



NOvA Project Status

John Cooper
Working Group Meeting
December 21, 2005



R&D, PED, LLP, Construction Table

NOVA Funding Profile

(in FY05 \$)

Connee has this

Suzanne working on the R&D SWF

| Fund Type | Year | | | | | | | Sum |
|---------------------|-------------------|-------------------|-------------------|--------------|--------------|--------------|--------------|----------------------|
| | FY06 | FY07 | FY08 | FY09 | FY11 | FY12 | FY13 | |
| R&D M&S (\$M) | 1.93 ^a | 2.00 ^b | 0.50 ^c | - | - | - | - | 4.43 |
| R&D SWF (\$M) | | | | - | - | - | - | - |
| PED (\$M) | - | 5.00 ^d | 2.50 ^e | - | - | - | - | 7.50 |
| LLP (\$M) | - | 7.00 ^f | - ^g | - | - | - | - | 7.00 |
| Construction (\$M) | - | - | 20.00 | 50.00 | 50.00 | 50.00 | 10.00 | 180.00 |
| Total by FY: | 1.93 | 14.00 | 23.00 | 50.00 | 50.00 | 50.00 | 10.00 | Total: 198.93 |

Notes:

a R&D funds in FY06 used for _____
need to get estimates of SWF

b R&D funds in FY07 used for _____

c R&D funds in FY08 used to complete Integration Prototype Near Detector

d PED funds in FY07 are used for final building design and value management studies

Final Site Access Road design effort estimate at \$ M

Final Building design effort estimated at \$ M

Value Management Studies estimated at \$ M from list below

Study #1:

Study #2:

Study #3:

e PED funds in FY08 are used for

**Steve Dixon: LLP @ \$ 5.13 M
Without indirects**

f LLP funds in FY07 are used for access road construction & site clearing starting ~ April, 2007

This builds a 3.6 mile access road from the Ash River Trail to the NOVA site.

These funds would be in the form of a grant/cooperative agreement to the University of Minnesota

g no LLP possible in FY08, correct?



Requirements Documents Status

- Anticipate 44 documents
- Have 22 = 50%
- Missing
 - 6 on commodities
 - but do have RFPs
 - 9 on Near Detector Assembly
 - 7 on Far Detector Assembly
 - These two reflect uncertainty in structure



Request for Quote Status

Status of NOVA RFPs

12/20/2005

| Subject | vendor discussions | draft RFP | req in system | final approved RFP | RFPs sent | # sent to | Date for Response | # Responses | Evaluation Board |
|--|---|------------------|------------------|--------------------|-------------------|-----------|-------------------|--------------------|---------------------|
| Extrusions (we provide resin) | PET, Sept 15 | 12-Aug | ~ Aug 1 | vers 1, Aug | 26-Aug | 10 | 23-Sep | 3 | 26-Sep |
| | Extrutech, June Itasca, Sept 6 | | | vers 2, Oct 7 | 10-Oct | 11 | 16-Nov | 3 | 21-Nov Extrutech |
| mixed scintillator | Bicron, Nov 7 Eljen, Nov 8 | 17-Oct | 21-Oct | 20-Dec | | 2 | | | |
| scintillator fluor mix (must mix with mineral oil, perhaps also with more pseudocumene) | Bicron, Nov 7 Eljen, Nov 8 Curtis Labs, Aug 25 | 20-Oct | 21-Oct | 20-Dec | | 3 | | | |
| mineral oil (Technical grade) | Penreco, Oct 25 | 6-Oct | 21-Oct | 10-Nov | 11-Nov | 10 | 14-Dec | 2 still testing | 16-Dec |
| mineral oil (Industrial NF) pseudocumene | Dixie Chemical, long ago but... Flint Hills, Nov 10 but ... | 18-Nov 17-Oct | 28-Nov 21-Oct | 28-Nov | on hold 12-Dec | 13 | 15-Dec 20-Jan | | |
| waveshifters | Curtis Labs, Aug 25 | 20-Oct | 21-Oct | 18-Nov | 28-Nov | 9 | 29-Dec | | |
| ISO tanks, mixing | EXSIF, Nov 15 Superior Carriers, Dec 20 | | | | | | | | |
| waveshifting fiber | Kuraray, Oct 31 Bicron, Nov 3 Polhitech, no longer exists -- Protvino, no contact | 17-Oct | 21-Oct | 18-Nov | 22-Nov | 2 | 23-Dec 13-Jan | | |

