February 11, 2008

MEMORANDUM TO   GREGORY T. LONG, EXECUTIVE DIRECTOR

FROM: Mark Hagerty, Chief Information Officer 𝑀𝐻

SUBJECT: TSP Systems Modernization Update

Background

On September 17, 2007 I and Roy Friend, Deputy CIO for Operations, briefed you and the FRTIB Board on a proposed strategic initiative to upgrade the TSP's aging information technology systems and capabilities. Based on that briefing the Board voted unanimously to provide approximately $15 million in FY08 funds to support this important project. The purpose of this memorandum is to provide you, and the Board, with an update on the status of that initiative.

As articulated in the September briefing, we had a specific set of goals supporting this initiative. Chief among these are:

- Implementing a robust, scalable, and survivable infrastructure with sufficient capacity to meet unexpected needs driven by crisis;
- Improving our processes and capabilities to ensure that all system changes are thoroughly tested for accuracy, reliability, and efficacy;
- Continuing to improve our Continuity of Operations posture and plans to ensure support of the Agency's Recovery Time and Recovery Point objectives, and
- Continuing to improve our corporate decision-making process for responding to disaster.
- Ensure the safety and security of TSP and FRTIB data, assets and people

As outlined in the following paragraphs, I am pleased to report that the activities surrounding this initiative are on track.

Current Status

As you may recall, our analysis focused on the elements of TSP's IT environment that serve as the backbone for providing critical Agency and participant support. These components included the Agency's mainframe computers, storage subsystems, security capabilities, distributed servers, network and telecommunications, people, and procedures. Following are the initial

findings relative to each of those elements, and the corresponding status of our efforts in those areas.

1. Mainframe Computers – An extensive analysis was performed by IBM in partnership with FRTIB and SI International to ascertain objective performance measures, and to determine if any bottlenecks or performance constraints existed in the current architectures.

    o Findings: – Our findings revealed that while the primary site mainframe had enough CPU capacity to handle the existing production workload (including a major market event that triggers an inordinate number of interfund transfers), it did not have sufficient processing capability necessary to perform end-to-end testing, a process improvement that we felt was critical to improving the software delivery process. Further, the primary site mainframe was memory-constrained; that is, it did not have available memory needed to support more concurrent processes necessary to reduce critical TSP batch processing windows. The backup site mainframe was of similar vintage, and did not have sufficient processing or memory capabilities required to support production workloads if needed. We also discovered during this analysis that the mainframes were no longer upgradeable, a fact that IBM admittedly neglected to inform us of in a timely manner.

    o Recommendations: We recommended replacement of both the primary and backup site mainframes with current technology, including additional memory and faster processors.

    o Status: Mainframes have been procured and installed at both the primary and backup sites, and are currently supporting our production workloads.

    o Efforts Remaining:

        ▪ Implement IBM-recommended performance improvements (FY08/Q2)- As part of their analysis we asked IBM to identify and recommend configuration changes that would increase efficiency and ensure we were achieving the best possible performance out of the new mainframes. These changes, while underway, require careful preparation and testing.

        ▪ Turn on additional processors (FY08/Q4) - While the new mainframes come with additional processors built in, all of the on-board processors do not have to be activated on day one. In fact, activation of the additional processors invokes higher software licensing costs from nearly all the Agency's software vendors (a normal business practice). Accordingly, we are staging the activation of the additional processors to both adhere to our projected budget, and to coincide with the additional workloads generated by broader testing capabilities. If needed, the processors could be activated in a matter of minutes.

        ▪ Implement full end-to-end MF test environment (FY09/Q2) - This is a key capability that will ensure the Agency can test major application changes against the entire participant database. The TSP record-keeping system is a massive,

highly integrated system with many (logical) changing components. Even the most subtle of changes can cascade throughout the system; the introduction of erroneous code could cause major perturbations throughout the system, and yield incorrect values on participant accounts and Agency accounting systems. End-to-end testing will enable the staff to be far more proactive, and confident, in implementing new features and changes.

