



# NOvA Project Status

John Cooper & Ron Ray

February 15, 2006



# Mike, Feb 3

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- Notes this \$ 10.3 M is PED only, no LLP, so we can't show using any LLP
- 
- We are meant to "try" to do a design-build.
- Presumably don't need the whole \$ 10.3M for design, so
  - 1) how much design
  - 2) how much build, assuming we get CD-3a sometime in FY07 and can use it that way.



# Mike, Feb 3

- Separate subject, he is having Acquisition Strategy problems
  - Opposition from the "grant shop" to a grant to U of Minn even though OHEP favors this
- So wants to pursue 2 scenarios, then pop 2 versions of AS up to next management level.
  - 1) grant / coop agreement as we have written already
  - 2) Fermi to subcontract the site access and building
- This means
  - a) we have to buy the land
  - b) space bank issues
  - c) ES&H oversight comes from Fermilab
  - d) would have to be a site office at Ash River from DO
  - e) would have to be a site office at Ash River from Fermilab
- So it would be Fermilab/North, a scheme not liked by OHEP but logical to \_\_\_\_\_ (OECM?)
- We could subcontract to U of Minn, but could not escape a) - e), so no percentage
- Also needs f) real estimate of D&D costs. Concept in CDR, now need \$ number with logic for the \$
  - (suggests I get someone else to work on this. Keith Schuh is on it)



# Mike, Feb 6

- Do you have a working funding profile yet?
  - John: No, we don't have a funding profile from our Cost and Schedule effort yet. We get our first look on Friday when we get it put together in one place in Open Plan, but it may not have contingency in it by then.
- Who will do the logistics for the CD-1 review? Casey Clark from Dan's office has asked.
  - John (checked with Dean): Marilyn Smith



# Mike, Feb 9

- They have figured a way to get a cooperative agreement for the site and building.
  - needs a new solicitation to be posted on grants.gov.
  - This needs to be a properly phrased request for competitive proposals.
- He wants NOvA help to write the technical part (ASAP), e.g.:
  - 1) describe location of bldg in general terms, don't say Ash River.
    - Make it so someone can read a map and figure it out.
    - They should be able to go either side of the NuMI beamline and understand it's the total off axis angle we want, not 12 km on the surface since the beam is in the air.  
**Wes Smart working on this.**
  - 2) describe the building. Secondary containment volume = \_\_\_\_\_, don't say how to do it
  - 3) describe "protection from cosmic rays" in terms of a reduction factor, not as feet of rock.
  - 4) describe other conditions on "near existing road", "near existing or easily upgraded power of \_\_\_\_\_"
  - 5) (my words here) "offerers should own the land or detail a plan on how they will acquire the land".
- **Sent him text yesterday, Steve Dixon did several drafts....**
- U of Minn would have to prepare a proposal against this request.



# Mike, Feb 9

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- HEPAP scheduled for March 3-4.
- If NuSAG report accepted, then will become public.



# Requirements Documents Status

- 38 documents anticipated
- **36 done**
- **95%**

WBS	
<b>Site and Buildings</b>	
Site Work Technical Requirements	doc 152
Site Logistics Technical Requirements	doc 156
Building and Detector Enclosure	doc 173
Outfitting Technical Requirements	doc 158
<b>Scintillator</b>	
Scintillator requirements	doc 604
Scintillator Blending System	doc 609
<b>Fiber</b>	
Fiber requirements	doc 535
<b>Extrusions</b>	
PVC Extrusion Requirements	doc 595
Extrusion requirements, PVC compound	doc 537
PVC Extrusion Shipping and Handling	doc 539
<b>Extrusion Modules</b>	
NOvA Module Requirements	doc 182
Requirements for machines & fixtures to construct extrusion modules	doc 183
<b>Electronics</b>	
Front End Electronics Requirements	doc 147
APD Module Requirements	doc 170
<b>DAQ</b>	
NOvA Data Acquisition Requirements	doc 34
<b>Near Assembly</b>	
Requirements for the Integration Prototype Near Detector	doc 407
Near Detector (support, muon steel, fixtures, tunnel transport, assembly table)	doc 596
Near Detector Scintillator Supply Infrastructure	
Near Detector scintillator filling equipment	doc 402
Near Detector Assembly and installation procedure	doc 601
Near Detector Electronics Installation & Checkout	doc 592
<b>Far Assembly</b>	
Far Detector north bookend	doc 413
Far Detector south bookend	doc 579
Far Detector base	doc 413
Far Detector material moving equipment	doc 413
Assembly Tables	doc 146
Structural Adhesive	doc 145
Glue Machine	doc 144
Block Raiser	doc 113
Far Detector alignment system	doc 580
Far Detector scintillator supply system	
Liquid Scintillator Filling Machine	doc 142
Far Detector materials storage	doc 132
Far Detector assembly and installation	doc 394
Far Detector Electronics Installation and Checkout	doc 404
Far Detector electronics and DAQ infrastructure	doc 404
Block Stability	doc 143
Full Scale Prototype	doc 141



