

**AMERICAN RECOVERY & REINVESTMENT ACT OF 2009**

***Assessment of Project Risks Associated with Key Engineering Projects***

**Report No. 912-2010**

**May 14, 2010**



**Audit Report Issued By:**

**NATIONAL RAILROAD PASSENGER CORPORATION  
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# Memo

Date May 14, 2010

From Dominic Pinto  
Acting Assistant Inspector General – Audits

To DJ Stadtler  
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Department Office of Inspector General

Subject **Assessment of Project Risks Associated with  
Key Engineering Projects or Programs**

cc

Attached is the audit report of our recently completed Assessment of Project Risks Associated with Key Engineering Projects or Programs. Our objective was to assess the inherent risks associated with a number of key Engineering projects and evaluate the risk mitigation tactics that were to be used in the management of high-risk items. The results of our review were discussed with Art Misiaszek, Senior Project Manager, Stimulus.



Dominic Pinto  
Acting Assistant Inspector General for Audits

Attachment

## EXECUTIVE SUMMARY

### **WHY WE DID THIS RISK REVIEW**

This review was conducted to:

- Assess the inherent project risks on high-investment ARRA Engineering projects.
- Review the measures being taken by Amtrak to keep the project risks within manageable levels.

On February 17, 2009, the President signed the American Recovery and Reinvestment Act (ARRA). The Act included \$1.3 billion in capital grants to fund a variety of projects to help Amtrak improve its infrastructure and security posture. The Act also required the Secretary of Transportation to take measures to ensure that projects funded by the Act would be completed within two years of enactment (February 17, 2011).

In March, 2009, the Federal Railroad Administration (FRA) provided a \$1.3 billion grant establishing requirements for Amtrak to complete the infrastructure and security projects within the terms of the Act. The grant agreement requires Amtrak to complete all ARRA-funded projects no later than February 17, 2011 and to continuously take actions to ensure projects are completed by February 17, 2011. Amtrak is allowed to request a waiver for projects that cannot be completed by February 17, 2011, but must demonstrate that it has taken “extraordinary” measures to complete the project on time.

***The February 17, 2011 completion deadline has resulted in further elevation of some project risks.***

As part of our obligations under ARRA, the OIG assessed the risks associated with nine major ARRA-funded projects being managed by Amtrak’s Engineering Department and the measures being taken to manage those risks. These projects have a budget value totaling \$277 million. The methodology for conducting

the risk assessment involved defining risk areas, reviewing project documents to determine the extent to which risks had been identified and mitigated, and holding extensive discussions with responsible project managers and their subject matter experts to identify and assess risks.

A total of 62 risk elements within 10 general risk categories were reviewed for each of the nine projects. The categories included risks associated with areas such as project finances, acquisition of materials and equipment, the project environment, and schedule constraints. Based on the review of documents and discussions with Engineering Department project representatives, each of the 62 risk elements was given a risk score of 1 to 5, denoting the level of risk that exists against each element on the project. A score of 1 represented a low risk for that element and a score of 5 represented a high risk. Any risk element receiving a score of 3.5 or higher was considered a “watch item” whose risk should be actively managed.

Of a total 558 risks elements examined (62 elements for each of 9 projects), we identified 57 as having a risk level of 3.5 or more resulting in a watch item. Three projects (Niantic River Bridge Replacement, Positive Train Control – NEC, and Positive Train Control – Michigan Line) had 10 watch items each.

In performing this assessment, it became clear that a significant number of risk items were either directly or indirectly attributed to the deadline of February 17, 2011. We therefore expanded our scope to also assess the impact of this deadline on Amtrak’s ARRA program.

The key risk areas across projects were 1) the ability to acquire materials and equipment in time to complete the project before the grant deadline of February 17, 2011; 2) environmental concerns; and 3)

schedule concerns. In total, of the risk categories evaluated, the three identified above had a total of 20 watch items spread among seven projects.

In many cases, the project managers were able to identify actions to mitigate risks. Specific mitigation actions are described in this report. The Amtrak project managers appear to understand the measures that must be used to mitigate the associated project risks and have begun to implement the majority of them. However, Amtrak managers and executives are not in a position to mitigate the most significant risk, the grant requirement that Amtrak take “extraordinary” measures in order to justify a request for relief from the project deadline. This requirement may have the unintended consequence of encouraging Amtrak to take actions that increase the risk of waste and inefficiency or even to take shortcuts that could increase the risk that the project will not perform as well as expected and will not provide the benefits expected.

Amtrak executives, including the President and CEO, are committed to ensuring that funds are utilized effectively and represent an appropriate use of taxpayer funds. They are in the process of making decisions about how to balance the need and desire to implement these projects against the need to spend taxpayer funds efficiently and effectively. However, as projects face slippages that threaten the completion date, which is not unusual for large construction projects, Amtrak executives are faced with either cancelling the project and identifying a substitute project that can be completed in time or taking extraordinary actions to meet the completion date. Identifying substitute projects at this point in time also increases risks and might result in funding lower priority projects that will bring fewer benefits than the originally selected project. Extraordinary actions that have been proposed by Amtrak include the addition of second or even third shifts on construction projects, reducing the scope of projects to accomplish less than originally planned, and dividing projects into two phases, one funded from ARRA funds and the second, post February 17, 2011, using Amtrak general capital funds.

The Law requires the Secretary of Transportation and Amtrak officials to take measures to ensure projects are completed by February 17, 2011. In fact, when Amtrak awarded the contracts, it had taken measures to complete the projects on time—those measures were reflected in contract completion dates that met the requirement. Subsequent events such as late material deliveries and ongoing negotiations with host railroads are now leading to delays that will require further measures, and perhaps extraordinary measures to meet the date.

The OIG agrees that reasonable measures should be taken to complete projects within the grant deadline, provided that completion is achievable through the utilization of methods and procedures normally used in the industry. Reasonable measures are those practices that one would expect to use under normal operating conditions. They follow due process in each step along the way and due diligence with regard to reasonable follow up and care that needs to be exercised. In this case that would include items such as normal shifts with a manageable amount of overtime, quantities of track outages that would minimize impacts to on-time performance, a signed contract that respects the grant provisions, and schedule contingencies that allow unplanned time for weather or other unforeseen circumstances.

