ATLAS Railcar Design Project Status Report

Fuel Cycle Research & Development

Prepared for
US Department of Energy
Nuclear Fuels Storage and
Transportation Planning Project

Oak Ridge National Laboratory:
Matt Feldman, Bill Reich

September 30, 2015

FCRD-NFST-2015-000799

ORNL/SPR-2015/545

EXECUTIVE SUMMARY

This report documents work performed supporting the US Department of Energy (DOE) Office of Nuclear Energy (NE) Fuel Cycle Technologies (FCT) Nuclear Fuels Storage and Transportation Planning Project (NFST) under work breakdown structure element 1.02.09.13 TR, "Hardware." In particular, this report satisfies the requirements of M2 milestone M2FT-15OR0913016, "Railcar Design Report" within work package ORNL-FT-15OR091301.

The purpose of this report is to document progress on the contract for the design and prototype fabrication of railcars to transport high level radioactive material (HLRM). As described in this report, a significant effort was expended over 18 months (March 2014 to August 2015) to prepare a combined sources sought notice and request for information, an acquisition plan, a presolicitation notice, and a request for proposals. This resulted in DOE awarding a contract on August 21, 2015 for the design and associated analysis, and prototype fabrication of cask and buffer railcars. The railcar design contract was awarded to AREVA Federal Services (AFS). The end result of this effort will be development of the final cask and buffer railcar designs, including associated analysis, and fabricated railcar prototypes ready for testing.

This is the first report on the railcar design effort. Because the design contract was only recently awarded, this first report focuses primarily on the significant effort expended to prepare for and award the design contract. Future updates to this report will be necessary and will describe progress on the design and railcar fabrication activities.

This page is intentionally left blank.

CONTENTS

LIST OF FIGURES

ACRONYMS

AAR	Association of American Railroads
AFS	AREVA Federal Services
CPFF	cost-plus-fixed-fee
DOE	US Department of Energy
DOE-ID	DOE Idaho Operations Office
DOE-NE	DOE Office of Nuclear Energy
FCRD	Fuel Cycle Research and Development
FFP	firm-fixed-price
HLRM	high-level radioactive material
HLW	high-level radioactive waste
NFST	Nuclear Fuels Storage and Transportation Planning Project
RFI	request for information
RFP	request for proposals
SNF	spent nuclear fuel
SOW	statement of work
SSN	sources sought notice
SSEB	source selection evaluation board
TTCI	Transportation Technology Center, Inc.

1. INTRODUCTION

The Nuclear Fuels Storage and Transportation Planning Project (NFST) was established to lay the groundwork for implementing interim storage, including the associated transportation of spent nuclear fuel (SNF) and high-level radioactive waste (HLW). The transportation of SNF and HLW will be primarily performed by rail and will require the design of specialized cask railcars to be approved by the Association of American Railroads (AAR) under AAR Standard S-2043.[1] AAR Standard S-2043 defines the performance specification for trains used to carry SNF and HLW. This report summarizes the planned approach to design new cask and buffer railcars that meet AAR Standard S-2043.

This report documents progress on the contract for the design, associated analysis, and prototype fabrication of railcars to transport high level radioactive material (HLRM). According to AAR, HLRM includes both SNF and HLW. As described in this report, a significant effort was expended over 18 months (March 2014 to August 2015) to prepare a combined sources sought notice and request for information, an acquisition plan, a presolicitation notice, and a request for proposals that resulted in DOE awarding a contract on August 21, 2015 for the design, associated analysis, and prototype fabrication of cask and buffer railcars. The railcar design contract was awarded to AREVA Federal Services (AFS). The principal subcontractor to AFS is KASGRO Rail, a company with extensive experience in the design and fabrication of heavy-duty railcars. DOE, AFS, and KASGRO Rail held a kickoff meeting on September 10, 2015 to discuss how specific tasks in this contract would be performed.

This acquisition continues to lay the groundwork to implement an integrated nuclear waste management disposition system by preparing for future large-scale transport of SNF and HLW. This acquisition is for railcar designs which will be owned by DOE, as well as prototype fabrication of one cask railcar and two buffer railcars. The end result of this effort will be final cask and buffer railcar designs, associated analysis, and fabricated railcar prototypes ready for testing.

This page is intentionally left blank.

2. DESIGN AND PROTOTYPE FABRICATION OF RAILCARS

Section 2.1 describes the efforts over the last 18 months to develop and implement a railcar design acquisition strategy that led to the successful signing of a contract for railcar design and prototype fabrication. Section 2.2 describes the initial activities during the first month after contract award and provides a brief overview of planned future activities for each phase of the project.