# Request for Quote Status

Status of NOVA RFPs

2/14/2006

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 Extrutech, June Itasca, Sept 6	12-Aug	~ Aug 1	vers 1, Aug vers 2, Oct 7	26-Aug 10-Oct	10 11	23-Sep 16-Nov	3 3	26-Sep 21-Nov Extrutech
mixed scintillator	Bicron, Nov 7 Eljen, Nov 8	17-Oct	21-Oct	20-Dec	22-Dec	2	7-Feb	none	na
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	22-Dec	3	31-Jan	none	na
mineral oil (Technical grade)	Penreco, Oct 25	6-Oct	21-Oct	10-Nov	11-Nov	10	14-Dec	2	19-Jan Precision Lubricants (also Penreco)
mineral oil (Industrial NF)		18-Nov	28-Nov	28-Nov	on hold				
pseudocumene	Dixie Chemical, long ago but ....  Flint Hills, Nov 10 but ....	17-Oct	21-Oct	12-Dec	15-Dec	13	20-Jan  31-Jan	1.5	UCA, Inc (China) Dixie Chem.
waveshifters	Curtis Labs, Aug 25	20-Oct	21-Oct	18-Nov	28-Nov	9	29-Dec	1	19-Jan Curtiss Labs
ISO tanks, mixing	EXSIF, Nov 15 Superior Carriers, Dec 20		on hold						
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	1	on hold

## Status of RFIs

APDs	Hamamatsu, Aug 9	11-Nov	xxxx	17-Nov	17-Nov	1	16-Dec	1 "guess"	29-Nov
raw PVC, decided 19-Dec to do RFI	Prime, Oct 17 Ashland (Georgia-Gulf), Sept 8, Nov 7 Aurora, Clairiant, Aug 23	6-Dec	xxxx	21-Dec	22-Dec	5	8-Feb	3	Prime Aurora PolyOne

2 cheap mineral oils: 2m and 10 m Attenuation Length @ 430 nm  
2 m version is adequate, results from U of M test cell show 5% loss of light