In fact, the grant agreement lists the types of measures Amtrak should take, and generally those measures are consistent with sound business practices. However, the term extraordinary measure is not defined in the grant agreement. Because the grant defines measures in a manner that is consistent with prudent business practices, arguably, extraordinary measures must entail additional actions that would significantly impact productivity, increase the potential for waste or inefficiency, negatively impact the quality of the final products, or extraordinarily impact the smooth operation of the railroad.

Because the grant agreement is driving these “extraordinary” measures rather than the Law, we are recommending that Amtrak apply to the FRA to amend the grant provisions. The grant provisions should

ensure a balance between spending taxpayer funds in a timely manner and achieving project objectives, without actions that could increase the potential for waste or inefficiencies. We also recommend that Amtrak apply to the FRA for a grant waiver in instances where reasonable measures have failed to bring the project within the grant deadline.

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## BACKGROUND

On February 17, 2009, the President signed the American Recovery and Reinvestment Act of 2009 (Recovery Act) into law in response to the economic crisis facing the nation. As part of this act, the National Railroad Passenger Corporation (Amtrak) received \$1.3 billion through an FRA grant to fund various infrastructure and security initiatives. The Recovery Act calls for extraordinary levels of spending over a very short period of time. Because of the increased potential for waste, fraud and abuse, Congress has tasked many OIG's, including Amtrak's, with special oversight responsibilities for programs funded through the Recovery Act. Our oversight responsibilities include assessments of Amtrak's ARRA programs before, during, and after completion.

The Federal Railroad Administration has been tasked to control and administer the grant. According to Amtrak's grant agreement with the FRA, the projects funded under the grant must be completed no later than February 17th, 2011 and on an exceptional basis only, Amtrak may apply for an extension on specific projects (for which they must furnish proof that they've taken all necessary extraordinary measures to meet this deadline).

The objective of this audit was to assess 1) the inherent risks associated with nine major ARRA-funded projects being managed by Amtrak's engineering department and 2) measures taken by Amtrak to keep project risks within manageable levels. These projects have a combined budget value totaling \$277 million.

This report also lays the foundation to ensure that project risks:

1. Are being taken into account early on in the project / program life cycle, in order to develop an effective risk mitigation plan.
2. Are being actively managed as a means of maintaining adequate control over the project.

During the course of our audit we expanded the scope beyond the nine engineering projects because it was clear to us that the February 17, 2011 contract completion date had company-wide implications. We met with senior Amtrak officials to discuss actions taken to meet that date. We also attended Amtrak's monthly ARRA status reviews in which all ARRA projects' estimated costs, actual costs, estimated completion dates, and changes in the projects' scope/objectives were reviewed.

During April, 2009, the Office of Management and Budget requested that the OIG provide a preliminary assessment identifying which ARRA projects or programs were considered to be high risk. The resulting report emphasized that the assessment was preliminary, and that it would be followed up by a more detailed program risk analysis (this report) on each of the key ARRA programs. The Engineering programs identified as potentially high risk and subject to further follow-up were:

<b><u>Project Name</u></b>	<b><u>Project Number</u></b>
1. Niantic River – Bridge Replacement	PRJ29116002
2. Positive Train Control (Michigan Line)	PRJ29112131
3. Positive Train Control (NEC)	PRJ29112113

4. Lamokin – Frequency Converter Replacement	PRJ29116023
5. Construct Maintenance Facility in Los Angeles, CA	PRJ29116045
6. NY Fire Standpipe System	PRJ29112114
7. Construct Maintenance Facility in Hialeah FL	PRJ29110037
8. Improvements to Platform Lighting in NEC Stations	PRJ29112117
9. Emergency Backup Power – Stations	PRJ29112118

The above list of projects comprises a total budget of \$277 million, representing approximately:

- 22% of Amtrak's total stimulus grant
- One-third of the total stimulus funding earmarked for non-security infrastructure initiatives
- Half of the total stimulus funding that was allocated by Amtrak toward Engineering / Construction initiatives.

For the majority of construction projects, a pre-defined sequence of events (described in Exhibit A) in the Engineering / Construction life cycle normally takes place. These events include a series of checks and balances that bring discipline to the process and assist in the management and control of the more complex projects or programs.

## ANALYSIS OF RISK ASSESSMENT

### Summary of Results

Of the nine projects that were evaluated for risk, five contained a significant number of high-risk areas that if not managed effectively would likely compromise the project's success. Among others, these projects included the Niantic River Bridge project budgeted at \$104 million and two projects involving Positive Train Control (PTC) with a combined budget of \$60 million. Of the ten risk categories (see Exhibit B) that were examined across projects, risk associated with Acquisition, Environment, Schedule Slippage, and Technology were identified as areas of the highest concern. In general the project / program managers were quick to recognize the high-risk items and put forward tactics that they believed would adequately manage the associated risk. The following summarizes the key risk areas that were identified during this review:

**Acquisition Risks** - The hard deadline of February 17, 2011 has stretched the capabilities of Amtrak's procurement infrastructure. A number of project leads expressed concern that materials and equipment would not be received in time to complete the projects within the deadline.

**Environmental Risks** - Because of unknown or unpredictable environmental factors such as soil contamination (LA Maintenance Facility) and marine concerns (Niantic Bridge), as well as the time required to obtain environmental approvals, environmental risks were elevated on a number of projects.

**Schedule Slippage** - The schedules for a number of projects is very tight, with little or no buffer. In fact for a number of projects (e.g. Construction of the Los Angeles Maintenance Facility), Amtrak paid acceleration premiums in order to have a chance of completing the project within the grant deadline.



**Technological Risks** – Of the nine projects that were reviewed, significant technological risks were identified on three, including the Niantic Bridge Replacement project and both of the Positive Train Control (PTC) projects. The risk on the Niantic Bridge project results from utilization of construction means and methods that had not been previously used by Amtrak while the risks associated with the PTC projects stems from the immaturity of aspects of the PTC technology itself.

