

1/14/02 (7)

1. Draft SNL Contract with Schedule attached.
2. DOT/VOLPE Draft Contract Summary
3. Draft list of casks (dates = SNL contract)
4. Characteristics of Storage Casks
5. Characteristics of Transportation Packages
6. Characteristics of Dual Purpose Casks
- 7.

Tasks

Ex 2

- 1.1
- 1.2
- 1.3 Simplified Model
- 2.1 Table - Weapons vs. Consequences
- 2.2 Guidance Doc. - Modeling Source Terms from Events
- 3.0 Truck & Rail Cask Models Devel.
- 4.0 Storage Cask Model Devel.
- 5.0 Events of Threat X Assessments for Storage
- 6.0 " " " " " " for Transport.

Ex 2

Portions Ex 2

E/6

3.0 Purpose

The purpose of this SOW is to perform studies of vulnerability of transportation and storage of nuclear materials to terrorist events and to train SFPO personnel to perform independent evaluations of similar events.

4.0 Expertise and Disciplines Required

The performing organization shall assure that the project team has the proper mix of nationally and internationally recognized technical experts, i.e., scientists and engineers with training and experience in dynamic structural analysis, source term assessments resulting from terrorist events, and radiological consequence assessments from those events. Specific disciplines required include, but are not limited to, structural and thermal engineering, and health physics. The principal, and other senior investigators shall have the professional credentials to qualify as expert witnesses at public hearings.

Personnel conducting safeguards work shall have technical experience in determining radiological source terms and in performing radiological impact analyses for adverse conditions. The personnel conducting this work must have experience in using structural computer models, such as Pronto (detailed analyses) and ANSYS/LS-DYNA (simplified analyses), MELCOR and MACCS computer codes (or equivalent) and experience in estimating the fuel performance for the conditions under consideration. The personnel working on this project part must have, as a minimum, a Department of Energy L-clearance or equivalent (Department of Defense).

The principal investigator shall provide technical oversight and continuity over all work performed on this project.

5.0 Work to be Performed

The staff will define the new design basis threat following receipt of Commission guidance. Initial work will focus activities designed to respond to Congressional inquiries, in specific, aircraft crashes into storage and transportation casks. Other activities will be defined and transmitted to SNL as resources permit.

Task 1 - Terrorist Events and Consequence Analyses from Aircraft Crashes

The following Subtasks are grouped in terms of technical specialties. Each Subtask event is comprised of a structural analysis, fuel performance analysis and resulting radiological consequences.

Task 1.1 Crashing Into an ISFSI

Develop computer models that simulate the consequences of a ¹ aircraft crashing into an ISFSI of a 100 by 100 cask array. Two structural computer models should be developed for the ² one model is a detailed mode requiring a super computer and the second model is a simplified model (on ANSYS/LS-DYNA) that can be executed on a desktop computer. Dimensions and cask design should be consistent with the HI-STORM SER. The HI-STORM cask is selected because SNL has readily available structural and MELCOR models of the HI-STORM cask. These models should be applied in the following analyses.

Portions ² Ex 2

1.1.a. **Structural Analyses (Technical Monitor - - Mahendra Shah)**

- i. Provide a description of the structural model for staff approval prior to performing calculations. **[Deliverable Date: February 28, 2002.]**
- ii. Prior to performing the calculations, provide, for staff review and approval, recommendations for angle of trajectory and speed of plane crashing into the casks. **[Deliverable Date: March 15, 2002.]**
- iii. Following staff approval of the analytic assumptions, perform the specific analyses.
- iv. Provide detailed documentation of the analysis and all structural behaviors of the cask and plane. **[Deliverable Date: June 14, 2002]**
- v. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task will be modified to perform up to two additional threat assessments, if needed. **[Deliverable Date: to be determined]**
- vi. Provide training for two to three SFPO staff personnel on performing the structural analyses. (Schedule to be coordinated between SNL and SFPO.)