2. Storage Subsystems – A complete review of the Agency's storage subsystems was performed. The systems' characteristics were evaluated to determine if the current technology was supporting the data transfer rates and recovery time objectives necessary to support the Agency's business continuity objectives.

   o Findings: An examination of the storage subsystems at both our primary and backup sites yielded a common set of challenges. At both locations we were supporting numerous independent solutions for systems operating on distributed servers, making it difficult to manage and ensure synchronization of primary and backup site data. The mainframe disk subsystems were at maximum capacity and slow by today's standards. In addition, we were experiencing processing bottlenecks directly related to disk operations.

   o Recommendations: We recommended replacing the storage subsystems at both Reston and Pittsburgh with leading edge, high-speed, scalable storage area networks (SAN).

   o Status: The initial deployment of SAN technology has been purchased and installed at both the primary and backup data centers. All participant statements previously maintained by numerous hardware storage platforms have been migrated to the new SAN. The design and storage requirements to support the consolidated server environment are nearly completed. We are currently working with product vendors to test replacement mainframe storage solutions.

   o Efforts Remaining:

     ▪ Procure Open Systems storage capacity to be implemented on the consolidated server infrastructure (FY08/late Q2 or early Q3)
     ▪ Identify and procure mainframe storage solution (FY08/Q4)
     ▪ Implement mainframe storage solution (FY09/Q1)

3. Security – IT and physical security are an ongoing focus, and were included as a critical element of all findings and recommendations.

   o Findings: Security has been an ongoing focus for many months, and a number of improvements have either been implemented (e.g., web passwords, account numbers) or are already underway (e.g., account profiles). Key findings during this review validated that while all data "in motion" is encrypted, the available technologies for en-

crypting data "at rest" are still somewhat immature. Further, not all firewall and intrusion detection/prevention capabilities have the level of redundancy we would prefer.

o Recommendations: Continue implementation of account profiles. Continue to conduct routine penetration testing, and include social engineering testing as part of the routine program. Continue procurement initiatives to implement account access, fraud monitoring, fraud detection and mitigation, anti-phishing, and data encryption improvements.

o Status:

- Account numbers were implemented Oct. 2007
- Procurements in progress for:
    - Fraud Detection and Mitigation software (pending procurement review and release).
    - "Brand Monitoring" and Anti-Phishing service (pending procurement review and release).
    - Social Engineering (Testing, Review, and Training - pending procurement review and release).
- Penetration tests have been performed at Reston, Pittsburgh, Clintwood and Fair Oaks locations.
- We have hired a Certified Information Systems Security Professional (CISSP) to oversee the FRTIB IT Security Program (FY08/Q1).

o Efforts Remaining:

- Implement customizable User ID (FY08 – Q4) -- While the implementation of the 13-digit account number was a major step forward in security, it introduced an increased level of complexity to TSP participants. We are working on a project that will allow participants to define a customizable User ID that will map to their account number, affording easier access.
- Hire additional contractor IT security personnel (FY08/Q3) - We have several significant initiatives under way in IT security, and there is no sign that the level of effort required will diminish over time. Accordingly, we will be adding additional contractor staff (and considering additional government staff) to keep up with demands.
- Incorporate Infrastructure changes into existing change process (FY08/Q3) – We are examining a number of methodologies for improving the way we propose, plan, approve and implement changes in the TSP architecture. Our goal is to ensure non-intrusive/disruptive implementation, appropriate audit trails, and proper documentation of all system changes.
- Identify areas of emphasis for IT Security Program (FY08/Q4) – Our new IT security program manager is conducting a thorough review of our practices and procedures; we expect ongoing improvement in that arena.

4.   Distributed Servers – We engaged an experienced independent consultant to review the TSP's distributed server architecture; and examining deployment and management methodologies for optimum utilization.

- o Findings: The assessment was completed in November, 2007. Our preliminary findings indicated that our existing inventory is rapidly approaching end-of-life and in need of technology refreshment, and there are too many "point solution" devices with direct attached storage. The completed study confirmed those findings, and laid the groundwork for an extensive reengineering effort.

- o Recommendations: We recommended a two-phased strategy to replace all servers in both the primary and backup sites with leading edge "Blade" virtual server technology. This technology is scalable, easier to manage, and affords significant redundancy and high availability. Further, we recommended implementing a full-scale test environment, the same approach we used for the mainframe.

- o Status: The engineering review is complete and we have reviewed and fully concur with the analyst's recommendations. In January, 2008 SI International hired a systems engineer to assist with designing and implementing the consolidated distributed-server environment.