**Risk Associated With The February 11, 2010 Deadline** – However, neither the project managers nor Amtrak's executives are in a position to mitigate the most significant risk to the program, which is that the grant between the FRA and Amtrak requires that all projects be completed by February 17, 2011, and that Amtrak must take extraordinary measures to meet this deadline. The Recovery Act itself states "... that the Secretary shall take measures to ensure that projects funded under this heading shall be completed within 2 years of enactment of this Act ...". The March 19, 2009 grant agreement between Amtrak and the FRA goes beyond this legislative requirement. This agreement not only requires that measures be taken to complete projects within two years, but also requires Amtrak to apply for waivers only after proving that "despite its best efforts" the project cannot be completed by February 17, 2011. The grant agreement also requires that as part of its waiver application, Amtrak "...should identify the extraordinary measures the Grantee has undertaken to meet the February 17, 2011 completion date..."

We believe reasonable measures should be taken to complete the projects before the deadline, but Amtrak should not use extraordinary measures to do so. The grant deadline is creating additional risks on a number of projects, risks that Amtrak has been mitigating through the use of extraordinary tactics that it would under normal circumstances not have to use. In some instances Amtrak has proposed the use of double and triple shifts for the duration of the project. Independent studies have concluded that productivity will show significant degradation if this tactic is maintained for an extended period of time<sup>1</sup>. In other instances, Amtrak management is faced with decisions to reduce project scope to accomplish less than was originally planned in order to meet the deadline. In the case with the Niantic River Bridge project, the project was split into two portions - one funded by ARRA and the other funded through other sources.

The following examples demonstrate extraordinary measures taken to meet the grant deadline:

1. **Virtual Fence Project.** This project was originally scoped to include virtual fencing at Amtrak facilities in Chicago, Seattle, Baltimore, and Washington. Because of time constraints associated with the grant deadline, both Chicago and Seattle facilities were removed from the scope. For the remaining scope, the project will only be completed into the test phase, and will not include implementation into operations. We are not aware of any project or extension that would take it beyond the testing or pilot phase.
2. **Sanford Florida Station Refurbishment.** This project was originally scheduled to be completed before the grant deadline using a single shift. However, a series of legitimate delays not anticipated by Amtrak or the contractor forced Amtrak to request that the contractor take all necessary actions to bring the projects back on schedule, instead of allowing the project to continue beyond February 17, 2011. The contractor will use overtime, extended shifts, or additional shifts to complete the work on time. Amtrak incur additional costs as well as an acceleration premium for the work.

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<sup>1</sup> Impact of Shift Work on Labor Productivity for Labor Intensive Contractor – Journal of Construction Engineering and Management © ASCE / March 2008

The need to meet the February 17, 2011 deadline is also impacting the ARRA Engineering decisions on project selection. We have noted, for instance, that new projects are still being introduced into the ARRA pipeline, while projects that have been planned since the beginning are being dropped for the exclusive reason that they cannot be completed within the grant deadline. We believe that the late identification of substitute projects may result in spending time and resources on lower-priority initiatives. This in turn will not only yield fewer benefits than the originally selected projects, but the shuffling of projects will itself result in an increase in waste, inefficiency, undue haste and perhaps even impact the quality of the finished product.

### **Risk Assessment Results**

During the audit, we evaluated 62 risk elements. Each was given a risk score of 1 to 5, denoting the level of risk that exists against each element on the project. A score of 1 represented a low risk for that element and a score of 5 represented a high risk. If any of the 62 risk elements received a score exceeding 3.5, it was given a “watch item” designation, meaning that this element could compromise aspects of the project or program if not actively managed.

Table 1 shows the distribution of watch item designators (i.e. risk elements with a score of 3.5. or higher) across projects and risk categories.

Program	Risk Categories and Number of Watch Items Within Each										
	Acquisition	Environment	Schedule	Objectives	Technology	Size & Complexity	Financial	Human Capital	Mgmt & Organization	Fraud	TOTAL
Niantic River Bridge Replacement	1	4	0	1	1	3	0	0	0	0	10
Positive Train Control - ITCS	3	1	1	1	3	0	1	0	0	0	10
Positive Train Control - ACESS - NEC	3	0	1	1	2	1	1	1	0	0	10
Lamokin Frequency Converter Replacement	2	1	4	1	0	0	0	0	0	1	9
Los Angeles Maintenance Facility	1	3	1	1	0	1	1	0	0	0	8
Hialeah Maintenance Facility	1	1	1	1	0	1	0	0	0	0	5
New York Standpipe	0	0	0	1	0	0	0	2	1	0	4
Platform Lighting	1	0	0	0	0	0	0	0	0	0	1
Emergency Backup Power - Stations	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>12</b>	<b>10</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	

Table 1 – Summary of Watch Item Items, By Project and Risk Category

**NOTES:**

1. For each project, a total of 62 detailed risk elements were examined within the 10 risk categories. Risk scores were formulated for each risk element, ranging from 1 (low risk) through 5 (very high risk). A risk score of 3.5 or higher on any of the 62 risk elements evaluated indicated significant risk, resulting in a “watch item”.
2. The risks scores for each element were derived through consultation and cooperation with the respective project managers and their associated subject matter experts.
3. Example: Risk assessment of the Niantic River Bridge project resulted in scores of 3.5 or higher on four risk elements associated with environmental issues surrounding the project. Each of these was captured on this table as a “watch item”.
4. 57 items of significant risk were documented out of a potential of 558 risk items (62 risk areas \* 9 projects examined)
5. Key areas of concern were a) the ability to secure materials and equipment on time; b) the schedule constraint c) environmental issues associated with some projects d) technological concerns associated with some projects.
6. Of the nine projects examined, five showed a significant number of elevated risk items. The project managers will need to focus their efforts toward keeping these risk areas under control.

## **Assessment of Projects by Risk Area**

This risk assessment evaluated each of the nine projects against ten areas of potential risk. The ten areas were each broken into a number of risk elements ranging in number from three to eight, depending on the risk area in question. Our general findings for each risk area are described below.