1.1.b. **Fuel Canister Performance (Source Term) Analyses - - (Technical Monitor: Kenneth Erwin)**

- i. Provide a description of the MELCOR model for staff approval prior to performing calculations. **[Deliverable Date: April 15, 2002]**
- ii. Prior to performing the calculations, provide, for staff review and approval, recommendations for modeling the fuel, source term calculations, and property damage estimates. **[Deliverable Date: May 1, 2002]**
- iii. Following staff approval of the analytic assumptions, perform the specific analyses. **[Deliverable Date: June 14, 2002]**
- iv. Provide detailed documentation of the analysis and all structural source terms within and exiting the cask. **[Deliverable Date: June July 31, 2002]**

- v. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task will be modified to perform up to two additional threat assessments, if needed.

[Deliverable Date: to be determined]

- vi. Provide training for two to three SFPO staff personnel on performing MELCOR calculations for the above event. (Schedule to be coordinated between SNL and SFPO.)

1.1.c. Thermal Analyses - - (Technical Monitor: Christopher Bajwa)

- vii. Provide a description of the thermal model for staff approval prior to performing calculations.

[Deliverable Date: April 15, 2002]

- viii. Prior to performing the calculations, provide, for staff review and approval, recommendations for modeling the thermal response to the accident.

[Deliverable Date: May 1, 2002]

- ix. Following staff approval of the analytic assumptions, perform the specific analyses.

- x. Provide detailed documentation of the analysis and all thermal system responses.

[Deliverable Date: July 31, 2002]

- xi. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task will be modified to perform up to two additional threat assessments, if needed.

[Deliverable Date: to be determined]

- xii. Provide training for two to three SFPO staff personnel on performing thermal calculations for the above event. (Schedule to be coordinated between SNL and SFPO.)

1.1.d. Radiological Consequence Analyses - - (Technical Monitor: Adelaide Giantelli)

- i. Provide a description of the radiological consequence model for staff approval prior to performing calculations.

[Deliverable Date: April 15, 2002]

- ii. Prior to performing the calculations, provide, for staff review and approval, recommendations for modeling the radiological responses to the accident. Include, among other considerations, the assumed meteorology conditions, release height, particle distribution, particle settling (both within and outside the cask), population probability distribution, decontamination and clean-up costs,

uptake pathways, uptake fractions, health effects of uptake and inhalation, ground shine, sky shine, etc.

[Deliverable Date: May 1, 2002]

- iii. Following staff approval of the analytic assumptions, perform the specific analyses.
- iv. Provide detailed documentation of the analysis and all radiological consequences as a function of distance. The documentation should include, among other information, the extent of the fuel damage, release fraction from the fuel (including the size distribution of the radionuclide particles), migration of isotope out of the fuel matrix, the thermal effects on the fuel, thermal driving forces, plate-out and settling.

[Deliverable Date: July 31, 2002]

- v. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task will be modified to perform up to two additional threat assessments, if needed.

[Deliverable Date: to be determined]

- vi. Provide training for two to three SFPO staff personnel on performing radiological consequence analyses for the above event. (Schedule to be coordinated between SNL and SFPO.)

Task 1.2: (Crashing Into an ISFSI)
(Technical Monitor: Mahendra Shah)

- 1.2.a. Provide, for staff approval, an analytic approach to model the consequences of a crashing into an ISFSI. Research the various trajectories and postulated being projected to the front, side, etc.) for various scenarios. Pros and cons should be provided on the need to model the dynamics of the plane, its projected and neglecting the dynamic contributions of the plane (e.g.,

[Deliverable Date: May 10, 2002]

- 1.2.b. Following the staff's review and approval of the proposed guideline developed above, develop computer models for assessing the consequences of crashing a (amount to be provided by NRC) onto an ISFSI identified in Task 1.1, above.