# Cost & Schedule Status

## Status of NOVA Cost & Schedule

red= changes in last 2 weeks

2/14/2006

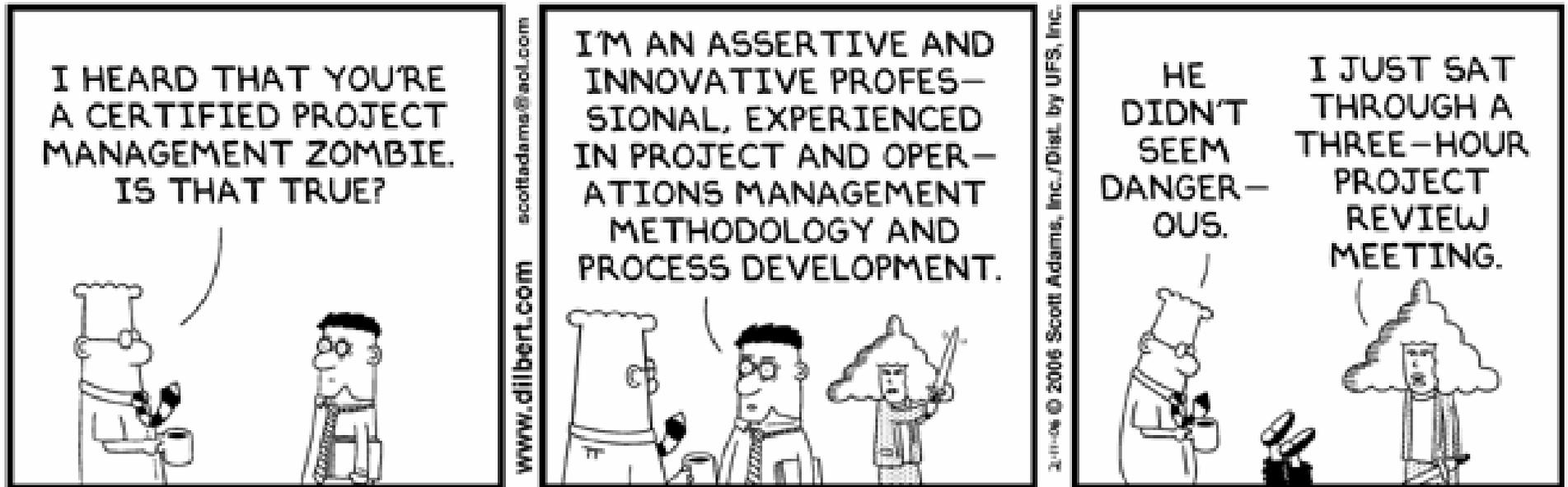
means Bill is "done" construction project, R&D less well developed

	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
<b>WBS</b>									
Site and Buildings	X	X	X	X	X	X	x	X	x
Scintillator	X	X	X	X	X	X		X	x
Fiber	X	X	X	X	X	X		X	x
Extrusions	X	X	X	X	X	X		X	x
Extrusion Modules	X	X	X	X	X	X		X	x
Electronics	X	X	X	X	X	X		X	x
DAQ	X	X	X	X	X	X		X	x
Near Assembly	X	X	X	X	X	X		X	x
Far Assembly	X	X	X	X	X	X		X	x

Project Office + L2s had a 1<sup>st</sup> run-through last Friday  
 6 hours, ~ 3500 lines in Open Plan  
 Identified several problems (milestones, linking)



# General view after 6 hours of staring at the NOvA schedule together



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# Contingency

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- “Rules” written
- Due for all tasks this Friday
- Ron will look at contingency on all items  $> \$ 1M$
- Ron has extracted contingencies relative to crude oil
  - Based on
    - Rules
    - History of commodity relative to crude oil to establish link
    - DOE estimate of crude oil prices in out years
    - History of crude oil to establish probability of larger swings due to “politics”



# Documented BOE status

Status of NOvA Basis of Estimate Documentation

2/14/2006

List of documents?      DRAFT document to Project Office?      Documents in binder?

WBS		List of documents?	DRAFT document to Project Office?	Documents in binder?
<b>Site and Buildings</b>		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			
<b>Scintillator</b>		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			
<b>Fiber</b>		X		
	Write-up of fiber RFP results			
<b>Extrusions</b>		X		
	Write-up of extrusion vendor RFP results			
	Write-up on raw PVC resin costs			
<b>Extrusion Modules</b>				
<b>Electronics</b>		x		
	Copy of RFI result from Hamamatsu		X	
<b>DAQ</b>				
<b>Near Assembly</b>				
<b>Far Assembly</b>				
<b>Project Office</b>		X	X	



# Prelim Hazard Analysis

## Status of NOvA Hazard Analysis

2/14/2006

	L2 manager completed HA sheet?	Harry and Keith have reviewed lists	Harry Ferguson & ES&H meet to review lists	Prelim Hazard Analysis complete
<b>WBS</b>				
<b>Site and Buildings</b>	X	X		X
<b>Scintillator</b>	X	X		X
<b>Fiber</b>	X	X		X
<b>Extrusions</b>	X	X		X
<b>Extrusion Modules</b>	X	X		X
<b>Electronics</b>	X	X		X
<b>DAQ</b>	X	X		X
<b>Near Assembly</b>	X	X		X
<b>Far Assembly</b>	X	X		X