1. **Acquisition Risks:** In evaluating risks associated with acquisition, we considered how difficult it would be to acquire the necessary materials and equipment in a time frame that would allow the project to be completed on schedule.

Most project teams had concerns regarding the duration of the procurement process and the historical timeliness of completion and delivery. Given the rigid due dates, they felt that this would impede timely completion of the projects. Moreover, most felt powerless to do anything about it.

Of the nine projects that were assessed, there were a total of 12 watch items relating to various aspects of acquisition.

2. **Environmental Risks:** Environmental risks are those risks associated with the environmental conditions in which the project must be executed. This can include unknown sub-grade conditions, potential site contamination, exceptionally volatile weather in the vicinity of the project, and similar environmental concerns.

High environmental risks were mostly associated with the Niantic River Bridge project and the LA Maintenance Facility Project. For the Niantic River Bridge, most of the concern surrounds the work that must be done underwater. The work requires approval from the US Coast Guard, which could in turn consume time and financial resources. For the LA Maintenance Facility project, the work is being performed on a site that is generally known to have environmental problems such as soil contamination, and when excavation begins, these problems may be uncovered, potentially delaying and adding costs to the project. In addition to this, the work environment is physically constrained, limiting the number of people that can work at the site at one time, which could add costs to the project.

Of the nine projects assessed there were a total of 10 watch items relating to various aspects of environmental risk.

3. **Schedule Risks:** Schedule risk is the risk that the project or program will not be able to be completed within the required time frame, in this case by Feb 17, 2011.

As mentioned previously, many projects had concerns about being able to complete delivery within the grant time frames and had doubts whether sufficient skilled resources could be mustered in time. The team responsible for the Lamokin Frequency Converter Replacement was especially concerned because Amtrak has had no recent experience with this type of project.

Of the nine projects assessed there were a total of 8 watch items relating to various aspects of schedule risk.

4. **Technology Risks:** This represents the level of risk associated with the relative maturity of the technologies being used.

Both of the Positive Train Control (PTC) projects have some technological aspects that the project teams consider as high risk. The major risks are associated with the lack of maturity of the technologies being utilized, as well as the complexity of the technology itself.

Of the nine projects assessed there were a total of 6 watch items relating to various aspects of technological risk.

5. **Objectives Risks:** These are associated with not being able to meet the project's objectives. The majority of project teams considered the risk of not being able to meet ARRA's schedule objectives (i.e. completion by Feb 17, 2011) to be very high.

Of the nine projects assessed there were a total of 7 watch items relating to various aspects of risk relating to the ability to meet the projects' objectives.

6. **Size and Complexity Risks:** The Niantic River Bridge replacement is the largest and most complex project of Amtrak's stimulus initiatives, and the project team's risk score reflects this. The LA Maintenance Facility has risks associated with dependencies on Utility companies that have not responded to their service requests.

Of the nine projects assessed, there were a total of 6 watch items relating to various aspects of the projects' size and complexity.

7. **Remaining four risk areas:** Assessment of the remaining risk areas identified a total of eight watch item items, distributed as follows:

- a. Financial Risk (risk of not completing the program within the allotted budget) – 3 watch items.
- b. Human Capital Risk (risk of not being able to acquire skilled human resources in sufficient numbers – 3 watch items.
- c. Management and Organizational Risk (clarity of scope, direction, procedures, controls, or operating conditions) – 1 watch item.
- d. Fraud: (concerns regarding higher-than-average risk of fraud or theft) – 1 watch item.

With few exceptions, the project teams' concerns in these risk areas were relatively low in both significance and relative impact on the projects themselves.

### **Amtrak's Risk and Mitigation Approach**

This section describes both the risks associated with each of the nine projects evaluated as well as the risk mitigation approaches being implemented by the project management team. In some instances the OIG believed that additional measures should be explored to further assist in the risk management effort. Those measures are also described in this section.

## Niantic River Bridge Replacement (PRJ29116002)

**Budget:** \$60,000,000 (funded through ARRA - total project budget is \$104 million)

**Status:** All major contracts in place, project is in progress

**Description:** This is the largest of Amtrak's ARRA-funded projects. It entails construction of a new bascule lift bridge and a new railroad alignment adjacent to the existing 102 year old bridge. The new bridge will be a 3 span bridge with a 142 feet long bascule lift span with a total bridge length of 373 feet. This new bridge will be equipped with modern machinery and control systems. To accommodate the new track alignment a 2,200 feet retaining wall and 5,000 lineal feet of track and catenary will be constructed. Improvements to the navigation channel, restoration of public walkway and beach and removal of the old bridge are also planned. The project not only allows Amtrak to significantly increase the speed of Acela trains over the span, but is recognized as being of benefit to both the local community in general and to the boating community in particular.

Several risk factors have been identified:

- 1) Environment – There are several environmental factors associated with this project that increase the inherent risk:
  - a. The project is located in an area that will result in higher-than-average time lost due to weather-related factors. The project team is managing this by building weather-related contingencies into the project schedule.
  - b. The site characteristics are complex. As an example, in order to complete the project, the local beach, which is in close proximity, must be closed down for a period of time and the beach rebuilt once the work is complete. The project team is managing this through close cooperation and communication with the local community as well as through frequent and proactive communication with environmental officials.
  - c. A significant portion of this project will require work in sub-water conditions, increasing the number of potential environmental and technological unknowns. To address this risk, the project management team will be teaming up with Mueser Rutledge Consulting Engineers (MRCE), one of the world's leading geo-technical firms, as well as with a number of marine environmental experts. By taking this approach, Amtrak is compensating for a lack of internal expertise in these technical areas.
- 2) Size and complexity – In addition to the extensive resources being dedicated to this project, there is an unusually large number of stakeholders involved, both internal to Amtrak and external. This increases the need for a high level of coordination and proactive communication practices in order to maintain the ongoing support for all stakeholders.

Mitigation: To address the risks associated with the size and complexity of the project, the project team will:

- a. Develop a schedule that includes not only the project teams' work, but also the work and deliverables from other departments within Amtrak, all vendors that will be involved with the project (over 30 vendors will contribute), and work and decision points from external stakeholders. If done properly will minimize the chances of key items being forgotten or ignored.
- b. Develop and implement a community outreach program that keeps the local community both involved and in step with the project. If done properly, this approach will not only foster community support but also help to identify community issues early on in the project that, if not addressed, could cause significant cost and delays down the road. Part of the community outreach program is the development of a common-access project information web site.