[Deliverable Date: October 21, 2002]

Task 1.3 Simplified Computer model (desktop model running on ANSY/LS-DYNA) Structural Analyses (Technical Monitor - - Mahendra Shah)

Portions ⁵ Ex 2

(Technical Monitor - - D. Huang)

b. NAC-LWT (Truck) Cask

[Deliverable Date: May 30, 2003]

(Technical Monitor - - D. Huang)

c. NAC-STC (Truck) Cask

[Deliverable Date: May 16, 2003]

(Technical Monitor - - D. Huang)

6.0 Deliverables and Schedule (including meetings)

The deliverables required under each phase with the anticipated time for delivery are provided under each task, above. All deliverables shall be provided to the NRC TPM responsible for each phase of this project.

The performing organization shall prepare a comprehensive final report in NUREG/CR format, summarizing all work performed under this project. The report shall include an executive summary of the findings of this project. It shall also include a complete description of the shipment models developed and rationale for the use of data and assumptions.

All reports shall be edited and reviewed by the performing organization and checked in accordance with the quality assurance requirements addressed under Section 13.0. The NMSS TPM will provide comments to the performing organization to be considered in the preparation of the final task report. These comments will identify potential problem areas, discrepancies, and technical insights on the draft report. The comments will be for the purpose of clarification only and will not be construed as to prejudge the performing organization's work or technical findings. Within the above schedule and after receipt of NRC comments, the performing organization shall revise the draft report, incorporating resolution of comments, and submit a camera-ready copy and an NRC-compatible, electronic media copy of the final report.

7.0 Period of Performance

The period of performance for this project shall continue until January 31, 2004.

8.0 Estimated Level of Effort

The estimated level of effort for this project is identified below.

Task Number	Estimated FY-02 FTE	Estimated FY-03 FTE	Estimated FY-04 FTE
1.1 (Plane Crash)	1.5	0	0
1.2 (Small Plane Crash)	1.0	0	0

9 Portion's Ex 2

1.3 () Model)	0.6	0	0
2.1 (Table of Weapons vs Consequence)	0.1	0	0
2.2 (Guidance Document)	0.3	0	0
3 (Truck/Rail Casks Model Development)	0.6	0	0
4 (Storage Casks Model Development)	0.6	0	0
5 (Event-X Storage)	0.5	3.0	0.3
6 (Event-X Transportation)	0.5	3.0	0.3
NRC Personnel Training	0.3	0.2	0
Total FTE	6.0	6.2	0.6

9.0 Meetings and Travel

Three meetings should be planned at NRC headquarters per physical year, with up to four travelers per meeting.

In addition, NRC personnel will meet with SNL personnel/contractors at SNL at least twice per physical year to review ongoing activities, as needed. Training for SFPO personnel will be held at SNL. Meeting notes shall be taken and distributed in accordance with Section 11.0 of this SOW.