2.1 Railcar Design Acquisition Strategy

The Department of Energy Idaho Operations Office (DOE-ID) awarded a firm-fixed-price (FFP) contract on August 21, 2015 for the design, associated analysis, and prototype fabrication of cask and buffer railcars to transport HLRM. This was the culmination of 18 months of concerted effort to prepare the solicitation, review and evaluate the proposals, and negotiate and sign the final contract with AREVA Federal Services.

The new cask railcars have been named *ATLAS*. The ATLAS Railcar Design Project logo is shown in Fig. 1.

Fig. 1. Logo for ATLAS Railcar Design Project.

DOE-ID initiated the 18-month procurement effort by writing an acquisition plan[2] and issuing a combined request for information (RFI) and sources sought notice (SSN) via the FedConnect website portal (www.fedconnect.net) on April 28, 2014. The RFI included a draft statement of work (SOW) and solicited ideas from all sources on how DOE should acquire the capability to transport casks of SNF and HLW. This feedback was used to help develop DOE's proposed acquisition strategy for the ATLAS Railcar Design Project. Six RFI modifications were posted to the web portal that included edits to the RFI language, extensions of the due dates, pre-proposal teleconference slides, and answers to RFI responders' questions.

Five companies responded to the combined RFI and SSN: MHF Services, AREVA Federal Services, KASGRO Rail, NAC International, and Technology Transportation Services. DOE carefully reviewed these responses and made changes to the SOW that was subsequently used in the request for proposals

(RFP). For example, the SOW in the RFI required the railcar design to fit into AAR clearance plate B, but several of these companies recommended changing the requirement to AAR clearance plate C. DOE accepted this recommendation and used plate C in the SOW.

A much larger change was made to the SOW between release of the RFI (April 2014) and the RFP (December 2014. During this time, DOE decided not to include railcar testing and approval in the SOW, so the current contract will not include testing of the railcars or approval by the AAR. Therefore, a follow-on contract will be required to perform this technical scope.

A presolicitation notice was posted by DOE-ID to the FedConnect web portal on November 21, 2014, announcing DOE's intention to issue an RFP to provide for the design, associated analysis, and prototype fabrication of cask and buffer railcars compliant with AAR Standard S-2043. The notice described the proposed three phases of project activity and anticipated that the resulting contract type would be FFP for Phase 1 and cost-plus-fixed-fee (CPFF) for Phases 2 and 3.

The RFP was posted to the web portal on December 8, 2014, as solicitation number DE-SOL-0006863 for the design, associated analysis, and prototype fabrication of railcars. Two amendments of the solicitation were later posted, both of which extended the proposal due dates. The NFST's cask railcar system requirements document[3] was included in the RFP package. A preproposal teleconference was conducted on December 22, 2014, that provided an overview of the RFP, a description of the SOW, instructions on responding to the RFP, and answers to questions received by DOE. DOE received the proposals on February 23, 2015 and immediately began the proposal review and evaluation process.

As documented in the source selection plan,[4] DOE assigned a chair to lead the source selection evaluation board (SSEB) in reviewing, analyzing, and evaluating the proposals received in response to the RFP. The SSEB conducted a thorough, comprehensive evaluation of proposals that included preparing independent government cost estimates, evaluation of technical, cost, and schedule components against the evaluation criteria, preparing an acquisition forecast, and supporting the contract negotiation process.

The successful results achieved by the SSEB include a 12-month schedule reduction and a single, negotiated FFP contract for all three project phases thus avoiding the riskier CPFF contract that was anticipated for Phases 2 and 3. Both cost and schedule were reduced in the final FFP contract along with reduced project risk to DOE. The successful negotiations resulted in DOE-ID awarding a FFP contract on August 21, 2015 to AREVA Federal Services.

2.2 ATLAS Railcar Design Project

The ATLAS Railcar Design Project has three phases that are being performed under a single multi-year FFP contract. Phase 1 is Mobilization and Conceptual Design, Phase 2 is Preliminary Design, and Phase 3 is Prototype Fabrication and Delivery. A brief summary of the major activities in each of the three project phases is provided in this section. The summary-level project schedule for each phase is shown in Fig. 2.

The schedule does not include any hold points between the phases, so the contractor does not need approval from DOE to start work on any of the phases. The scheduled completion dates for Phases 1, 2, and 3 are August 2016, March 2017, and March 2019, respectively. Note that Phase 2 is scheduled to start in April 2016, which is four months before Phase 1 is scheduled to be finished.