#### Other Mitigation Tactics That Could Be Explored

Develop a detailed communication and reporting plan. This plan would take the form of a document that would describe the communication objectives, each type of report or communication to be issued, the format and frequency, and a feedback mechanism. A communication plan of this type would improve the likelihood of stakeholder support remaining constant through the project life cycle. *This mitigation tactic has since been implemented.*

- 3) Acquisition – Municipal authorities have expressed concern about the number railroad crossings that need to take place to ship materials and equipment to the job site, and have asked Amtrak to explore alternative means of transport. In response, Amtrak has arranged for materials to be dropped off each night at the train crossing instead of the job site. The materials and equipment are then to be delivered by train to the job site. Note that this process has not been tried by Amtrak in the past. It is a first, and as such will likely experience some logistical issues. The project will experience issues if / when this process breaks down for any length of time.

Mitigation: To address the supply chain management risk, the Amtrak Project Manager is working regularly with both URS Corporation (the Construction Management contractor) and the General Contractor to fine-tune the process to the extent possible, recognizing that the risk will continue until all material has been acquired.

- 4) Human capital – Although human capital has not been identified as a watch item, the project team still has concerns that skilled personnel in some crafts may become scarce as ARRA projects (Amtrak and non-Amtrak) accelerate across the board.

Mitigation: To address the potential human resource issues, both Amtrak and URS have initiated an apprenticeship program for key skill sets. Although this will support Amtrak's succession planning needs, it is unclear how effective this approach will be, given the deadlines imposed by the grant agreement between Amtrak and the FRA.

**Positive Train Control – ITCS - Michigan Line (PRJ29112131)**

<b>Budget:</b>	\$25,000,000
<b>Status:</b>	Contract has been issued to General Electric
<b>Description:</b>	PTC is technology that enforces positive train stops without human intervention. A federal mandate requires the installation of PTC by 2015 to make rail services as safe as technology can support. The PTC system is already installed on 52 miles of track along the Michigan line. The project is to extend it to the remaining 46 miles of track.

The key risks associated with this project include:

1. Acquisition: The project has several acquisition-related concerns:
  - a. Additional signaling units (known as signal huts) will be needed for this project. The lead times are significant and the design work had not been completed when this assessment took place. The team had concerns over the delivery time frame, especially when considering that the demand for signal huts increases in proportion to the volume of work on the tracks.

Mitigation: To the extent practicable, Amtrak will ensure that related communication circuits, breakers, relays, and other materials commonly used on signal huts are kept in stock. Additionally, Amtrak is meeting with GE on a bi-weekly basis to get a head-start on the material requirements.

- b. General Electric owns the technology associated with this type of PTC system, and the work was sole-sourced to that company. However, the contract negotiations were time-consuming and resulted in start delays, putting additional pressure on the ability to meet the ARRA completion deadline.

Mitigation: The appropriate completion deadlines have been integrated into the contractual agreement with GE.

- c. The team is concerned that products that are normally purchased from foreign countries will be disallowed under the Buy America provisions of the ARRA legislation. A number of products are normally purchased from Canada and it was not clear what US-based companies could quickly provide equivalent products.

2. Schedule: The project is concerned that it may not be able to complete the work before the established grant deadline.

Mitigation: General Electric will be the prime contractor for this project, since GE had previously designed and implemented the PTC system on other portions of the Michigan line. Amtrak has built implementation deadlines into its contract with GE as a means of mitigating this risk.

Amtrak is also reviewing in detail GE's implementation plans and schedules to ensure that they



integrate effectively into Amtrak's other work schedules along the Michigan Line. This advance effort would minimize any possible delays that arise due to schedule conflicts.

3. **Technology:** There are risks associated with implementing a technology that is not mature. Although this type of PTC system has been in operation along parts of the Michigan line for a number of years, Amtrak has never been fully satisfied with its performance. Additionally, Amtrak is the only North American organization that has implemented this type of PTC system in the field.

**Mitigation:** At the time that the field work for this assessment was conducted, the project manager intended to build performance clauses into the GE contract as a means of satisfying the existing performance issues. However, the project team now believes that improvements in the data radio network have made this approach unnecessary.

### **Positive Train Control – ACSES - NEC (PRJ29112113)**

<b>Budget:</b>	\$35,000,000
<b>Status:</b>	Behind schedule but in progress
<b>Description:</b>	The Advance Civil Speed Enforcement System (ACSES) PTC system has been in operation in the Northeast Corridor for a number of years (since 1996) but is not installed on all NEC track. The objective of this program is to extend installation of the ACSES system to cover all Amtrak-owned track miles on the NEC.

Although most of the project work is well understood, there are several factors that increase the project risk:

1. **Technology:** A new radio and communication system that uses 220 megahertz channels is being developed for use with the ACSES system. This new system has not been fully tested, which introduces a certain measure of technological and financial risk to the project.

**Mitigation:** If the new radio equipment acquisition and testing begins to lag behind the rest of the installation, all viable work and installation will be completed first, with the radio equipment being plugged in later. *The project team has since chosen to create a much simpler specification based on current off-the-shelf products, thus significantly reducing the associated risk.*

2. **Schedule:** In the past, PTC installation has always required more time than anticipated. The Amtrak management team acknowledges that it will be very difficult to complete the entire job within the grant deadlines, especially given the personnel shortages and technology change described above.

**Mitigation:** Amtrak management intends to mitigate this risk by:

- a. Assigning dedicated construction gangs to the project, thus increasing productivity as work progresses.

- b. Building much more detail into the project schedule than has been done in the past. This will help increase the project manager and supervisors' control over the project and detect issues early on.

Other Mitigation Tactics That Could Be Explored

Other tactics that should be considered are:

- a. Weekly tracking and update of project schedules, to assess issues early.
  - b. Frequent reviews between the project manager and field foremen and supervisors.
  - c. Full coordination between the work to be accomplished and the track outage schedules.
3. Human Capital: There is a shortage of skilled personnel capable of performing the work quickly and efficiently.

