Monthly Letter Status Report

Reporting Period	April 2002
Name and Address	Organization 6141, Mail Stop 0718 Sandia National Laboratories P. O. Box 5800 Albuquerque, NM 87185-0718
JCN	J5412
Title	Vulnerability Assessments for Transportation and Storage of Radioactive Materials
Principal Investigator	Ken B. Sorenson
Project Period of Performance	March 2002 through September 2004

Objective

This program has four objectives:

1. Determination of the mechanical and thermal response of radioactive material transport and storage packages, especially spent fuel packages, to the(that might be associated with a terrorist attack. Ex 2
2. For terrorist attack scenarios of concern, estimation of the radioactive source terms that might be released from packages failed by the attack.
3. For scenarios of concern that lead to significant radioactive releases to the environment, calculation of the consequences of the radioactive release (e.g., radiological doses, health effects, costs)
4. Demonstration for NRC staff of the analyses performed using computer codes.

Technical Progress

Task 1.1: Jetliner Crash into an ISFSI.

Zapotec Analyses. During finite element impact calculations, when one Lagrangian object impacts (contacts) another Lagrangian object, extreme distortion of Lagrangian mesh elements often causes the computation to "crash." In order to avoid this "contact" problem, an alternate solution approach was attempted for the Zapotec cask impact calculations. The alternate solution approach "donates" mesh elements of the Lagrangian aircraft model to the CTH mesh based upon a coordinate-based element death criterion. Essentially, portions of the aircraft falling within a prescribed bounding box (the region within which portions of the plane are impacting the cask) are donated to the CTH mesh. The donated material then behaves as an Eulerian CTH

Portions Ex 2

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material for the problem duration. The advantage of this approach is that we now have Eulerian material interacting with the Lagrangian cask, thereby avoiding the problem of element death posed by contact between impacting Lagrangian objects.

A "simplified" Zapotec calculation was conducted to assess this alternate solution approach. The "simplified" problem considered a reduced aircraft mesh (main fuselage body and front gear assembly) impacting the Lagrangian cask. The underlying ISFSI concrete slab was modeled as a CTH material to reduce the volume overlap calculations. The problem was run for a duration of 30 msec. Figures (a) – (d) illustrate the effectiveness of the approach. In these figures, (a) to take advantage of symmetry, only half of the jetliner and the cask are modeled; (b) the portion of the jetliner that is "wrinkled" is the region in which the Lagrangian elements of the plane have been donated to the Eulerian mesh of the CTH calculation; (c) the solid black line is the floor of the passenger compartment (in the CTH region, this line is grey colored and shaped like a hair pin), and (d) the blue cylinder represents the front landing gear. The figures illustrate how the aircraft "flows" into the CTH mesh. The aircraft nose is observed to crush-up upon impact with the cask. In May, the analysis will be expanded to assess the impact of the full aircraft model against the target.

EX 2

EX 2 portions

Task 1.2: Small Plane Crash into an ISFSI.

Small Plane Survey. Most of the data needed to complete the Survey of Small Aircraft has been acquired and is currently being compiled into a single database for analysis. It is anticipated the Small Aircraft Database will be fully populated in about two weeks. An investigation was begun of whether the small plane data can be used to construct a nomograph, that correlates three measures of the ( ) of small aircraft: 1) impact kinetic energy of the fully loaded plane, 2) conflagration/deflagration with respect to the full fuel carrying capability of the plane, and 3) (carrying capacity referenced to ( ) as a function of maximum aircraft useful load.

Task 1.3: ANSYS/LS-DYNA Jetliner Model. ANSYS/LS-DYNA was purchased and first attempts to use the code were begun. These initial attempts to use the code showed that getting the Southwest Research model of the HI-STORM storage cask to run in our version of ANSYS/LS-DYNA will not be straightforward. SNL staff are working with the ANSYS support staff to resolve this input problem. Next month work will continue on developing an approach for the Subtask 1.3, "Simplified (Computer model Structural Analysis."

Task 1.4: Jetliner Crash into a Spent Fuel Rail Cask. No work done this month.

Task 1.5: Small Plane Crash into a Spent Fuel Rail Cask. No work done this month.

Task 1.6: Small Plane Crash into Other Radioactive Material Packages. No work done this month.

Task 2.0: Weapons, Radioactive Materials, Consequences. Work on the format and contents for the table that will summarize the results (package damage, dispersal of particulates, radiological consequences) of prior studies of sabotage events involving radioactive material packages was begun.

Task 3.0: Models for Other Spent Fuel Transportation Casks. No work done this month.

Task 4.0: Models for Other Spent Fuel Storage Casks. No work done this month.

Task 5.0: Threat Assessment for Sabotage Scenarios Involving Storage Casks. No work done this month.

Task 6.0: Threat Assessment for Sabotage Scenarios Involving Transportation Casks. No work done this month.

Task 7.0: Models for Transportation Packages for Other Radioactive Materials. No work done this month.

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Budget Status

The following table presents program costs ($K) by task for the current month and for the fiscal year to date:

Task	Title	Current Month	Fiscal Year to Date
1.1	Jetliner Crash into an ISFSI	80.0	80.0
1.2	Small Plane Crash into an ISFSI	2.4	2.4
1.3	ANSYS/LS-DYNA Jetliner Model	4.5	4.5
1.4	Jetliner Crash into a Spent Fuel Rail Cask	0.0	0.0
1.5	Small Plane Crash into a Spent Fuel Rail Cask	0.0	0.0
1.6	Small Plane Crash into Other Radioactive Material Packages	0.0	0.0
2.0	Weapons, Radioactive Materials, Consequences	10.5	10.5
3.0	Models for Other Spent Fuel Transportation Casks	0.0	0.0
4.0	Models for Other Spent Fuel Storage Casks	0.0	0.0
5.0	Threat Assessment for Sabotage Scenarios Involving Storage Casks	0.0	0.0
6.0	Threat Assessment for Sabotage Scenarios Involving Transportation Casks	0.0	0.0
7.0	Models for Transportation Packages for Other Radioactive Materials	0.0	0.0
8.0	Threat Assessment for Sabotage Scenarios Involving Other Packages	0.0	0.0
	Code Demonstrations	0.0	0.0
	NRC Support	68.2	68.2
	TOTAL	165.6	165.6

The financial reporting for this month is based on the 189 submitted at the end of February of 2002. $165.6 K was spent during March of FY2002. Total FY2002 spending to date is $165.6 K. The $68.2 K spent on NRC Support represents the costs (a) of preparing for an attending the meeting at NRC where the general approach for performing this project proposed by SNL was discussed with NRC staff, (b) of conducting organizational meetings with managers and staff of the other SNL Departments that will be working on this project at which tasks, schedules, and budgets were defined, and (c) of writing project Work for Others proposals (the NRC 189s for this project).