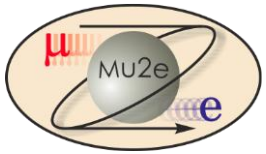
Fermilab

Value Engineering
WBS 3.0



T. Lackowski

L2 Manager

10/22/2014

VE Study

- Using the Advanced Conceptual Design drawing as the basis a Value Engineering workshop was held on February 14-15, 2013.
- The workshop followed the Corp of Engineer's OVEST format.
- The A&E disciple leads participated in the workshop as independent experts. The workshop doubled as an informational kickoff meeting and as a team building.

Planning, Agenda and Participant List

Draft 2/5/13

Mu2e Conventional Construction Value Engineering

Agenda

February 14, 2013 8:00 AM to 4:00 PM

8:00 to 10:00	**Information**	
8:00 – 8:15	Welcome and Introduction	Tom Lackowski
8:15 to 9:00	Value Engineering Process	Lee Hammond
9:00 to 9:30	Civil, Architectural, Structural Current Design	Tom Lackowski and Ron Jedziniak
9:30 to 9:45	HVAC, Process Water Current Design	Emil Huedem
9:45 to 10:00	Electrical Current Design	Randy Wielgos
10:00 to 10:15	**Coffee Break**	
10:00 to 12:00	**Function Analysis**	
10:00 to 10:30	Project Overview, Physic goals	Doug Glenzinski
10:30 to 11:00	Accelerator	Steve Werkema
11:00 to 11:30	Solenoids	Mike Lamm
11:30 to 12:00	Muon Beam	George Ginther
12:00 to 1:00	**Lunch**	
1:00 to 2:30	**Speculation**	Lee Hammond
2:30 to 2:45	Coffee Break	
2:45 to 4:00	**Speculation**	Lee Hammond

February 15, 2013 8:00 to 12:00

8:00 to 10:00	**Proposal Evaluation**	Lee Hammond
10:00 to 10:15	Coffee Break	
10:15 to 12:00	**Development Presentation and Implementation**	Tom Lackowski

Mu2e Conventional Construction Value Engineering

Participant List

Lee Hammond	Proctor / Mech. Engineer	FNAL
Adam Jasinski	Civil Engineer	Middough
William Sonna	Structural Engineer	Middough
John Nowakowski	Mechanical Engineer	Middough
Sukdev Sinha	Electrical Engineer	Middough
Mike Shrader	Project Manager	Middough
Steve Ejnik	Senior Manager	MIddough
Jeff Brandt*	Mech. Engineer	FNAL
George Ginther*	Physicist	FNAL
Kermit Carlson	Physicist Engineer	FNAL
Jerry Leibfritz (Schedule Permitting)	Mech Engineer	FNAL
Chuck Federowicz	Civil Engineer	FNAL
Steve Dixon	Architect / PM	FNAL
Emil Huedem*	Mechanical Engineer	FNAL
Randy Wielgos*	Electrical Engineer	FNAL
Ron Jedziniak*	Designer	FNAL
Tom Lackowski*	Structural Engineer	FNAL

Part Time Attendees

Ron Ray*	Project Office (PM)
Doug Glenzinski*	Project Office (DPM)
Kurt Krempetz*	Project Office (Project Eng)
Mike Lamm*	Solenoids
Steve Werkema*	Accelerator