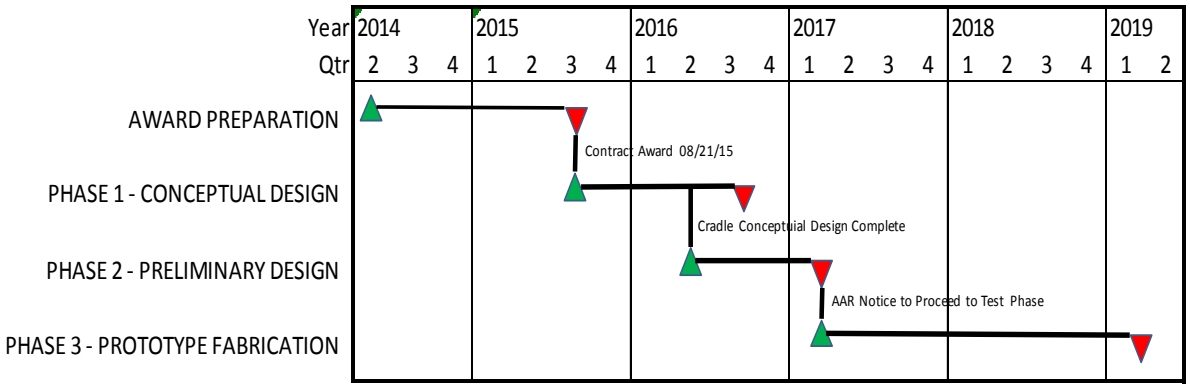

Fig. 2. Schedule for ATLAS Railcar Design Project.

The ATLAS Railcar Design Project kickoff meeting was held on September 10, 2015, in Washington, DC, at the DOE Forrestal Building. The kickoff meeting marked the beginning of the contractors' technical efforts. The primary contractor is AREVA Federal Services, with six supporting subcontractors. The seven organizations and their primary roles on the ATLAS Project are as follows:

AREVA Federal Services (AFS): project integrator, conceptual designs of cask cradles and attachment mechanisms

AREVA-TN (aka Transnuclear): cask-to-cradle-to-ATLAS railcar loading procedures, peer review.

KASGRO Rail: railcar attachment overview, railcar conceptual design, detailed railcar designs including finite-element modeling, and prototype fabrication.

> Note: KASGRO Rail is a fabricator of heavy-duty railcars with an AAR-certified quality assurance program. A point of particular importance to the ATLAS Project is that KASGRO Rail is the fabricator of the US Navy's M-290 cask railcar, the only AAR S-2043 approved railcar to be manufactured to date.

Transportation Technology Center, Inc. (TTCI): dynamic modeling of railcar designs and AAR Standard S-2043 submittal expertise.

Stoller Newport News Nuclear (SN3): peer review of ATLAS cradle design and loading procedures based on previous experience as cradle designer/fabricator of the US Navy's cask cradle

MHF Services, Inc.: peer review of Phase 1 cask and cradle design data packages and AAR plate C dimensions and cask railcar clearance

Coghill Communications, Inc.: woman-owned small business responsible for document management.

2.2.1 Phase 1: Mobilization and Conceptual Design

The five major activities in Phase 1 are as follows:

1. conceptual design of cradles and the cradle-to-railcar attachment system,
2. conceptual design of the ATLAS cask railcar,
3. conceptual design of the buffer railcar,

4. development of general loading procedures for each cask, and
5. functional and operational requirements of the cask and buffer railcar designs.

2.2.2 Phase 2: Preliminary Design

The six major activities in Phase 2 are as follows:

1. develop Phase 2 design package with procurement specifications, qualified vendor listing, design drawings/cut sheets, and fabrication inspection requirements;
2. perform design analysis, including nonstructural analysis, finite modeling for structural analysis, dynamic modeling and load simulation, and safety monitoring system design and analysis;
3. develop preliminary S-2043 design package and submit to AAR;
4. conduct periodic reviews and briefings with AAR representatives to track submission package status, and provide follow-up support to AAR as needed during the review process;
5. provide DOE with a copy of the AAR notification to "proceed with the test phase"; and
6. generate and provide a cost estimate and delivery schedule to DOE for a future production run of 120 ATLAS cask railcars and 60 buffer railcars.

