



WILLIAM & MARY

CHARTERED 1693

US APA shipping frames and testing plan

Jeff Nelson

APA transport internal review
(Liverpool)

24 Jan, 2020

State of planning

- The current US-based fabrication plan and costing was developed by W&M based on Peter/George's designs a year ago
- This basis of estimate (with 30% contingency) was part of the NSF proposal budget completed in July
- Production for all 3 US factories will be centralized at W&M

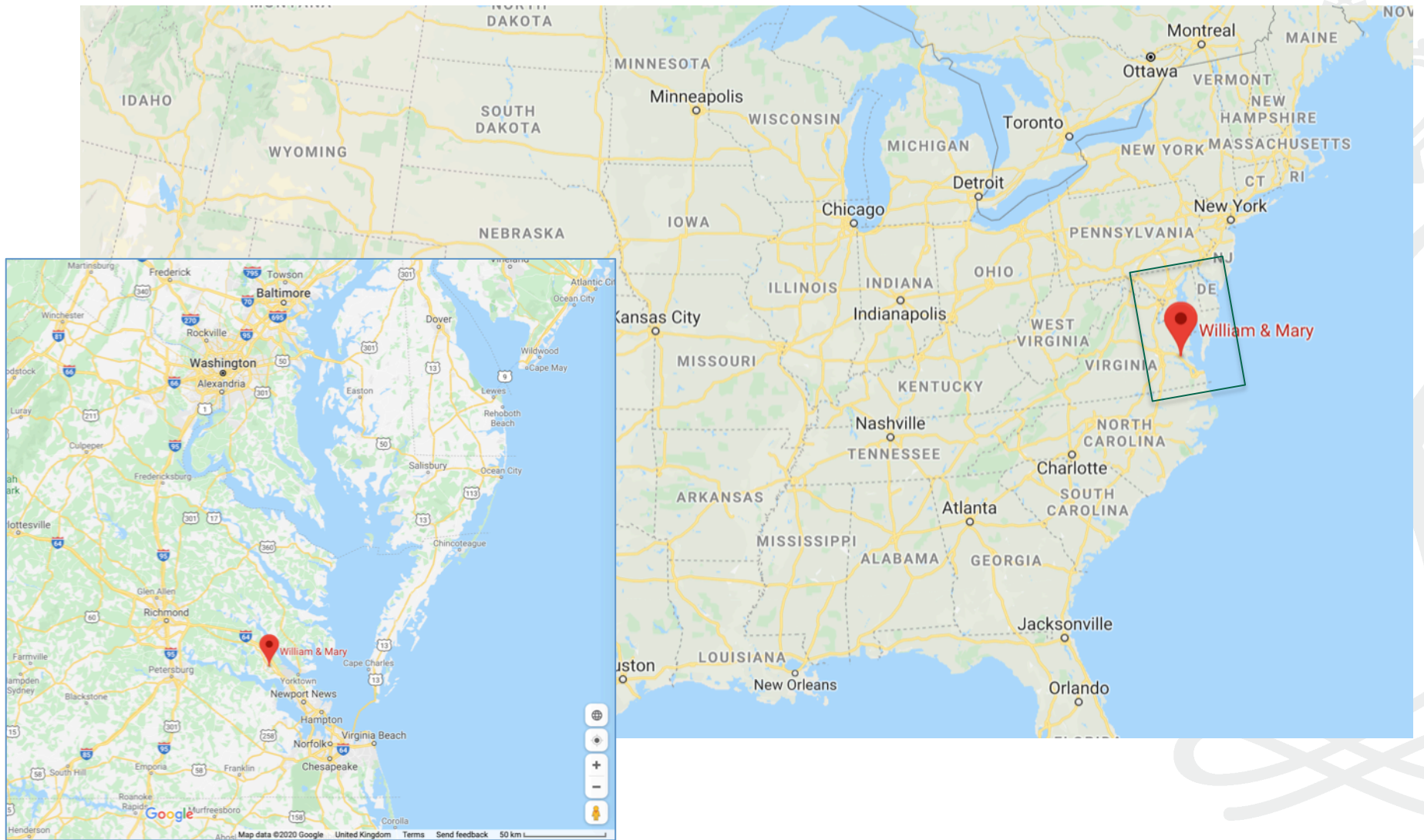
Production model

- Central welded frames made in local weld shop using dedicated fixturing, inspected, cleaned/painted, load tested, and shipped in batches to the factories
 - The current quotes are from local shops who do structural welding, but not ASME fixtures
 - Likely the costs will be higher now that it has been designated a fixture
 - Load testing to be completed off site and accomplished commercially - not in current costs
- The mounts are likely fabricated in a different shop(s), assembled with coil springs and hardware, inspected at W&M, and packed for shipping in batches to the factories
 - These costs were based on catalog materials costs and 2:1 vendor labor assumption
 - With part drawings we can update this with real quotes
- The components for the removable side frames (costed as 80:20) and their covers (costed as plywood since APAs are covered by foam panels anyway) will be purchased and assembled in the W&M high bay, test fit, and packed for shipping in batches to the factories
- Pallets will be purchased from one of the many crating companies in near-by port of Norfolk, and shipped in batches to the factories, cost based on quote from a vendor used for other projects; bids required in bulk
- Anticipate commercial wrapping
 - Current costs based on materials and do-it ourselves.
- Data loggers will be purchased and shipped to factories
 - Current costs for less capable devices than suggested by Tom Jones (\$1800/pc)
 - Can we reuse these instead of buying multiple for each crate?