- o Efforts Remaining:

  - ▪ Complete engineering design (FY08/Q2)
  - ▪ Identify and execute Phase 1 procurements (FY08/Q3)
  - ▪ Identify and execute Phase 2 procurements (FY09/Q1)
  - ▪ Server consolidation implementation (FY08/Q4 – FY09/Q4)

5.   Network and Telecommunications – As part of the Agency's plan for implementing Internet Protocol version 6 (IPv6, mandated by OMB), the network topology was reviewed to determine if optimum bandwidth and redundancy was in place to support TSP operations and business continuity objectives.

- o Findings: We confirmed that in addition to introducing IPv6-compliant hardware, a number of routers and switches are approaching end-of-life and will need to be replaced. We also identified some areas where better redundancy should be established, as well as some opportunities for better throughput if additional bandwidth was procured.

- o Recommendations: As part of our transition to IPv6, eliminate all single points of failure (SPOF) associated with critical network hardware and telecommunication paths.

- o Status:

  - ▪ Network monitoring software has been selected and procured.

- The draft network redesign is complete and pending final review to ensure it meets engineering design requirements for the consolidated server and SAN implementations.
- A draft Statement of Objectives for telecommunications circuits has been completed and is pending procurement review and release.

o Efforts Remaining:

- Begin implementation of network monitoring tools (FY08/Q3)
- Identify and procure network hardware (FY08/Q3)
- Implement Network and Telecommunications redesign (FY08/Q3 – FY09/Q4)
- Review costs relevant to design. The reengineering of the network is the one area where the overall investment is likely to exceed our initial estimate. While we are still awaiting final quotes from vendors and service providers, hardware, telecommunications lines and associated bandwidth are certain to be considerably more expensive than anticipated. In each case it is likely that, given the project timeline, we will be able to work within our FY08 budget, allocating any additional costs into the FY09 budget.

6. People – Dispersal is an integral part of the Agency's business assurance strategy. A high-level review of both Agency and contractor personnel dispersal was included in this effort.

o Findings: Access to and dispersal of key personnel is critical in an emergency situation. We have been continuously reviewing our personnel posture with respect to business continuity, and have come to the conclusion that, while the parallel call centers offer excellent dispersal of personnel, our posture weakens as we work toward the FRTIB employee base. While not specifically designed to ensure access to appropriate skill sets, the SI International contract also affords a certain amount of dispersal by virtue of having personnel located in Fairfax VA, Birmingham AL, Metairie LA, and Kansas City MO. Agency employees, on the other hand, are by and large centrally located in the District of Columbia office.

o Recommendations: Opportunities exist to utilize the FRTIB space at Fair Oaks in a manner more conducive toward business continuity. Telecommuting arrangements that support Agency business goals are also a potential avenue for consideration.

o Status:

- A plan is being developed to ensure that appropriate skill sets are adequately dispersed and readily available to support Agency business/mission requirements at any given time.

7. Procedures - Procedural improvement is often among the cheapest way to improve efficiency and effectiveness, and we looked for opportunities to improve processes as part of this

analysis. Toward that end we are actively working on a number of activities that will emphasize continuous process improvement. Chief among those are:

o   As mentioned previously, performing end-to-end functional testing using loads commensurate with production is an extremely important factor in ensuring the accuracy and efficacy of all significant changes. This initiative is largely dependent on the increased capability of the mainframes and distributed-server environment; and the increased capacity associated with the introduction of the SANs.

o   We are continuing to improve our business continuity plans, and continuing regular testing. This is an ongoing initiative that involves all business units of the Agency. While we have implemented and tested the business continuity capabilities of the record-keeping system, Agency business units still need to develop and document business continuity plans. We will be assisting Office Directors and designated staff in this important effort.

o   We are evaluating a strategy that will maintain non-critical, seldom used data on lower cost storage technology. The Agency stores an extraordinary amount of data, a large amount of which is rarely if ever accessed. We are researching archival methods that, while still affording access to data, will do so in a less costly manner than storing it on expensive disk drives.

o   We are continuing to build on the improvements and investments made in configuration management (CM) during FY07. Toward that end we recently implemented CM tools for our public (Agency) web site and are in the process of implementing the tool for the public side of the TSP web site and the TSP infrastructure components. This process improvement will carry over into the current TSP Modernization Effort and the redesign the account access web site as well.
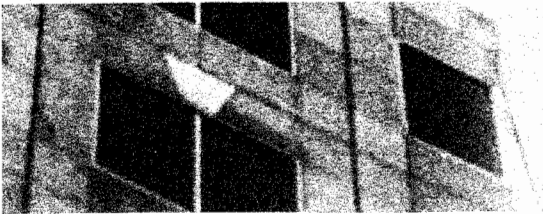
Summary

As reflected by the status of each of the efforts, I am pleased to report that the overall TSP modernization project is on track, with no major concerns to report. While we do not expect significant overruns to this initiative, we do anticipate a long-term financial obligation to support the increased software maintenance costs associate with the major performance improvements. These costs will be clarified in our FY09 budget submission.