Status of RFIs

| | | | | | | | | |
|-----------------------------------|--|--------|-----|--------|--------|---|--------|--------------------|
| APDs | Hamamatsu, Aug 9 | 11-Nov | xxx | 17-Nov | 17-Nov | 1 | 16-Dec | 1 "guess" on 11/29 |
| raw PVC, decided 19-Dec to do RFI | Prime, Oct 17 Ashland (Georgia-Gulf), Sept 8, Nov 7 Aurora, Clairiant, Aug 23 | 6-Dec | xxx | | | | | |



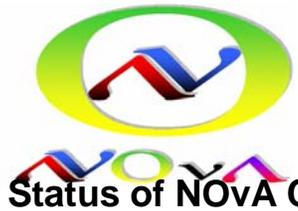
BOE (basis of estimate) status

Status of NOVA Basis of Estimate Documentation

12/20/2005

| | List of documents? | DRAFT document to Project Office? | Documents in binder? |
|--|--------------------|-----------------------------------|----------------------|
| WBS | | | |
| Site and Buildings | X | | |
| Excavation in Soil unit cost | | | |
| Excavation in Rock unit cost | | | |
| Concrete unit costs | | | |
| Structural steel unit costs | | | |
| Metal siding unit costs | | | |
| Elevator | | | |
| Bridge Crane | | | |
| Electrical Service Upgrade | | | |
| Scintillator | X | | |
| Write-up of mixed scintillator RFP results | | | |
| Write-up of Fluor concentrate RFP results | | | |
| Write-up of mineral oil RFP results | | | |
| Write-up of pseudocumene RFP results | | | |
| Write-up of waveshifter chemical RFP results | | | |
| Fiber | X | | |
| Write-up of fiber RFP results | | | |
| Extrusions | X | | |
| Write-up of extrusion vendor RFP results | | | |
| Write-up on raw PVC resin costs | | | |
| Extrusion Modules | | | |
| | | | |
| Electronics | x | | |
| Copy of RFI result from Hamamatsu | | X | |
| DAQ | | | |
| | | | |
| Near Assembly | | | |
| | | | |
| Far Assembly | | | |
| | | | |
| | | | |

No
change



Where are we on Cost & Schedule?

Status of NOVA Cost & Schedule

red= changes in last 2 weeks

12/20/2005

| | Initial talks with Bill? | List of Tasks | Durations of Tasks | Relationships among tasks | Assign labor resources | Assign M&S \$ Resources | Add contingency | Provide L3 descriptions | Provide Task Notes |
|--------------------|--------------------------|---------------|--------------------|---------------------------|------------------------|-------------------------|-----------------|-------------------------|--------------------|
| WBS | | | | | | | | | |
| Site and Buildings | X | X | X | X | X | X | | X | x |
| Scintillator | X | x | x | x | | | | X | |
| Fiber | X | x | | | | | | X | |
| Extrusions | X | x | x | x | | | | X | |
| Extrusion Modules | X | x | | x | x | x | | X | |
| Electronics | X | x | x | x | | | | X | x |
| DAQ | X | x | x | x | | | | X | x |
| Near Assembly | X | X | x | x | x | x | | X | |
| Far Assembly | X | X | x | x | x | x | | X | |

At least a start in > 65% of the boxes, **up 15%**
 (structure uncertainty holding the work back)

Bill Freeman to advise me next week on estimated time to finish
 (this may steer Director's Review date)

Will have to push L2 managers in Jan, meeting Jan 3,11,17,25
 (will pick weakest L2 and concentrate, then next weakest...)



Status of NOvA Hazard Analysis

12/20/2005

First pass to Harry Ferguson
 L2 manager completed HA sheet?
 Harry Ferguson & ES&H meet to review lists
 Prelim Hazard Analysis complete

WBS

| | | | | |
|---------------------------|----------|----------|--|--|
| Site and Buildings | X | X | | |
| Scintillator | x | | | |
| Fiber | x | | | |
| Extrusions | x | | | |
| Extrusion Modules | x | | | |
| Electronics | X | X | | |
| DAQ | X | X | | |
| Near Assembly | X | X | | |
| Far Assembly | X | X | | |

Harry's draft

| | | |
|-------------------------------------|----------|--|
| Hazard Analysis Document | | |
| Introduction | X | |
| Methodology | X | |
| NOvA zones table: principal zones | X | |
| NOvA zones table: zone descriptions | X | |
| Figures | | |
| fig 1 Far Site elevation @1204 ft | X | |
| fig 2 Far Site elevation @ 1234 ft | X | |
| fig 3 Far Site section | X | |
| fig 4 Far Site section | X | |
| List of hazards from above list | | |