10.0 Project Status Reports

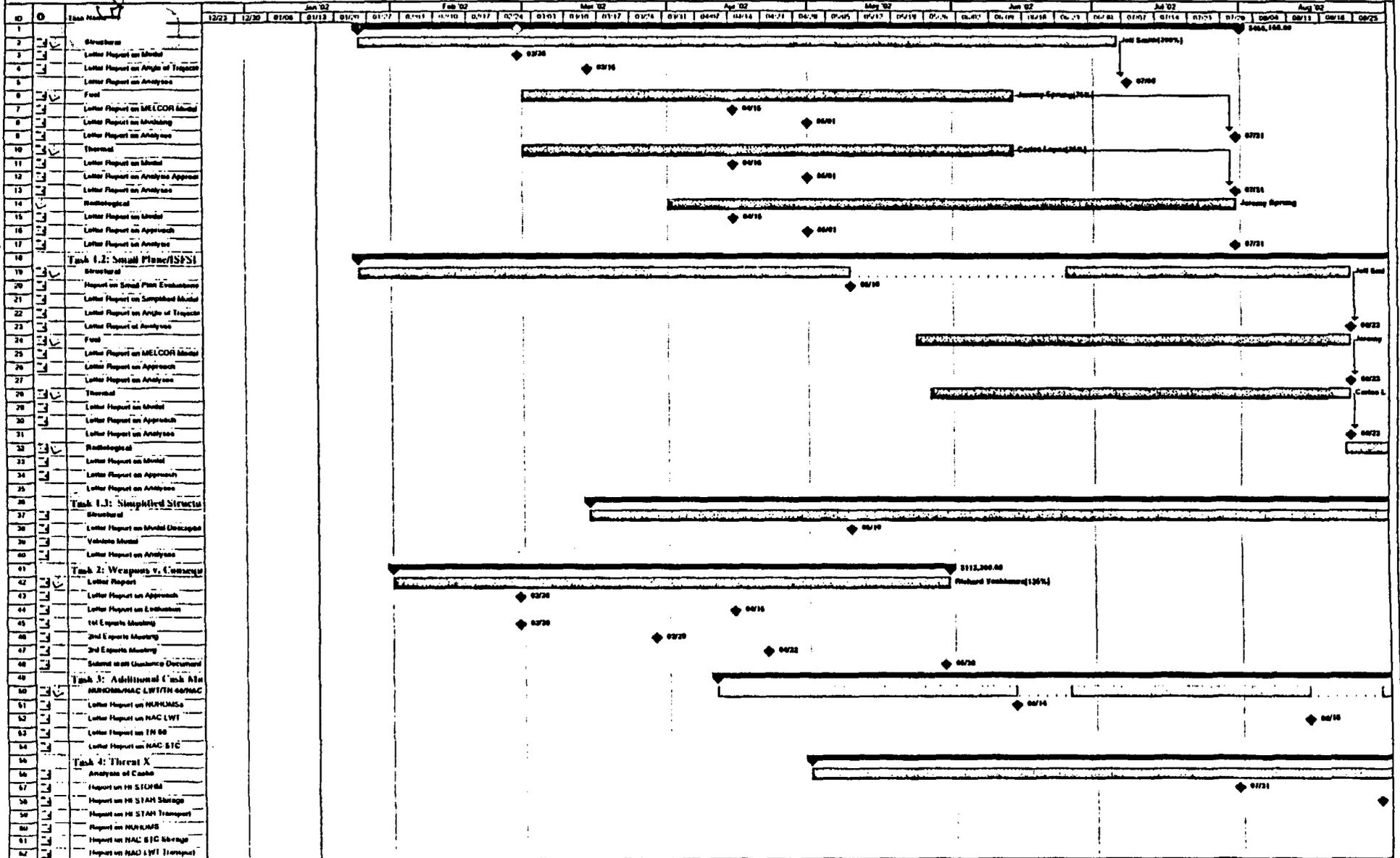
The performing organization shall submit a Monthly Letter Status Report (MLSR) by the 20th day of each month with distribution as shown below. The MLSR should contain, at a minimum, all of the required information as shown MD 11.7, Exhibit 12, "Monthly Letter Status Report Requirements."

11.0 Distribution of Deliverables

The following summarizes the required report distribution under this SOW. The NMSS TPM shall provide the performing organization with current NRC mailing addresses for this distribution.

Distribution	Monthly Letter Status Reports	Meetings Workshops & Trip Reports	Draft Formal Tech. Reports	Final Formal Tech. Reports
NMSS TPM	1	1	9	10
NMSS TAPM	1	1	5	1*
SFPO Pgm				

NMSS Terrorist Scenario Analyses



Portions Exd

Project Name: NMSS
 Date: Wed 01/16/02

Task: [Bar] Milestone: [Diamond]

Project Progress: [Bar] Report Up Progress: [Bar]