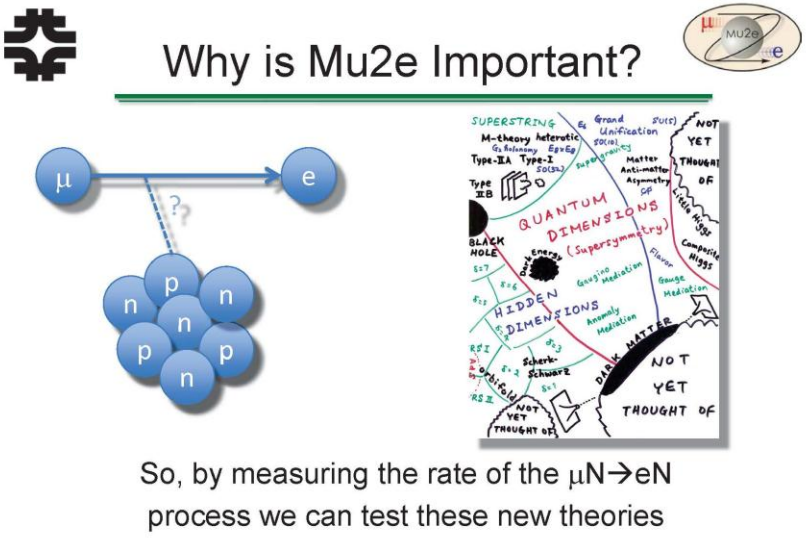
- Project Team

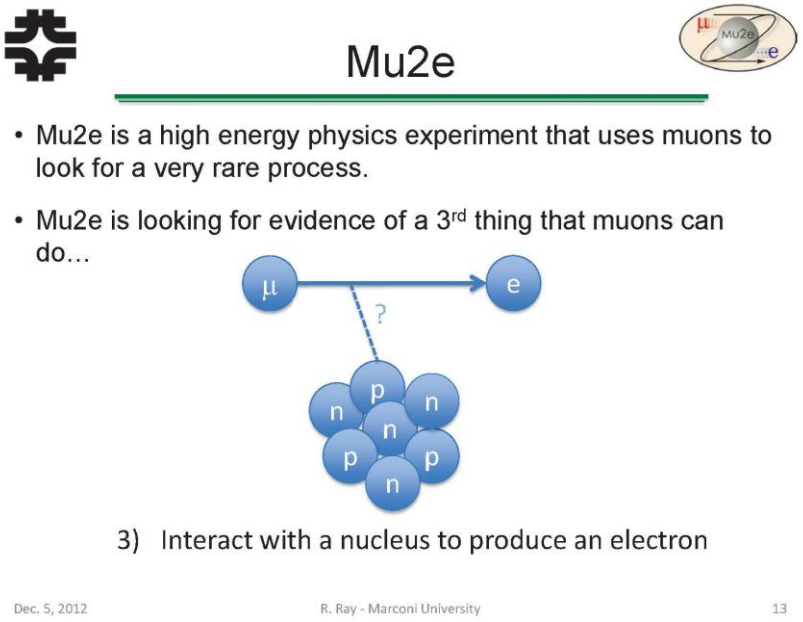
Information and Functional Analysis Phases

- Understand the background and decisions that have influenced the development of the design through a formal presentation by the designers.
- Analyze the key functional issues governing the Project. The functions of any facility or system are the controlling elements in the overall VE approach. This procedure forces the participants to think in terms of function, and the cost and impacts associated with that function.
- Define Project objectives and key criteria governing the project.
- Determine Project's definition of Value.

Information and Functional Analysis Phases

- Talks were given by major project stakeholders, describing the physics, the scientific equipment, installation and operational requirements.
- Talks also were given by in-house FESS disciplines describing the facilities design as of the Advanced Conceptual.





Speculation Phase

- The VE Team thinks of as many ways as possible to provide the necessary function within the project areas at a lesser initial or Life-Cycle Cost which represent improved value to the project.
- Judgment of the ideas is prohibited.
- The VE Team is looking for quantity and association of ideas, which will be screened in the next phase of the study.
- Many of the ideas brought forth in the creative phase are a result of work done in the function analysis. This list may include ideas that can be further evaluated and used in the design.