<b>Hazard Analysis Document</b>	Harry's draft	Completed:
Introduction	X	X
Methodology	X	X
NOvA zones table: principal zones	X	X
NOvA zones table: zone descriptions	X	X
Figures		
fig 1 Far Site elevation @1204 ft	X	X
fig 2 Far Site elevation @ 1234 ft	X	X
fig 3 Far Site section	X	X
fig 4 Far Site section	X	X
List of hazards from above list		



# Conceptual Design Report

Status of Conceptual Design Report

2/14/2006

Chapter	Author	1st draft (# pages)	2nd draft (after comments)	Final
i	Title Page			
ii	Author List			
iii	Preface	1	1	
iv	Table of Contents	yes		
1	Executive Summary	John	1	
2	NOvA Scientific Requirements	Gary/John	14	
3	Overview of the NOva Design	John	30	
4	Alternative Designs Considered	John	14	
5	Optimization and Risk Analysis	John	19	
6	WBS Dictionary for the Construction Project	Ron	9	
7	Site Description	John	13	
8	Conventional Facilities	John	x	
9	Scintillator	Ron/John	8	12
10	Wavelength Shifting Fiber	Ron	6	
11	PVC Extrusions	John		
12	PVC Modules	Ron	6	
13	Photodetector & Electronics	Ron	11	
14	Data Acquisition System	Ron	6	
15	Near Detector Assembly	Ron	6	
15	Far Detector Assembly	Ron	x	
17	ES&H Overview	John		
18	Quality Assurance Overview	John		
19	Risk Analysis Overview	John		
20	Stakeholder Input	John	x	
21	Cost Range and Schedule Range	John	X	
A1	WBS dictionary for R&D	Harry		
A2				
<b>SUM</b>			<b>144</b>	



# CDR: Executive Summary Change

## 1. Executive Summary

### 1.1 Introduction

Fermi National Accelerator Laboratory and the NOvA Collaboration composed of 142 scientists and engineers from 28 Universities and Laboratories around the world have collaborated to create this conceptual design for a new detector to study neutrino oscillations using the existing Department of Energy investment in the NuMI neutrino beam at Fermilab.

### 1.2 Project Components

NuMI is not a “project” component

The NOvA Project consists of **three** main elements:

1. A new building on a site near the US-Canadian border in Ash River, Minnesota to house the NOvA detector. This site is 810 kilometers from Fermilab. The building is 22.5 meters wide by 196 meters long and is sunk 14 meters below the existing grade into granite rock at the site. The excavated granite is used to cover the detector with a 3 meter thick overburden as a cosmic ray shield.
2. A 30 kiloton neutrino detector composed of ~ 762,000 cells of extruded PVC plastic in a cellular structure. Each cell is 3.9 centimeters wide by 6.0 centimeters deep and is 15.7 meters long. The cells are filled with a total of 7.0 million gallons of liquid scintillator. The liquid scintillator comprises 73% of the total mass, making this a totally active tracking calorimeter detector designed for identification of electron neutrino ( $\nu_e$ ) interactions. The detector is read out via 26,000 kilometers of 0.8 millimeter diameter optical wave-shifting fiber into approximately 24,000 avalanche photodiodes with associated electronics.
3. A small 200 ton detector on the Fermilab site to measure the inherent beam backgrounds.



# CDR: Executive Summary Change

## 1.3 Use of Existing Facilities

The existing Fermilab NuMI beam transport, target, focusing horns, vacuum decay pipe, and absorber will be used to provide the neutrino beam for NOvA. The NuMI beam is used in a new way by placing the NOvA detector at an angle  $\sim 15$  milliradians off the beam axis to obtain a muon neutrino ( $\nu_\mu$ ) beam sharply peaked at 2 GeV in energy. The small 200 ton detector will be placed in the existing NuMI underground tunnel at a depth 105 meters below grade.

## 1.4 Capabilities

In a five year run with  $6.5 \times 10^{20}$  protons per year delivered by the Fermilab Main Injector to the NuMI target, NOvA would measure the probability for muon neutrino to electron neutrino oscillations ( $\nu_\mu \rightarrow \nu_e$ ) down to a value ten times smaller than the existing experimental limit.