TSP Systems Modernization Update

February 11, 2008

Background

- Last briefed the FRTIB Board on September 17, 2007.
- Recommended several key, strategic upgrades/improvements to the TSP IT infrastructure.
- Received FY08 budget approval for:
    - Storage Subsystem $5,400,000 (FY 07, 08)
    - Server Consolidation $1,500,000 (FY 08, 09)
    - Network Modernization $1,986,000 (FY 08)
    - Mainframe replacements $6,300,000 (FY 07, 08)

Objectives - revisited

- Implement a robust, scalable, and survivable infrastructure with sufficient capacity to meet unexpected needs driven by crisis.
- Improve our processes and capabilities to ensure that all system changes are thoroughly tested for accuracy, reliability, and efficacy.
- Continue to improve our Continuity of Operations posture and plans to ensure support of the Agency's Recovery Time and Recovery Point objectives.
- Continue to improve our corporate decision-making process for responding to disaster.
- Ensure the safety and security of TSP and FRTIB data, assets and people.

Deliver *critical* TSP services *no matter what*!

Activities to Date

- Completed a comprehensive engineering review of TSP mainframe computing environment
  - Initial Findings
    - Existing mainframes did not have sufficient processing capacity necessary to perform end-to-end testing necessary to improve program delivery.
    - Existing mainframes were not upgradable.
    - Memory constraints prevented us from reducing TSP processing windows.
  - Initial Recommendations
    - Replace both mainframes with newer technology; more memory, faster processors
  - Subsequent Findings & Recommendations
    - COTS Application Software licenses must be upgraded to operate on larger mainframe
  - Status
    - Mainframes have been procured and installed, and are currently supporting both our primary and backup data centers.
  - Effort Remaining
    - Implement IBM-recommended performance improvements (FY08/Q2)
    - Turn on additional processors (FY08/Q4)
    - Implement full end-to-end MF test environment (FY09/Q2)

Activities to Date *(cont'd)*

- Analyzed storage subsystem infrastructure for capacity, throughput and scalability.
    - Initial Findings
        - Quickly nearing capacity and (floor) space limitations.
        - Slow by today's standards.
        - Difficult (if not impossible) to encrypt data at rest.
        - Data housed across multiple device types.
        - Large volume of data requires faster access and less contention (wait time).
        - Technology supports efficient mainframe data synchronization with Pittsburgh, but server data synchronization falls short of recovery objectives.
    - Initial Recommendations
        - Replace storage subsystems in Reston and Pittsburgh with high-speed, scalable solution.
    - Status
        - Purchased and installed initial instantiation of enterprise storage area network (SAN)
        - Completed storage requirements for consolidated server environment w/growth
        - Working with product vendors to test replacement mainframe storage solutions
    - Effort Remaining
        - Procure Opens Systems storage capacity to be implemented on the consolidated server infrastructure (FY08/late Q2 or early Q3)
        - Identify and procure mainframe storage solution (FY08/Q4)
        - Implement mainframe storage solution (FY09/Q1)
    - Critical Success Factors
        - Procurement expediency
        - Maturity of "data at rest" encryption technology
        - Resources not overly consumed by ongoing audits and audit actions

