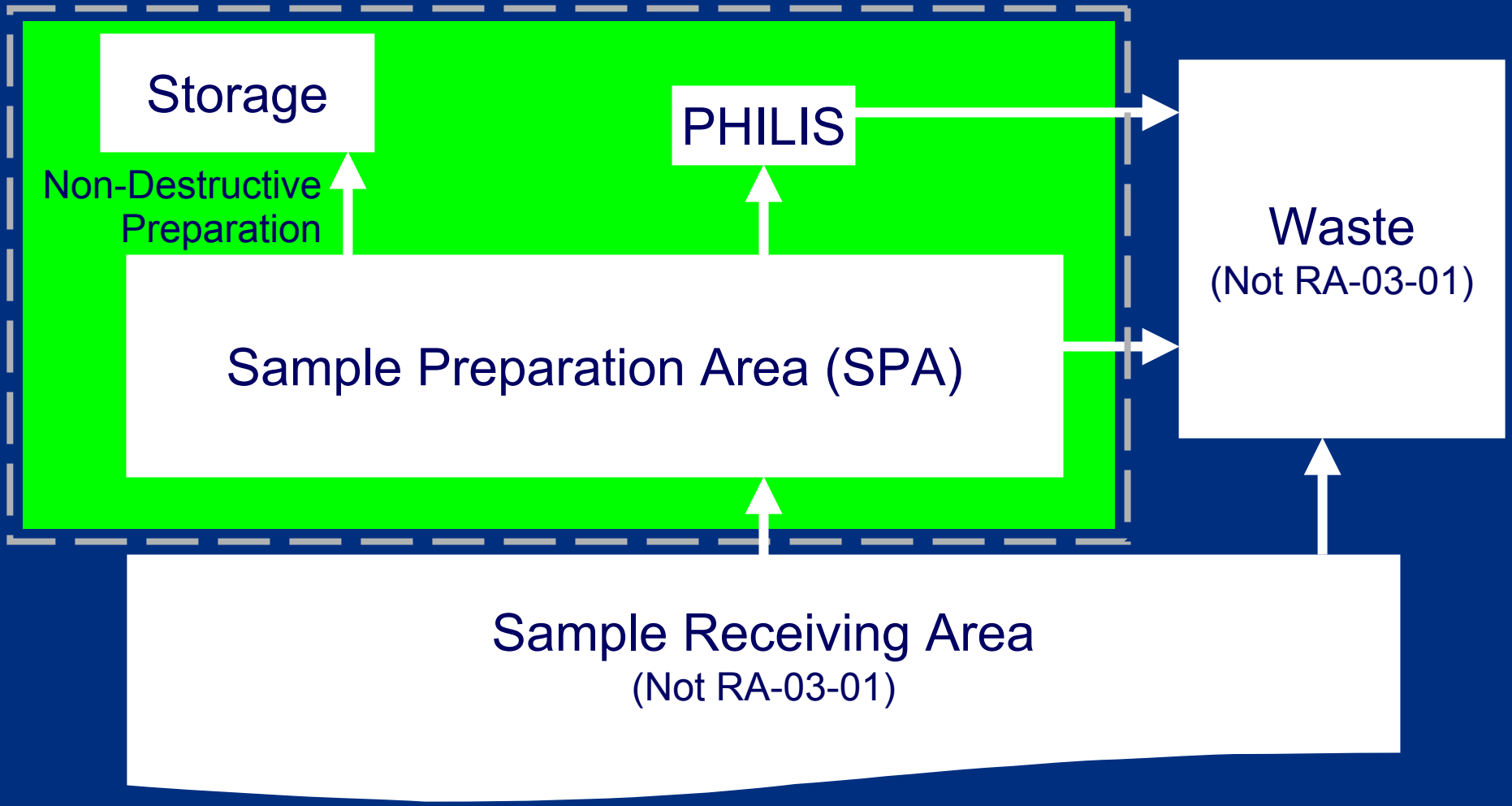
Portable High-throughput Integrated Laboratory Identification System (PHILIS)