Speculation Phase

Speculation List

Priority	Item Number	Color Legend (DRAFT Feb. 14-15, 2013) (Gut-Feel) may **not** result to large savings (Gut-Feel) may result to savings. Will be evaluated? (potential cost savings TBD) Obvious Cost Savings Warranted Increase in Performance to be evaluated Will be evaluated By Others, not CES, whether high cost savings impact or not (not shaded) = Items that I'm Not Sure	Who to develop short description	(gut-feel) Estimated Cost Savings	Comment
	43	use Indian Ck road as part of the truck turnaround, take out new turnaround	Adam	$-10K	
	44	interrupt Kautz Rd tertiary power feed	Adam	$-10K	
	45	shorten gas routing that follows Kautz Rd	Adam	$-10K	
	24	make generator natural gas	Tom	NA	*Lower Operating Costs*
	50	remove EG from containment area	Randy		
X	12	relocate stair 4 to west corridor from stair 3	Tom	$-100K	
X	13	relocate stair 2 corridor from stair 1	Tom	$-100K	*May not meet shielding reqd.*
X	23	eliminate Kautz road bypass and straighten east route	Lee/Adam	$-500K	*Needs Directorate OK*
	27	look at location of dump resistor	Kermit	$-1K	
	28	reduce parking spaces	Emil	$-.5K	
	29	use MC1 parking with walkway over berm	Tom		
	47	re-contour parts of stockpile to lessen dirt removal	Chuck	$-100K	
	48	closer stockpile... south of bldg	Tom		
X	49	simplify underground structure at column B1	William		
	51	dry type transformers adjacent to bldg.	Tom		
	52	ballast issues, remote limitations	Sukdev		
	59	two smaller transformers	Randy W		
X	26	reduce mech room space	Lee		
	57	provide infrastructure for rental HVAC for installation phase	Emil	NA	
	58	conduct model reviews	Adam		
	10	replace shielding blocks with cast in place where possible	Tomski		
	14	examine penetration material	Tom		
X	22	flip elec/mech room to eliminate utility congestion	Randy	NA	Better Design
X	30	benefit of raising low bay	Steve D		
X	32	Mezzanine over portion of low bay	Kermit		
X	37	stack toilet and mech space to reduce low bay area			
	53	unforeseen conditions clause policy	Tom		Transfer Risks
	1	Waterproof or control water inflow in the PS region	Tomski/Steve E.		
	2	Provide for Collection of process water in enclosure especially around PS / trench gutter along walls	Kermit		
	11	building over PS hatch Weather protection while open	Jeff		
	21	turn west crane catwalk 180degrees	Tom		
	41	hardstand for PS hatch	Adam		
	36	integrate future clean space system with civil HVAC system	Tom		
	55	provide sealed combustion gas appliances	Lee		
	17	procure shielding blocks with later funding	Tom		
	54	TS hall , imbed transfer lines into wall, increase highbay 2 feet	Jeff		
X	60	make room for tornado shelter in stair 1, enhance room for controlled access entry	Tom/Lee		

Speculation Phase

Speculation List

Priority	Item Number	Color Legend (DRAFT Feb. 14-15, 2013) (Gut-Feel) may **not** result to large savings (Gut-Feel) may result to savings. Will be evaluated? (potential cost savings TBD) Obvious Cost Savings Warranted Increase in Performance to be evaluated Will be evaluated By Others, not CFS, whether high cost savings impact or not (not shaded) = Items that I'm Not Sure	Who to develop short description	(gut-feel) Estimated Cost Savings	Comment
	3	secondary containment for raw skid	Kermit		
X	7	verify hook height on crane	Kermit		
X	9	look at length of loading dock wrt to closing OH door with truck inside	Steve E		
X	18	verify crane coverage with shield blocks	Jeff		
	62	Verify OHD size			
	61	Raw skid shielding possibilities	Lee		
	31	will minimum shielding allow for beam intensity increases in future	Chuck		
	6	truck ramp from east in lieu of high bay truck access and smaller high bay	Steve D		
	15	add bay for power supplies at highbay level	Jeff		
	19	increase bldg past column A	Jeff		
	33	rotate bldg to cover PS, TS and DS	unknown		
	5	eliminate elevator	Steve D		
	8	combine elevator/stair access to eliminate one set of interlocks	Lee		
	42	relocate Kautz Rd farther west	Adam		
	46	on Kautz Rd use retaining walls instead moving hill	Adam		
	25	eliminate generator	various		
	40	run power supply cabling under highbay floor	Kermit		
	16	ventilate highbay	Emil		
	34	chilled racks/ventilate highbay---No condensate!			
	35	modular server room for racks in highbay			
	39	raise highbay AHU to open floor space	John		
	56	consider desiccant DOAS	Lee		
	20	exterior crane to reduce bldg. size	Steve D		
	38	move power supplies to mezz above lobby	Kermit		
	4	move sumps to outside to enhance maintenance accessibility gets motors outside of magnetic field	Chuck		
	62	Trench configuration in DS region	Kermit		

Color Legend *(DRAFT Feb. 14-15, 2013)*
(Gut-Feel) may **not** result to large savings
(Gut-Feel) may result to savings. Will be evaluated? (potential cost savings TBD)
Obvious Cost Savings
Warranted Increase in Performance to be evaluated
Will be evaluated By Others, not CFS, whether high cost savings impact or not
(not shaded) = Items that I'm Not Sure

Evaluation

- Defines the criteria to be used for evaluation.
- Analyzes and judges the ideas resulting from the creative session. Ideas found to be impractical or not worthy of additional study are discarded. Those ideas that represent the greatest potential for cost savings and value improvement are developed further. A weighted evaluation is applied in some cases to account for impacts other than costs (such as schedule impacts, aesthetics, etc.).

Building over PS Hatch

Mu2e Conventional Construction
Value Engineering

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: 11 PAGE NO: 1 OF
DESCRIPTION: Building over PS hatch. Weather protection while open

ORIGINAL DESIGN:
Currently there's only an outdoor roof hatch above the PS/target area. There is a big concern that this is a major spot for leak (rain, humidity, temperature) from the outdoor to the lower target area, where dry environment is critical.