The existence of neutrino oscillations means that neutrinos have mass. In a six year run equally split between neutrino and anti-neutrino beams, NOvA can resolve the neutrino mass ordering for a significant portion of the available parameter space for these oscillations. **This capability is a unique aspect of NOvA not duplicated by any other proposed experiment.**

## 1.5 Cost & Schedule

The Total Estimated Cost of the NOvA Project is in the range \$ **xxx** M - \$ **yyy** M. The Total Project Cost is in the range \$ **XXX** M - \$ **YYY** M. A schedule range of **N** to **M** years is proposed for the construction project.



# Funding Profile

## NOVA Funding Profile

(in FY05 \$)

Fund Type	Year							R&D Sum	Sum
	FY06	FY07	FY08	FY09	FY11	FY12	FY13		
R&D M&S (\$M)	1.93 <sup>a</sup>	2.00 <sup>b</sup>	1.00 <sup>c</sup>	-	-	-	-	4.93	
R&D SWF (\$M)	2.80 <sup>a</sup>	2.80 <sup>b</sup>	-	-	-	-	-	5.60	
PED (\$M)	-	10.30 <sup>d</sup>	- <sup>e</sup>	-	-	-	-		10.30
LLP (\$M)	-	-	-	-	-	-	-		-
Construction (\$M)	-	-	20.00	50.00	50.00	50.00	10.00		180.00
<b>Total by FY:</b>	<b>4.73</b>	<b>15.10</b>	<b>21.00</b>	<b>50.00</b>	<b>50.00</b>	<b>50.00</b>	<b>10.00</b>	<b>Total:</b>	<b>190.30</b>
<b>Cost &amp; Schedule Profile:</b>	10.3								10.3

### Notes:

**a R&D funds in FY06 used for prototype design and prototypes, including initial purchases for Integration Prototype (SWF estimates for FY06,07 based on FTE estimate done for EPP2010 in 9/2005)**

**b R&D funds in FY07 used for Integration Prototype**

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

**d PED funds in FY07 are used for design-build: design, then start construction @ CD-3a**

**Final Site Access Road design effort estimate at \$ 0.80 M**

**Final Building design effort estimated at \$ 2.43 M**

**Final Outfitting, Site Logistics, & Management design effort estimated at \$ 0.82 M**

above 3 total to \$ 4.05 M design estimate

**This leaves 6.25 for construction in FY07**

estimate for access road was \$ 5.13 M without indirects

**e No PED funds in FY08 ??**



# Our schedule to complete the work for a Feb 28 review:

- Jan 27 -- **DONE**
  - 1<sup>st</sup> draft CDR
- Feb 3 – **ALL DONE**
  - Deadline for L2 managers to get tasks, durations, relationships, labor, M&S for construction project to Bill Freeman
  - John and Ron publish rules for contingency – Feb 5
  - Harry, 1<sup>st</sup> draft prelim Hazard Assessment
- Feb 8 – **95% DONE**
  - Finish Requirements Documents



# Our schedule to complete the work for a Feb 28 review:

- Feb 10 – **1<sup>st</sup> one in progress, 2<sup>nd</sup> DONE, 3 & 4 Delayed**
  - Deadline for L2 managers to get tasks, durations, relationships, labor, M&S for R&D to Bill Freeman
  - Internal Technical Board meeting to look at “final” Cost and Schedule so all understand the links
  - Contingency added to construction project by L2 managers for all tasks following rules – trying to do the > \$ 1 M by 2/17
  - 2<sup>nd</sup> draft of CDR from Ron and John, close to final?
    - Closer by 2/17, but some will spill into next week
- Feb 17
  - L2 managers finish task notes
  - L2 managers get Basis of Estimate docs to Suzanne
  - L2 managers add contingency to R&D tasks -- concentrate 1<sup>st</sup> on construction
  - Bill has to pretty much finish this week . . . .
- Feb 22 -- **SCHEDULED**
  - Rehearsal talks by all speakers



# What will be missing

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- Will not have Cost & Schedule for Site / Building in a design-build model
- R&D will be sketchy in favor of completing the construction project
- Chapter 21 of CDR: Cost, Sched, Scope Ranges
  - will come at absolutely the last minute