Mitigation: When this project began, Amtrak was significantly understaffed for the work to be done and needed to increase related staff levels by 25%. The new personnel require training and field expertise, so Amtrak is mitigating the staffing risks by teaming the new hires with trained, experienced personnel. This is a reasonable approach and will help in making sure that the quality of work remains high.

Other Mitigation Tactics That Could Be Explored

Another tactic that should be considered as well is the development of an installation procedures guide, which would not only improve procedural consistency but would also serve to improve the learning curve for new personnel starting on the job.

**Lamokin Frequency Converter Replacement (PRJ29116023)**

<b>Budget:</b>	\$60,000,000
<b>Status:</b>	Project in progress, but late due to delays in state historical preservation approvals
<b>Description:</b>	Rehabilitate the 3 Rotary Frequency Converters at Lamokin - install new stator coils, rewind 23 motor rotor coils and install new collector rings, and reassemble the motor. Purchase and install six new 20MVA transformers. Purchase and install 14 ea 13.2kV generator and bus tie breakers. Purchase and replace all protective relay, control and power cables and control systems including Remote Terminal Units(RTU). Replace major components at Lamokin's 60Hz substation, which feeds the rotary converters.

Amtrak management is familiar with most of the components and key tasks associated with this project, but it has not actually implemented a project of this type in recent years. Key risk factors include:

1. Schedule – Several factors add to the schedule risk:
  - a. There is an extensive amount of work to be accomplished in a constrained time frame, with the last of six transformers being scheduled for delivery in November, 2010 – only three months before the grant deadline.
  - b. Deliveries of this type of item have a history of being late. However, scheduled deliveries are currently ahead of schedule.
  - c. Because Amtrak has not recently executed a project of this type, there is a risk that the schedule being established for the project may not be accurate.

Mitigation: The project team has not proposed any tactics to mitigate the schedule risk.

Other Mitigation Tactics That Could Be Explored

- a. The current project schedules are Excel-based. While this is a fine tool for some applications, it is not the right tool to use on a \$60 million project that is seriously time-constrained. In order to build proper work breakdown structures, understand detailed task dependencies up front, and manage progress effectively on a day-to-day basis, a project scheduling / tracking / reporting tool such as Primavera or MS Project should be used. If the expertise to use such a tool effectively does not exist within the project team, then outside expertise should be purchased for the duration of the project. *This tactic has since been implemented.*
- b. Since Amtrak Engineering has not executed this type of project in recent years, an external subject matter expert should be engaged on a consulting basis. This expert’s role would be to help develop detailed schedules, providing expertise on duration, staffing requirements, lead times, pitfalls, and other factors that can impact the project. The subject matter expert would also be responsible to ensure that no significant details have been omitted from the resulting project schedules.

**Los Angeles Maintenance Facility (PRJ29116045)**

<b>Budget:</b>	\$30,000,000
<b>Status:</b>	Contract issued, estimated \$5 million overrun
<b>Description:</b>	This project will see the construction of a railroad car maintenance facility geared toward servicing Superliners, Viewliners, and Amfleet II fleets.

Several associated risk items have been identified:

1. Acquisitions Risks – There are a number of long lead items, such as luggage racks for rolling stock or prefabricated steel for bridges that historically have taken longer to procure and receive than planned.

Mitigation: Amtrak is placing focus on the timely review and approval of shop drawings, to minimize delays in the procurement of long lead items. Regardless, the project has experienced some schedule slippage due to shop drawing review and changes. Schedule workarounds and acceleration change orders will be necessary due to the approval of equipment shop drawings and acquisition being on the project critical path. The schedule workarounds and project acceleration to meet the grant deadline will result in additional project cost.

2. Schedule Risk – Historically, projects of this nature have taken longer to execute than originally planned. In this instance, the environmental unknowns and constraints will increase the schedule risk, explaining the team’s concern over completing the project within the ARRA-imposed deadlines.

Mitigation: The contractor has agreed to complete the project within the grant deadline. In order to mitigate the schedule risks, the project will implement overtime, extended shifts, or multiple shifts as needed in order to complete the project on time. This will likely increase the overall project costs, reduce productivity, and result in waste.

3. Environmental Risk – The project is operating under space-constrained conditions, with other construction taking place in close proximity. Additionally, the site is known to have discovered instances of soil contamination in the past, which has the potential to impact construction on this project.

Mitigation:

- a. The project team is coordinating its construction schedules with both other construction teams and with the Mechanical Department (which will be the user of the new facility).
  - b. Cleanup of contaminated soil is being factored into the project schedules.
4. Financial Risk – The project’s budget is already understood by Amtrak management to be inadequate, with the expectation that the budget must be raised to approximately \$33 million. The initial estimates from which the original budget was derived were insufficiently detailed and did not take into consideration the following factors:
    - a. Higher labor costs in the Los Angeles region,
    - b. Additional work and contingency planning required to address site-based environmental issues,
    - c. Constrained working space on the building site, which will elevate some of the project labor costs

Mitigation: A more detailed estimate has already been established, resulting in an assessment that the budget needs to be increased to \$33 million.

#### Other Mitigation Tactics That Could Be Explored

Aside from increasing the budget, Amtrak management should consider the following additional tactics:

- a. Building detailed, cost-loaded schedules that validate the budget increase.
- b. Setting aside an unallocated portion of the budget to serve as a contingency in the event of unforeseen costs or cost increases.

### **Hialeah Maintenance Facility (PRJ29110027)**

<b>Budget:</b>	\$30,000,000
<b>Status:</b>	Contract issued, estimated \$5 million overrun
<b>Description:</b>	This project will see the construction of a second railroad car maintenance facility geared toward servicing Superliners, Viewliners, and Amfleet II fleets. While the facility itself will be of similar design, capabilities, and size as the facility being built in Los Angeles, the site environment is quite different, resulting in a significantly different set of risks.  The Engineering department has combined this project with Project # 29116066 – Implementation of a 480KV transmission line on the same site. The project manager feels that the combined budget of \$30 million will be sufficient to accommodate both jobs, including contingency.