Status of Conceptual Design Report

12/20/2005

2nd draft
(after TB
reading)

Chapter

| | Author | outline | 1st draft | 2nd draft (after TB reading) | Final |
|-----|---------|---------|-----------|---|-------|
| i | | X | | | |
| ii | | X | | | |
| iii | | X | | | |
| iv | | X | | | |
| 1 | John | X | | | |
| 2 | Gary | X | X | } Now need to iterate for consistency | |
| 3 | John | X | X | | |
| 4 | John | X | X | | |
| 5 | John | X | X | | |
| 6 | Ron | X | x | | |
| 7 | John | X | | | |
| 8 | John | X | | | |
| 9 | Ron | X | X | | |
| 10 | Ron | X | X | | |
| 11 | | X | | | |
| 12 | Ron | X | X | | |
| 13 | Ron | X | X | | |
| 14 | Ron | X | X | | |
| 15 | Ron | X | X | | |
| 15 | Ron | X | x | | |
| 17 | | X | | | |
| 18 | | x | | | |
| 19 | Ron | x | | | |
| 20 | | | X | | |
| 21 | | | | | |
| 22 | John | X | X | | |
| A1 | Ron +L2 | X | x | | |
| A2 | | | | | |



Status of other required documents

| | Critical Decision Prerequisites | Draft Start Date | Draft Completion Date | Target Completion Date | Date Completed | Date Approved | Current Status | Notes |
|------|--|------------------|-----------------------|------------------------|----------------|---------------|----------------|---|
| CD-0 | Justification of mission need document | | | | | 29-Nov-05 | | DONE |
| | Preconceptual Planning | | | | | | | |
| | Mission Need Independent Project Review (?) | | | | | | | OECM |
| CD-1 | Conceptual Design Report (Detector CDR) | | Dec-05 | Jan-05 | | | | Outline done. Drafts of several chapters done |
| | Acquisition Strategy | Aug-05 | Sep-05 | Sep-05 | | | Done | Draft complete. Several iterations with M. Procaro. |
| | Baseline range & Cost Estimates and Resource Loaded Schedule | | | Dec-05 | | | | In progress - critical path |
| | Draft Configuration Management Document | Aug-05 | Sep-05 | Dec-05 | Nov-05 | | Done | More work needed for final CM document |
| | Preliminary Project Management Plan (PMP) | Aug-05 | Aug-05 | Oct-05 | | | Review | Needs input from cost and schedule |
| | Preliminary Hazard Analysis Report & NEPA | Aug-05 | | Dec-05 | | | | Waiting for input from L2 managers |
| | Preliminary Project Execution Plan (PEP) | Aug-05 | Sep-05 | Sep-05 | | | | Iterating with Procaro |
| | WBS Dictionary | Nov-05 | Nov-05 | Nov-05 | Nov-05 | | | Uploaded to docdb |
| | Preliminary Risk Management Plan | Nov-05 | Nov-05 | Dec-05 | Nov-05 | | Done | Used it already! |
| | Project Data Sheet for design | | | | | | | ? |
| | Verification of mission need (NuSAG?) | | | | | | | NuSAG reports by end of year? |
| | PARS Reporting | | | | | | | determine content of monthly reports |



Risk Management, have turned crank

| | |
|---|------------------------------|
|  <p style="text-align: center;">NOVA Project Office</p> <p style="text-align: center;">RISK ACCOUNTING FORM</p> | WBS Number: 2.8.1 |
| | Identified by: Dave Ayres |
| | Date: Dec 4, 2005 |
| | Page 1 of 2 |
| <p>Statement of Risk (with context): Horizontal extrusions at the end of a 32 plane block are supported by the vertical extrusions on only one side. FEA calculations indicate a problem for the horizontal modules near the bottom of the detector where the vertical modules experience maximum swelling when filled with liquid scintillator. The shear stress on the adhesive for these horizontal modules is comparable to the shear strength of the adhesives we have tested. This does not provide an adequate safety factor.</p> | |
| <p>Risk Type (Cost, Schedule, Technical): Technical</p> | |
| <p>Risk Impact (Low, Moderate, High): High</p> | |
| <p>Probability of Occurrence (% Low, Moderate, High – from Table 2 of NOVA Risk Management Plan): Moderate</p> | |
| <p>Severity of Risk (Low, Moderate, High - From Table 2 of NOVA Risk Management Plan): High</p> | |
| <p>Other WBS items impacted by this risk item: 2.1, 2.4, 2.8</p> | |
| <p>Mitigation Strategy (Different strategies to mitigate this risk. When must it be mitigated?):</p> <p>We are exploring a number of options:</p> <ul style="list-style-type: none"> • Capture all horizontal modules between vertical modules on both sides. This changes our fundamental 32 plane block structure to a 31 or 33 plane structure with consecutive vertical planes at each gap. This will have a small impact on the assembly process and virtually no impact on data reconstruction and analysis. • Increase the thickness of the outer walls and the inner webs for the vertical extrusions while leaving the profile of the horizontal extrusions unchanged. This will make the detector slightly less active but it is unlikely to make a significant difference. The overall cost will increase since PVC costs more than the mineral oil we would be displacing. This also complicates the module manufacturing process and the detector assembly process because there are now two types of modules to keep track of. This is a minor complication. | |