PROPOSED DESIGN:
Provide/Install building enclosure above the hatch and have the said space be environmentally protected (airconditioned/heated) and weather protected. Permanent crane could be incorporated in this scheme.

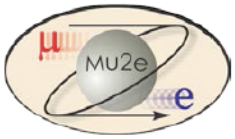
ADVANTAGES:
This will allow the unnecessary infiltration of raw outside air to the target space which has a critical humidity requirement
This will address material handling in the target area

DISADVANTAGES:
Cost

JUSTIFICATION:
The added first cost appear to be justified considering the values added to the project. A life cycle cost analysis is recommended to fully quantify the justification

Mechanical Room Layout

Mu2e Conventional Construction
Value Engineering



VALUE ENGINEERING PROPOSAL

PROPOSAL NO: 22 PAGE NO: 1 OF
DESCRIPTION: Flip the Mech/Elec Room Layout to Avoid Utility Conflicts

ORIGINAL DESIGN: The present design of the building Mech/Electrical room requires the incoming electrical service duct bank to cross the ICW and DWS piping systems.

PROPOSED DESIGN: The proposed design will coordinate the routing of the electrical duct bank, ICW and DWS utilities to avoid underground crossings.

ADVANTAGES:

1. Utilties with less crossings are more efficient to maintain and generally cost less to construct

DISADVANTAGES:

1. The Mech/Electrical Room will need to be arranged to accommodate the utilities.

JUSTIFICATION:

Eliminate Kautz Road

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Value Engineering

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: 23 Eliminate Kautz road bypass and straighten east route.PAGE NO: 1 OF
DESCRIPTION:

ORIGINAL DESIGN: Relocate Kautz Road to the west to provide space for the proposed Mu2e Building.

PROPOSED DESIGN: Reducing the beam energy from 25 to 8 KW eliminated the requiremtn to fence the PBAR Rings and Transport beamline. This reduction of the beamline energy allows traffic to use existing roads to the east to travel from north to south and not build the portion of Kautz road removed.

Excavate and Haul Existing Stockpile						
Excavation	42000	cy	$14	$588,000	0.2	$705,600
Hauling	46200	cy	$5	$231,000	0.2	$277,200
Place Aggregate Base for relocated Kautz Road	42000	sf	$3	$126,000	0.2	$151,200
Pave and Stripe Relocated Kautz Road	33700	sf	$2	$64,030	0.2	$76,836
Remove Kautz Road						
4" Pavement Removal	2655	sy	$6	$15,001	0.2	$18,001
12" CA-6 Removal	885	cy	$22	$19,470	0.2	$23,364

ADVANTAGES: The main advantage is cost savings by not excavating and hauling the existing earth pile and the road construction. The current estimate has $1,264,600 for the cost of this work. Reducing this cost by 50% is reasonable.

DISADVANTAGES: Eliminating this portion of Kautz Road does modify a long establish route and moves traffic from the west to the east of the PBAR Rings

JUSTIFICATION: Massive Cost Savings.

Diesel to Gas Generator

Mu2e Conventional Construction
Value Engineering

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: 24 PAGE NO: 1 OF
DESCRIPTION: Make Generator Natural Gas

ORIGINAL DESIGN: The present design includes a diesel generator for standby power services in the building.

PROPOSED DESIGN: The proposed design would specify a natural gas generator in lieu of the diesel generator.

ADVANTAGES:
1. Natural gas line is routed adjacent to the generator
2. Natural gas does not require scheduled fuel deliveries
3. Natural gas does not pose a spill risk