TTA-5



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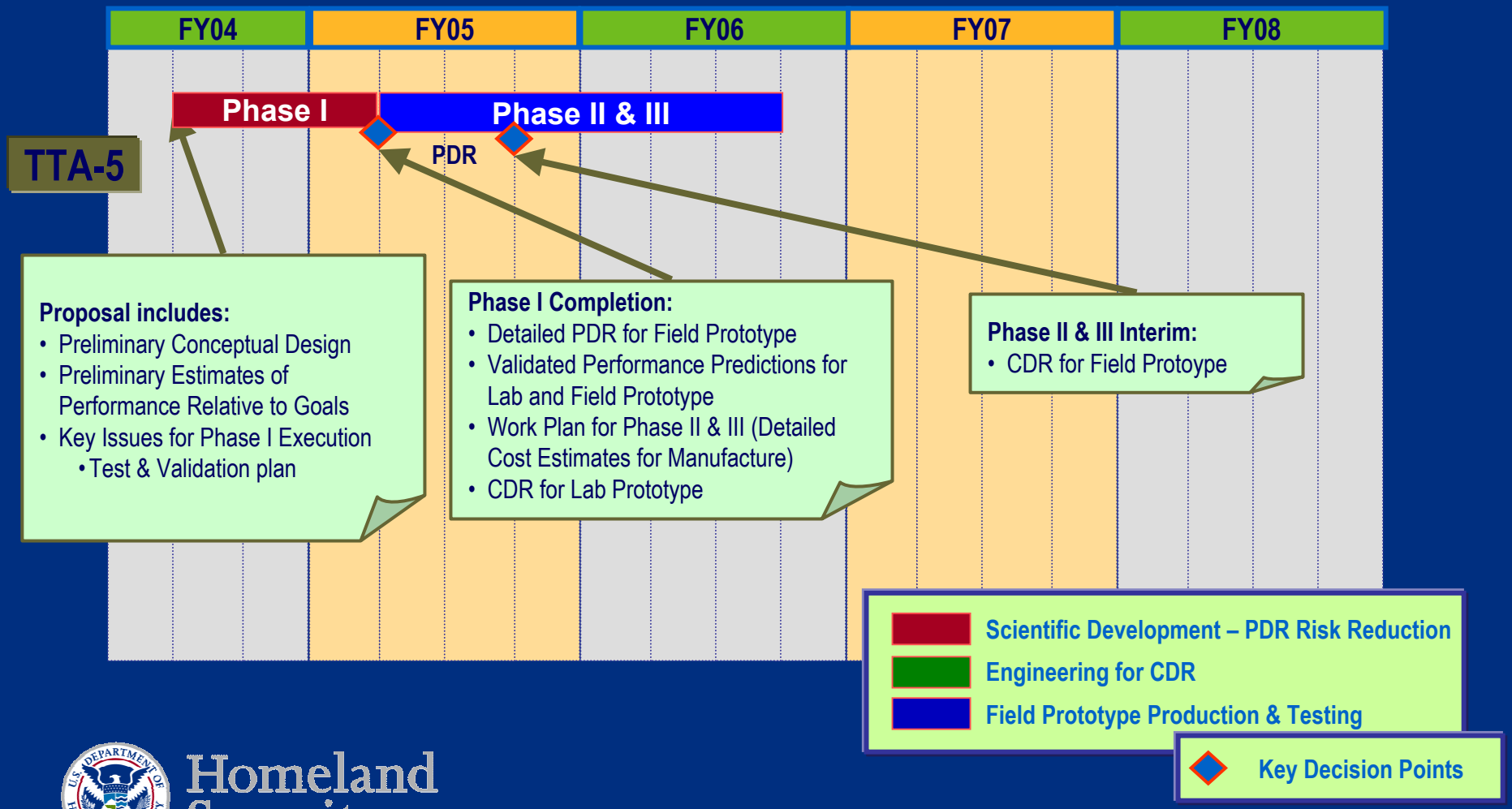
PHILIS Timeline

For TTA-5, the initial Phase is anticipated to be primarily a design study resulting in a detailed design at a Critical Design Review (CDR) level. Based upon an evaluation of the TTA-5 CDRs, HSARPA will select one or more Teams to produce one or more field prototypes during Phase II/III.

Notional Program Schedule

Bidders are encouraged to provide accelerated schedule if possible



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PHILIS – System Characteristics

- Self-contained mobile unit (e.g., a typical delivery van)
- Operates with on-board power
- Fully operational within two hours or less of arrival at an incident location
- Requires no interfacing with local facilities other than for waste handling
- Relies on commercially available consumables and components

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Portable High-throughput Integrated Laboratory Identification System (PHILIS)

This system will be rapidly deployable in the field and capable of analyzing thousands of samples per day in order to identify chemically contaminated areas. The lower detection limit will meet or be lower than the Environmental Protection Agency (EPA) permissible exposure limits (PELs) for the presence of CWA and TIC contamination.

PHILIS – System Goals

Throughput

Other Criteria

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PHILIS – System Performance Goals

The ability to analyze, prepare and report on at least 1,000 (vapor, liquid, solid, mixed state) samples per 24 hours operation, including identification of TOC present within a given sample above the EPA PEL, relying on automated sample tracking, processing, waste analyses, and data read-out, and identification of samples for re-analysis when positive for selected analytes.

PHILIS Phase I Deliverables

- PHILIS / SPA interface: detailed description
- All sample state (vapor, liquid, solid, mixed state) input capable
- Sample volumes, masses, and tracking information
- SPA operations concept, especially related to the desired throughput
- Cost of ownership must be derived and defended with preliminary data
- Details of automation to meet the throughput requirements, cost, and identification of alternate strategies to accomplish these requirements, with cost estimates
- Detailed Phase II/III SOW

Other Opportunities

- HSARPA Web Site: www.dhs.gov
  - Research & Technology / Laboratories & Research Facilities / HSARPA
- Best Practices Workshops
  - HSARPA Industry Day 17 Nov 2003
    - Sheraton National Hotel, Arlington, VA
  - HSARPA Academia Day 15 Dec 2003
    - DoubleTree Hotel, Arlington, VA

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