| | |
|--|------------------------------|
|  <p style="text-align: center;">NOVA Project Office</p> <p style="text-align: center;">RISK ACCOUNTING FORM</p> | WBS Number: 2.8.1 |
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| | Page 2 of 2 |
| <ul style="list-style-type: none"> • Sand the extrusion faces before gluing them together to increase surface area and improve shear strength of the bond. • Continue to search for stronger adhesives. • Support the bottom horizontal extrusions off of the floor to reduce the dependence on the adhesive at the high shear point. | |
| <hr/> <p>Risk Management Board met on Dec 14, 2005 to review the mitigation strategy and progress, heard.....</p> | |



Other Items

- Ken Larson,
 - Hired consultant lawyer
 - Wonder why we chose a state route vs. federal (faster)
 - Asks for paper trail, DOE instructing us to go to state (sorry)
 - Asks for copy of our contract with SHE (asked Steve and Bob)

- Mike Procaro
 - Draft CDR not yet ready
 - He is out of office after Thursday until Jan 3 (might read email)
 - Would rather have readable product than garbled chapters

 - DOE thinking about their charge, emphasize ranges, not thinking to mention CD-2



Status of PVC structure problem

- **Recall structure swells when filled**
 - FEA on adhesive shear stress shows safety factor of only 1 – 1.5
 - Adhesive shear strength / FEA shear stress = ~ **400 psi** / **325 psi**
- **Pursuing work-arounds**
 - 31 block assemblies instead of 32
 - All horizontal modules surrounded on both sides with verticals
 - 325 psi FEA shear stress → **230 psi**, so SF=1.7
 - Bottom horizontals not suspended from verticals?
 - **Did not help**: buckling stability of 31 planes compromised since on stilts
 - Thicker PVC (50% thicker: 4.5 mm walls vs. 3 mm)
 - Doing both horizontal cells and vertical cells does not help
 - Vertical cells only reduces FEA shear stress to **170 psi**, so SF=2.4
 - Stronger adhesives
 - Gorilla PVC cement measured at **500 psi**, so SF=2.9
 - Epoxysystems 705 advertised as > 1000 psi, not in hand for testing yet
 - Sand PVC for better bonding
 - 3M2216 + 60 grit emery gives **950 psi**, so SF=5.6, needs more testing
- **Not all problems solved, but we are more optimistic**



Engineering Review of Conceptual Structure

- Suggested by Pier and Jim
- Have charge, pursuing committee for Jan 10

The NOvA project has a rather unique plastic (rigid PVC) structure and understanding this 30 kiloton structure is crucial to the experiment. We have to be sure the structure can be assembled from its component parts and will remain resilient to any failure modes once assembled. This charge is for the committee to conduct an informal review of the conceptual NOvA structural design. The design is not complete, so the aim of the review is to provide the NOvA Project Manager with advice on the paths being taken to address design problems and with advice on any additional design problems you may see from your fresh perspective.

The review should be kept at working level: No formal presentations, no audience. Dave Pushka (project engineer), Vic Guarino (engineer in charge of the Level 2 WBS “Assembly” task), and Ang Lee (FEA engineer on NOvA) will provide existing documents and interact with the review committee during the review. John Cooper (Project Manager) and Ron Ray (Deputy Project Manager) will attend to listen and to answer any scientific questions about the designs.

The committee is requested to provide a written report to John Cooper by the end of Thursday, January 12. The short time scale is required by the rapid review schedule for NOvA set up by the Directorate and the DOE for CD-1 level reviews in February - April, 2006.