2.2.3 Phase 3: Prototype Fabrication and Delivery

The four major activities in Phase 3 are as follows:

1. procure materials needed for prototype railcar fabrication, with KASGRO providing quality receipt inspections of all materials and AFS providing quality assurance oversight;
2. fabricate one prototype ATLAS cask railcar and two prototype buffer railcars in accordance with the AAR-approved preliminary design;
3. deliver the prototype railcars to AAR's TTCI facility in Pueblo, Colorado; and
4. deliver the final, as-built ATLAS Railcar Project documentation package to DOE.

3. CONCLUSIONS AND FUTURE ACTIVITIES

This report documents the successful results achieved by DOE in negotiating and signing an FFP contract for the design and prototype fabrication of railcars to transport HLRM. The report describes the significant effort expended over 18 months (March 2014 to August 2015) to prepare the required acquisition documentation resulting in DOE awarding a contract on August 21, 2015, for the design and prototype fabrication of cask and buffer railcars.

The successful results achieved include a 12-month schedule reduction and a single negotiated FFP contract for all three project phases, thus avoiding the riskier CPFF contract that was originally planned for phases 2 and 3. Cost, schedule, and project risk to DOE were all reduced in the final FFP contract.

Future activities are envisioned to perform the required testing and to obtain final approval of the cask and buffer railcars from AAR. The effort to design and develop railcar prototypes, conduct the necessary testing, and secure approval of S-2043–compliant railcars is estimated to take 7 to 9 years to complete. AAR approval will require extensive full-scale testing of the individual railcars and the complete railcar consist.

The complete consist testing will require DOE to acquire a new escort car which must meet all S-2043 requirements. However, DOE has decided not to initiate a program to develop its own escort car because the US Navy is already engaged in such a program. DOE believes that the Navy's escort car design will meet all AAR and DOE requirements, so it is not necessary for DOE to have a separate program. DOE drafted a memorandum of understanding with the Navy for this effort that is awaiting approval. If the Navy's escort car design is not finished when DOE is ready to start full consist testing (March 2019), then DOE plans to use a surrogate escort car with the same weight and center of gravity.

DOE will have several options to choose from (lease, purchase, etc.) to establish and maintain the necessary railcar fleet for SNF and HLW shipments. Once the design and prototype testing is under way, DOE will decide whether to procure or lease the necessary rolling stock. DOE does not plan to develop any new locomotives but will expect private railroad companies to provide locomotives compatible with the S-2043 compliant railcars.

When DOE begins to make shipments from nuclear power plants, DOE plans to remove the greater-than-class-C (GTCC) waste from power plants in the same train shipment along with the SNF[a]. The GTCC waste casks will be handled the same as the casks containing SNF, so these trains will not be "dedicated trains" in the strict legal definition. Strictly speaking, a dedicated train would carry only HLRM, not GTCC waste. The use of nondedicated trains is allowed under AAR Standard S-2043 as long as all the vehicles in the consist meet the requirements of S-2043.

While a complete transportation system cannot be fully developed until a destination site is known, long lead-time activities necessary for transportation system development such as design and prototype fabrication can be addressed now. DOE's NFST is proactively laying the groundwork so that a

[a] Removal of GTCC low-level radioactive waste at shutdown sites is discussed in this report because the Court of Appeals for the Federal Circuit (see below) has held that because the NRC has determined by rule that, unless the NRC approves an alternative method, GTCC low-level radioactive waste requires disposal in a geologic repository, such waste is considered high-level radioactive waste under the terms of the Standard Contract.

Yankee Atomic Electric Co. v. U.S., 536 F.3d 1268 (Fed. Cir. 2008)

Pacific Gas & Electric Co. v. U.S., 536 F.3d 1282 (Fed. Cir. 2008)

transportation system capability will be available to ensure safe, secure, efficient movement of SNF from commercial nuclear power reactor sites in a timely manner when a receiving site becomes available.

Because the design contract was only recently awarded, this first report focused primarily on the significant effort expended to prepare for and award the design contract. Future updates to this report will describe progress on the design and railcar fabrication activities.

REFERENCES

[1] "Performance Specification for Trains Used to Carry High-Level Radioactive Material," *Car Construction Fundamentals and Details, AAR Manual of Standards and Recommended Practices*, Standard S-2043 (effective 2003 revised 2008).

[2] *Acquisition Plan Railcar Design Project Revision 00*, Department of Energy, DE-SOL-006863 (November 2014).

[3] *AAR S-2043 Cask Railcar System Requirements Document*, FCRD-NFST-2014-000093 Rev. 1 (December 1, 2014).

[4] *Source Selection Plan, Request for Proposal Number DE-SOL-0006863, Design and Prototype Fabrication of Railcars for Transport of High-Level Radioactive Material*, Department of Energy (December 2014).