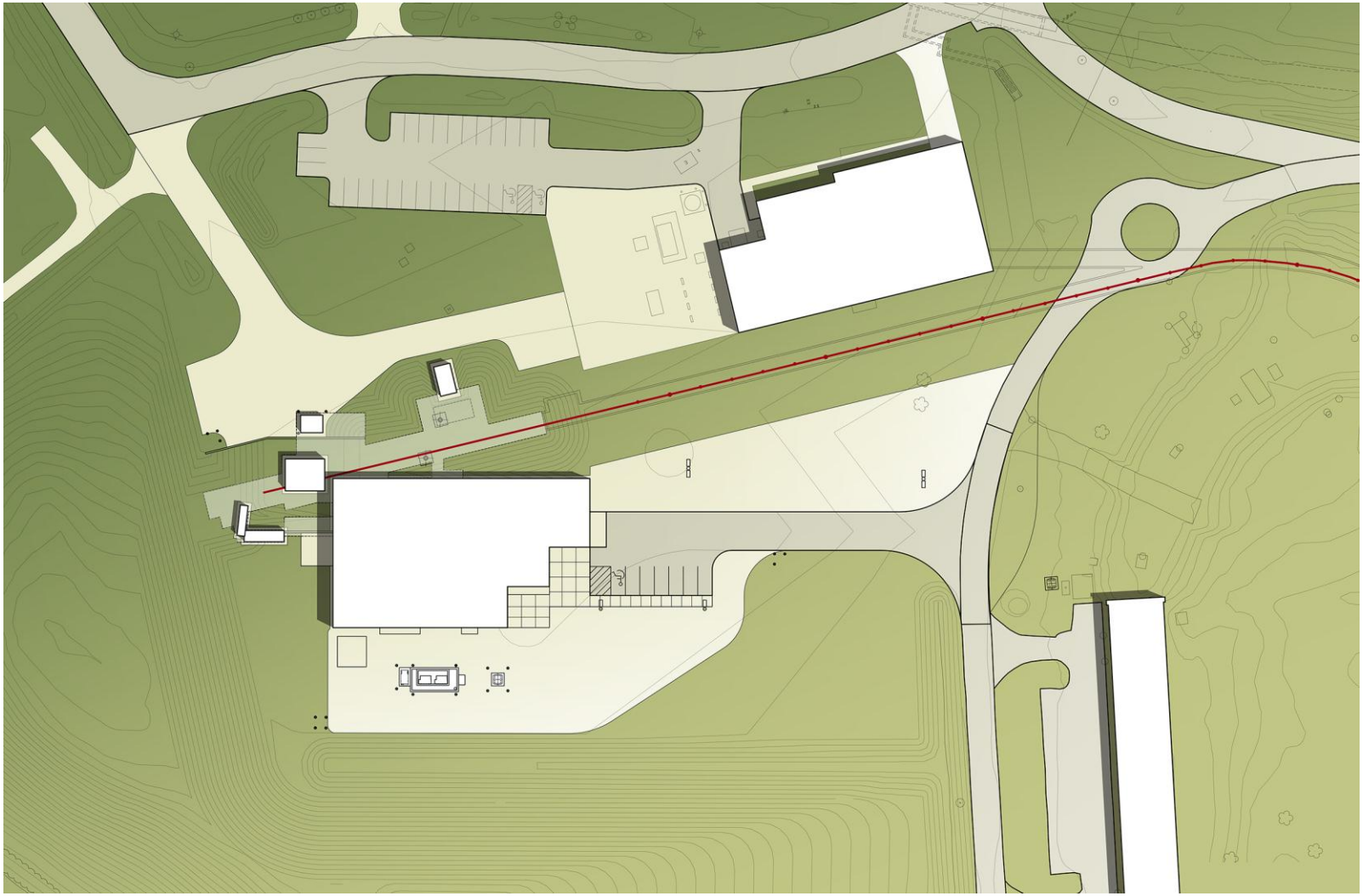
DISADVANTAGES:
1. Natural gas generators require larger engines for the same rating as diesel
2. Natural gas generators generally cost more than a diesel due to sizing
3. Relies on the natural gas distribution system

JUSTIFICATION:

Development Phase

- During the development phase of the VE study, many of the ideas are expanded into workable solutions. The development consists of:
    - Description of the recommended design change.
  - Descriptive evaluation of the advantages and disadvantages of the proposed recommendation.
  - Cost comparison and LCC calculations.
  - Each recommendation is presented with a brief narrative to compare the original design method to the proposed change.
  - Sketches and design calculations, where appropriate, are also included in this part of the study.

Site Plan, eliminated Kautz Road.



Presentation

- The presentation is the compilation of the recommendations in the form of a written report. The recommendations, the rationale that went into the development of each proposal, and a summary of key cost impacts are presented at that time so that a decision can be made as to which Value Management proposals will be accepted.
  - In addition to the monetary benefits, the VE Workshop provides a valuable opportunity for key project participants to come together, then step aside and view the project from a different perspective. The VE process therefore produces the following benefits:
    - Opportunity to explore all possible alternatives
    - Forces project participants to address "value" and "function"
    - Helps clarify project objectives
    - Identifies and prioritizes Client's value objectives
    - Implements accepted proposals into design
    - Provides feedback on results of the study

See Mu2e Doc Db 2742 for full report

2742