Risk factors include:

1. Environmental. There is possible soil and water contamination on the site.

Mitigation: The project has implemented a set of procedures to handle the identification and removal of soil and water contamination as quickly as possible.

2. Schedule: The time frame to complete the job is very tight.

Mitigation: The general contractor agreed to a schedule that provides for a February 2011 completion. While this is a positive development, the nature of a construction project of this size increases the likelihood that unforeseen conditions will occur. The project team is prepared to discuss acceleration methods with the General Contractor should unforeseen conditions during construction delay the project. Schedule workarounds after contract award to the general contractor will require a change order and will increase the overall cost of the project.

### New York Tunnel Standpipe Installation (PRJ29112114)

<b>Budget:</b>	\$22,600,000
<b>Status:</b>	Contract awarded - in progress but behind schedule.
<b>Description:</b>	This project adds an air monitoring system to the existing New York tunnel standpipe system, which incorporates the addition of air-vacuum isolation valves with fail safe actuators in the tunnels. It also includes the installation of standpipe deluge valves, air compressors, associated piping, electrical power and controls to provide a fully operable fire standpipe system. The project also includes bonding and grounding installation for the standpipe system.

In general, the project management team is comfortable with the job, the quality of the estimates, and their chances of completing the job within the ARRA time frame. We were told that the chosen vendor has performed similar work for Amtrak and that Amtrak has been satisfied with the vendor's performance. The type of work being performed is not new to Amtrak, having had a long history of similar projects being successfully executed in the past.

1. Human Capital: The only potentially high risk uncovered is the availability of skilled personnel to perform the work. We were informed that there is a significant shortage of force account personnel available for the job, and when Amtrak trains new personnel other railroads recruit them.

Mitigation: Amtrak intends to implement a focused hiring program in order to close this skills gap.

### Platform Lighting (PRJ29112117)

<b>Budget:</b>	\$10,000,000
<b>Status:</b>	Contract awarded, project is in progress
<b>Description:</b>	This project will see the installation of new lighting on platforms at stations along the NEC. Stations include Washington Union Station, Baltimore Penn Station, Philadelphia 30th Street Station, Providence, and Route 128.

The OIG chose to assess the risk of this project because of performance issues with previous platform lighting efforts. However, our assessment showed a project that has very little inherent risk because:

1. The current cost estimates of \$6.6 million are significantly lower than the project's budget of \$10 million.
2. Past problems have been virtually eradicated through extensive use of new designs on platforms that encounter a variety of environmental conditions. Basically, the new designs have been vetted and tested in the field, with successful results. The same design is to be used for this project.

3. The construction and setup are relatively simple. Although the parallel platform refurbishment work taking place in some locations may complicate the effort, the project team firmly believes that the grant deadline will not be a factor.
4. Design specifications are already 100% complete on three of the five stations. The remaining station designs will have the same basis as those already completed.

#### **Emergency Backup Power – Stations (PRJ29112118)**

<b>Budget:</b>	\$4,030,000
<b>Status:</b>	Currently in the design phase
<b>Description:</b>	Allow for continuation of train and passenger movement and for personnel to fully operate in the event the station loses power. Back up system would add redundancy and includes emergency generation, UPS and improved electrical wiring. Stations include Washington Union Station, Baltimore Penn Station, 30th Street Philadelphia, and Providence, Rhode Island.

No inherent risks were identified by the project team.

## CONCLUSIONS

During the course of this risk assessment, it became evident that the deadline of February 17, 2011 was an overriding factor in a number of the project decisions. Management was faced with decisions such as:

- a. What projects to include or exclude from the ARRA program,
- b. What vendors to include or exclude from competition, depending on their willingness to commit to the completion deadline,
- c. The decision to introduce double and triple shifts for extended periods of time, regardless of the impact on productivity or potential waste.

The grant agreement dated March 19, 2009 and amended on July 14, 2009 between Amtrak and the FRA allows Amtrak to apply for a waiver of the February 17, 2011 deadline on projects that cannot be completed by that date. However, as part of its application, Amtrak is expected to demonstrate that it has taken extraordinary measures to meet the deadline.

In our opinion, a number of the elevated risks that these programs are experiencing have come into existence as the unintended consequence of the hard deadline imposed by the grant agreement. This is particularly true for the risks associated with acquisition, schedule, and environment, the majority of which are either driven or heightened as a result of the required completion date.

The OIG agrees that reasonable measures should be taken to complete projects within the grant deadline, provided that completion is achievable through the utilization of methods and procedures normally used

in the industry. Reasonable measures are those practices that one would expect to use under normal operating conditions. They follow due process in each step along the way and due diligence with regard to reasonable follow up and care that needs to be exercised. In this case that would include items such as normal shifts with a manageable amount of overtime, quantities of track outages that would minimize impacts to on-time performance, a signed contract that respects the grant provisions, and schedule contingencies that allow unplanned time for weather or other unforeseen circumstances. Because the grant terms identify measures that are generally consistent with prudent business practices, the term extraordinary measure, which is not defined, must therefore include actions outside of normal practices that would adversely impact productivity, increase the potential for waste or inefficiency, negatively impact the quality of the final products, or extraordinarily impact the smooth operation of the railroad.

## RECOMMENDATIONS

We recommend that Amtrak:

1. Avoid taking any extraordinary measures that can significantly impact productivity, increase the potential for waste, negatively impact the quality of the final products, or extraordinarily impact the smooth operation of the railroad.
2. Apply to the FRA to amend the grant provisions to ensure a balance between spending taxpayer funds in a timely manner and achieving project objectives, without actions that could increase the potential for waste or inefficiencies.
3. Apply to the FRA for a grant waiver in instances where reasonable measures failed to bring the project within the grant deadline.



## MANAGEMENT'S COMMENTS AND OIG RESPONSE

We provided Amtrak with a draft report on April 30, 2010 and received a response on May 11, 2010. Management's response is included in its entirety in the Appendix to this report. Management agrees with the report's findings and concurred with all three recommendations.