Activities to Date *(cont'd)*

- Reviewed security environment
  - Initial Findings
    - Firewalls, intrusion detection, antivirus all in place, but building redundant capabilities is prudent.
    - All data "in motion" encrypted.
  - Initial Recommendations
    - Change to new storage area network should include encrypting data at rest.
  - Subsequent Finding and Recommendations
    - Additional emphasis required on network vulnerabilities
    - Additional emphasis on tracking Infrastructure changes required
    - Additional emphasis needed on FTRIB/TSP IT Security Program
  - Status
    - Account numbers implemented Oct. 2007
    - Procurements in progress for:
      - Fraud Detection and Mitigation software
      - "Brand Monitoring" and Anti-Phishing service
      - Social Engineering (Testing, Review, and Training)
    - Quarterly penetration tests performed at Reston, Pittsburgh, Clintwood and Cumberland locations
    - Hired CISSP to oversee FRTIB IT Security Program (FY08/Q1)
  - Effort Remaining
    - Implement customizable USER ID (FY08 – Q4)
    - Hire additional contractor IT security personnel (FY08/Q3)
    - Incorporate Infrastructure changes into existing change process (FY08/Q3)
    - Identify areas of emphasis for IT Security Program (FY08/Q3)
  - Critical Success Factors
    - Procurement expediency
    - Maturity of "data at rest" encryption technologies
    - Resources not overly consumed by ongoing audits and audit actions

Activities to Date *(cont'd)*

- With support from an outside consultant, completed a comprehensive review of TSP server environment.
    - Initial Findings
        - Too many "point solution" devices with direct attached storage.
        - Approximately 80% of servers at both Reston and Pittsburgh will be end-of-lifecycle by FY08 end.
        - Current infrastructure does not support end-to-end testing for systems supported on Open Systems Platform
    - Initial Recommendations
        - Consolidate and replace servers in both Reston and Pittsburgh with new Blade virtual server technology, which is scalable, and configured for redundancy and high availability.
        - Include a test environment for application testing
    - Status
        - Hired server virtualization expert on contractor staff (mid-Jan 08)
        - Draft server consolidation (SCON) engineering design 75% complete
    - Effort Remaining
        - Complete engineering design (FY08/Q2)
        - Identify and execute Phase 1 procurements (FY08/Q3)
        - Identify and execute Phase 2 procurements (FY09/Q1)
        - Server consolidation implementation (FY08/Q4 – FY09/Q4)
    - Critical Success Factors
        - Procurement expediency
        - Resources not overly consumed by ongoing audits and audit actions

Activities to Date *(cont'd)*

- Completed a comprehensive review of the entire TSP network and telecommunications infrastructure for bottlenecks and single points of failure (SPOF)
    - Initial Findings
        - Existing network's routers and switches don't support IPV6.
        - Inadequate redundancy in some areas.
        - Many components reaching end-of-lifecycle.
        - Bandwidth (capacity) is adequate in most areas, but some segments need improvements.
    - Initial Recommendations
        - As part of transition to IPv6, eliminate all single points of failure associated with critical network hardware and paths.
        - Proactively monitor/manage the TSP network and servers with appropriate tool sets to ensure fast problem recognition and resolution
    - Status
        - Network monitoring software selected and procured
        - Draft network design complete – pending final review to ensure it meets SCON requirements
        - Draft Statement of Objectives for telecommunications circuits completed and pending procurement review and release
    - Effort Remaining
        - Begin implementation of network monitoring tools (FY08/Q3)
        - Identify and procure network hardware (FY08/Q3)
        - Implement Network and Telecommunications redesign (FY08/Q3 – FY09/Q4)
    - Critical Success Factors
        - Procurement expediency
        - Overall costs will be higher than expected (tbd)
        - Resources not overly consumed by ongoing audits and audit actions

Activities to Date *(cont'd)*

- Enhanced quality assurance (QA) and configuration management (CM) procedures

  - Initial Findings
    - Improved QA processes require additional processing power

  - Initial Recommendations
    - Initiated plans for a new full-sized, end-to-end functional test area to verify system functionality

  - Status
    - Hired QA/CM lead to address Government roles and expectations/measures of contractor performance
    - Installed CM software tools for mainframe and distributed applications to control code access/changes
    - Installed CM software tool on "frtib.gov" web site

  - Effort Remaining
    - Procure additional maintenance for mainframe CM software tool to cover increased hardware capacity
    - Install and configure CM software tool on "tsp.gov" web site
    - Complete system documentation effort; baseline for future changes and validation
    - Complete processes to assess software maintenance costs
    - Increase market research efforts to identify COTS solutions

  - Critical Success Factors
    - Completion of hardware upgrades
    - Completion of CM/QA policies, procedures and metrics (web & infrastructure) (FY08/Q4)

Summary

- Project on track, no significant issues to report.
- Working to clarify FY09+ budget impacts for additional hardware and telecommunications costs, maintenance tail.