Last summer's costing

Item	Vendor labor hrs	Vendor labor cost	Materials/parts	One-time costs	W&M tech hours	W&M tech costs	Total per crate	Total Overall	Notes
Central Frame			\$319,200.00	\$5,000.00			\$4,200.00	\$324,200.00	taking the lower of two quotes from preliminary drawings from 80:20 catalog. labor to assemble is 16 hours for side frame
Side Frames			\$280,001.37		2,736	\$54,720.00	\$4,404.23	\$334,721.37	Stock costs from catalog, labor assumed at the 2:1 costs as materials to vendor labor; Quote for springs.
Crate Mount	1,363.16	\$129,500.00	\$239,815.00				\$4,859.41	\$369,315.00	Lowe's catalog; labor is 40 hours per crate
Exterior Protective Panels			\$131,083.00	\$341.00	3,040	\$60,800.00	\$2,524.78	\$192,224.00	uline catalog, labor assuming 8 hours to do all the crate assembly by a lab tech.
Package for Shipping			\$8,976.00	\$2,969.00	608	\$12,160.00	\$278.11	\$24,105.00	Non-expert guess based on past crates
Base Pallet			\$228,000.00				\$3,000.00	\$228,000.00	Catalog price for 3 per crate estimated for \$2.50 per mile based on logistics manger for fermi lab
Instrumentations			\$18,924.00				\$249.00	\$18,924.00	
Shipping			\$57,170.00				\$752.24	\$57,170.00	
Total Cost		\$129,500.00	\$1,283,169.37	\$8,310.00		\$127,680.00	\$20,267.75	\$1,548,659.37	
									# of crates contingency 76 30.00%
Labor cost per crate	\$3,383.95	\$257,180.00							
Material cost per crate	\$16,883.81	\$1,283,169.37							
One-time purchase	\$8,310.00	\$8,310.00							
Total per crate cost	\$20,267.75	\$1,540,349.37							
Total overall cost		\$1,548,659.37	\$2,013,257.18						

Where is William & Mary?



W&M high bay



Prototyping

- Get signed off engineering designs and procedures at CERN/UK/FNAL/W&M and Minnesota
- FY20 SOW with Fermilab for prototype frame production at W&M in place
 - 1 shipping frame with accouterments
 - 2 carts (of each type)
- Test fit all parts and assembly at W&M
 - Assume a site visit to “kick the tires”
- Ship these to Ash River
 - Get some logged data from unloaded frames during shipment
 - Test loading and unloading APAs in both orientations
 - Test the handling operations for both shaft stations (w/ empty APA frames)
 - Test the handling needed for removing APAs in the cleanroom
 - Test attaching and movement with both carts (w/ empty APA frames)
 - Test access to head board areas in both orientations (w/ empty APA frames)
 - Test PD installation on APA in the shipping frame to verify accessibility (w/ empty APA frames)
- Ship to SURF
 - When cage is available test at both upper and lower shaft stations (w/ empty APA frames)
 - Cage planned to be available late summer

Time frame for prototype frame production

- Need to complete the engineering design review...
- Will update costing, identify viable vendors, get current quotes for all components (prototype and production) as they are finalized this winter
- Longest lead time is the central welded frame and required fixturing at the vendor
 - Even the prototype contract will require bids
 - Current quotes both say delivery within 5-6 weeks from start. Depends on their work load, which is lighter in the winter
- Ideally, do AR tests before the 1st UK frames are made



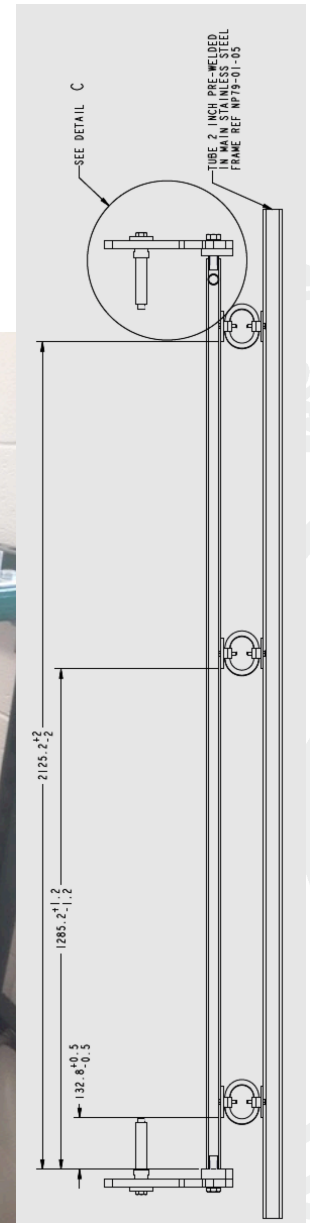
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Back up

A small test

- Testing loaded coil springs for creep when oriented sideways (also measured hook's constant in each orientation)
 - Also looks at displacement (which is redundant with the vendor data)
 - We do not orient the coils in their standard (compression vs shear)
- Initially doing this with SBND springs
- Will do this again with DUNE springs when they specified





Soudan Mine operations
MINOS scintillator modules

600 lifts





Soudan Mine operations:
MINOS steel

962 lifts