We consider management's comments to be responsive to the recommendations.

Audit Staff - Dominic Pinto  
Consultant - Ken Elias

## Overview of the Engineering / Construction Process EXHIBIT A

In order to understand the risk context, it's important to understand how Amtrak's Engineering / Construction process helps to mitigate risk. For the majority of construction projects, the following sequence of events normally takes place.

1. Architectural design is completed to the 30% level.
2. 30% design is reviewed and marked up
3. Design is completed to the 60% level
4. 60% design is reviewed and marked up
5. Design is completed to the 90% level
6. 90% design is reviewed and marked up
7. 100% design is completed, reviewed, and finalized. Construction is authorized to begin.
8. Bill of Materials is finalized, with quantities and estimated costs
9. "Schedule of Values" is issued, itemizing the deliverables and sequence of deliveries.
10. Construction and construction management procedures are documented.
11. Construction takes place. During this construction, adjustments are often made for unknown / unexpected field conditions, weather, and fine details not itemized in the design specifications (e.g. specific building materials).
12. Tasks and progress are tracked either daily or weekly
13. Inspections and quality assessments are made for each key component.
14. Substantial completion is achieved, with a list of outstanding items

NOTE: For projects known as "design / build" projects, steps 3 – 7 above are commonly integrated into a single step, with a final review taking place upon completion of 100% design.

## SCOPE & METHODOLOGY EXHIBIT B

We conducted this performance audit from September, 2009 to April, 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. The following methodology was used in conducting this audit.

We selected nine of Engineering's high-investment projects for our risk assessment, which centered on an examination of each program's inherent risks. The selection was based on our initial assessment of those projects we considered to have the highest risk potential. In conducting this audit, we interviewed Amtrak Engineering personnel who were familiar with both the program details and execution environment. We then evaluated each program against categories and elements of program risk. We reviewed the risk elements in each project and discussed the relative risk weighting of each one. We also identified a mitigation approach for those items identified as having potential high risk. For each project, we reviewed the adequacy of the project managers' risk management approach and put forward supplementary suggestions where we felt that additional measures would help to further mitigate the associated risks.

In preparation for the risk assessment, we developed an Excel-based software template that identified 10 categories of risk containing 62 risk elements against which each project was examined. Using this template, we evaluated the following ten aspects of project risk:

1. Acquisition – How difficult is it to acquire the materials and equipment needed for this project in a time frame that will allow the project to be completed within the ARRA time constraints?
2. Environment – Are there environmental factors such as exceptionally volatile weather, site contamination, sub-grade conditions, or institutional issues that increase the unknowns under which the project must operate?
3. Schedule – What are the risks that the project or program will not be completely executed with high quality within the ARRA time constraints?
4. Objectives – How clear are the project scope, objectives, measurement criteria, and associated performance metrics? Additionally, what are the risks that the program will not be able to achieve the associated ARRA objectives?
5. Technology – How mature and well developed are the technologies, methods and procedures, and concepts being used on the project?
6. Size / Complexity – Is the size and / or complexity of the project such that unknown factors or combination of factors serve to elevate the project's inherent risks?
7. Financial – what is the risk that the program will not be completely executed with high quality within the allocated budget?
8. Human Capital – how difficult is it to acquire and retain adequate quantities of skilled personnel for all aspects of this project or program?
9. Management and Organization – how well defined are the project organization, roles & responsibilities, and program controls? What is the potential for political or organizational disruption of the project's progress?
10. Fraud – Are there areas of the project or program where the fraud potential is historically elevated?

We conducted a series of risk reviews with Engineering. Each review was attended by at least two Engineering subject matter experts, one of which was always the corresponding project or program manager. The focus of our reviews was to assess each risk category and element within the risk assessment, determine the relative risk weighting of each, and where necessary identify a mitigation approach for those items identified as having potential high risk.

The risk assessment effort was based upon the knowledge of the subject matter experts and the questions and challenges put forth by the OIG. At the start of each session the OIG emphasized the importance of extracting the high-risk items so that those risks could be shared appropriately and mitigated effectively. The work session results were shared with the participants for review, comment, and consensus.

The risk rankings themselves were defined as follows:

- 1 = Risk level is negligible (no action needed)
- 2 = Risk level is low (but should still be monitored)
- 3 = Normal risk (mitigation plan may be needed)
- 4 = Elevated risk (an approved mitigation plan is needed)
- 5 = Very high risk (an alternative approach should be considered)

# APPENDIX

NATIONAL RAILROAD PASSENGER CORPORATION  
60 Massachusetts Avenue, NE, Washington, DC 20002  
tel (202) 906-3369, fax (202) 906-2174

## Memo



Date: May 11, 2010  
To: Ted Alves

From: DJ Stadler  
Department: Finance  
Subject: Report No. 912-2010 – Assessment  
of Project Risks Associated with  
Key Engineering Projects  
cc:

This is management's official response to the IG Audit Report No. 912-2010 – Assessment of Project Risks Associated with Key Engineering Projects.

1. Avoid taking any extraordinary measures that significantly impact productivity, increase the potential for waste, negatively impact the quality of the final products, or extraordinarily impact the smooth operation of the railroad.

**Management agrees and will avoid taking extraordinary measures that would impact productivity, increase the potential for waste, negatively impact the quality of the final products, or extraordinarily impact the smooth operation of the railroad.**

2. Apply to the FRA to amend the grant provisions to ensure a balance between spending taxpayer funds in a timely manner and achieving project objectives, without actions that could increase the potential for waste or inefficiencies.

**Management will discuss the potential to amend the grant agreement with FRA and seek information regarding FRA's willingness to amend the grant requirements.**

3. Apply to the FRA for a grant waiver in instances where reasonable measures failed to bring the project within the grant deadline.

**If management determines that extraordinary measures are required to complete a project by the February 17, 2011 deadline, it will either refrain from committing to the project and redirect the funds to other projects that comply with the grant agreement and the intent of the law, or else it will apply for an extension based on the fact that it has taken reasonable measures to meet the deadline. Management will describe the measures it has taken and adverse consequences of taking additional extraordinary measures.**