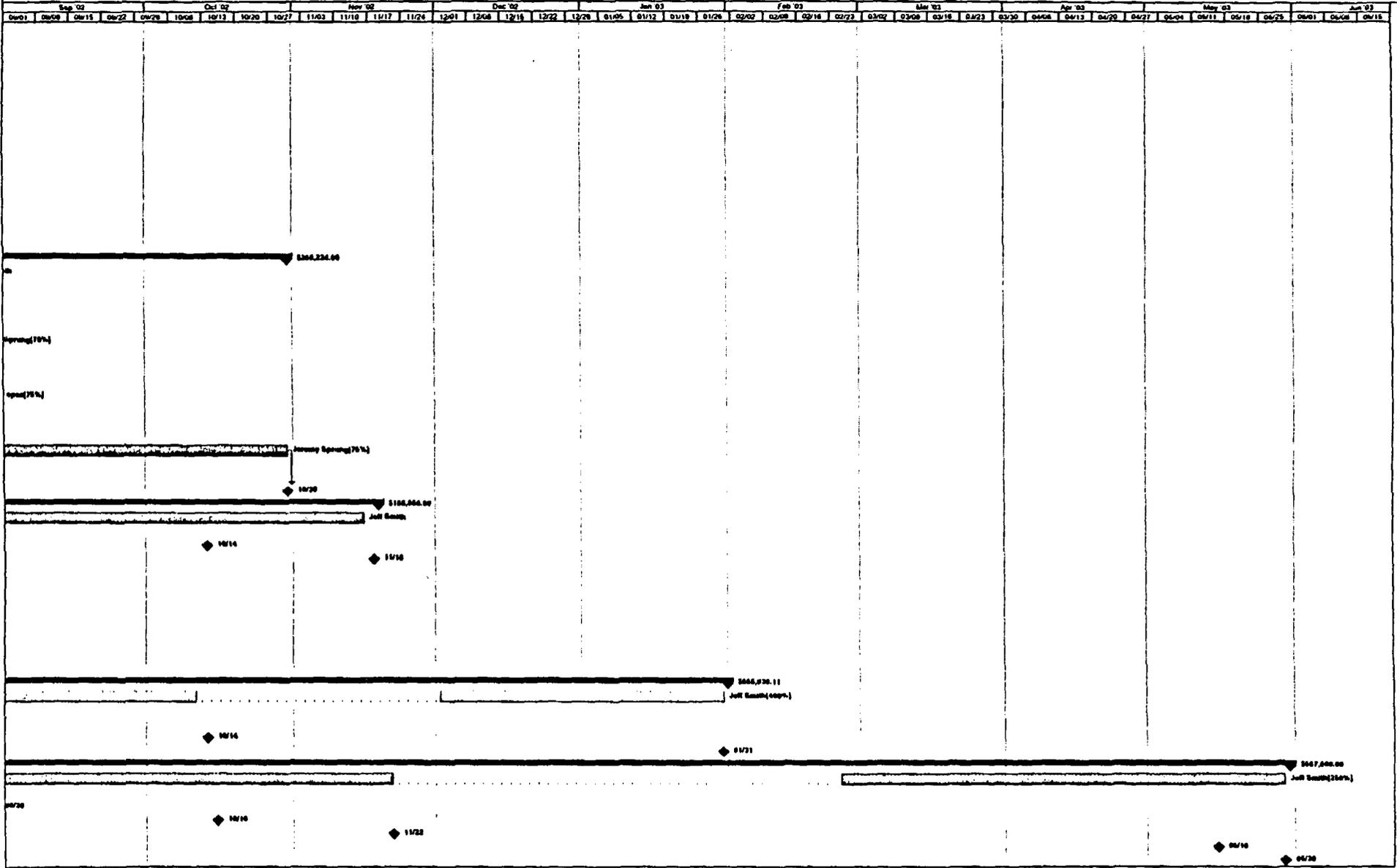
External Task: [Bar] External Milestone: [Diamond]

Project Summary: [Bar] Decision: [Diamond]

Report Up Task: [Bar] Report Up Milestone: [Diamond]

Spot: [Bar]

NMSS Terrorist Scenario Analyses



Project: James View: Wed 01/16/02

Task: Milestone: Picked Up Task: Picked Up Milestone:

Progress: Summary: Full Up Progress: Syn: External Task: Project Summary:

External Milestone: Deadline: