Factory Update – Chicago

Ben Stillwell

on behalf of the Chicago APA factory team –

Ed Blucher, Dave Schmitz, Rich Northrop, Marc Berthoud, and Zack Siegel

APA Workshop

22 January 2020

Outline

- Chicago APA factory overview
- Factory design
  - Baseline layout: Accelerator building
  - Layout for possible alternative location
  - Design status
- Year 1 factory setup schedule
  - Baseline
  - Alternative location
- Transition to factory operations
  - Organization
  - Staff hiring plan
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- Safety
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  - Controls

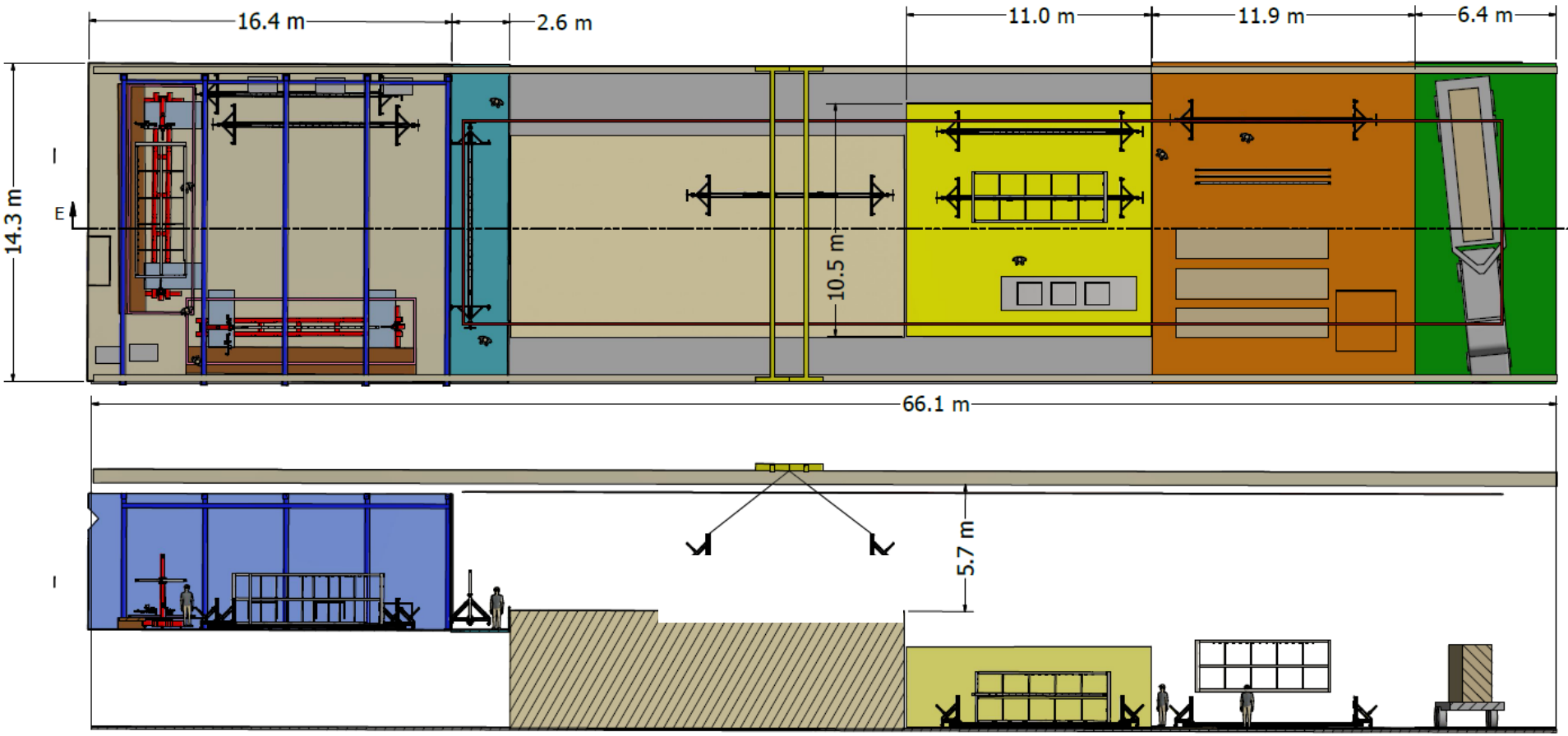
Chicago APA factory - overview

- Proposal describes fabricating APAs according to the following schedule:

Production Site	Year 1	Year 2	Year 3	Year 4	Year 5	Total
University of Chicago	2	9	13	13	13	**50**

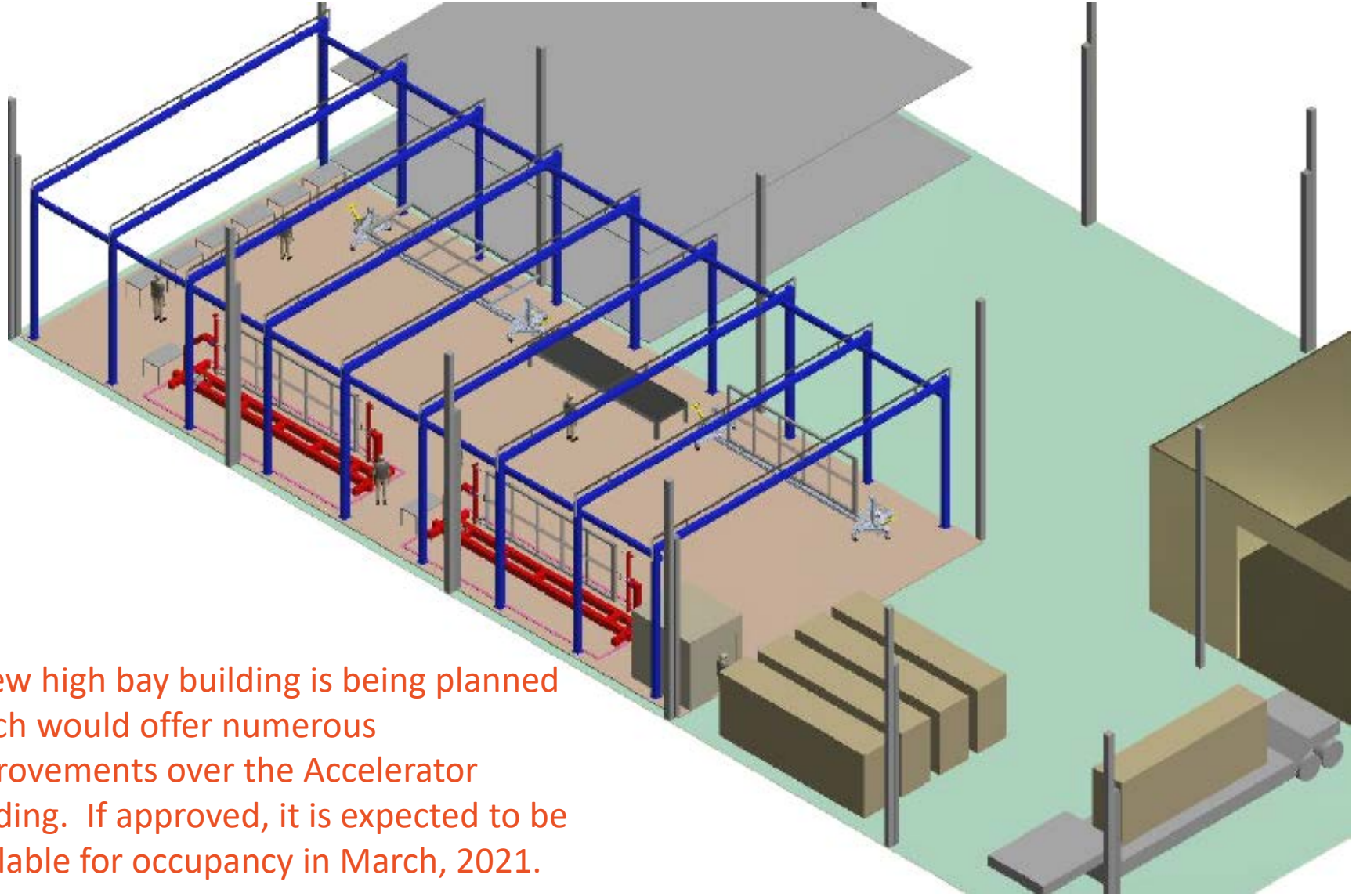
- Finished and inspected frames, mesh panels, boards and other related components will be delivered from other US consortium members.
- Work at Chicago includes:
  - Receipt inspection, inventory, and storage of received components.
  - Assembly of APA components, including wires.
  - Quality checks of finished assembly.
  - Packaging and shipping of finished APAs

Factory layout – baseline: Accelerator building



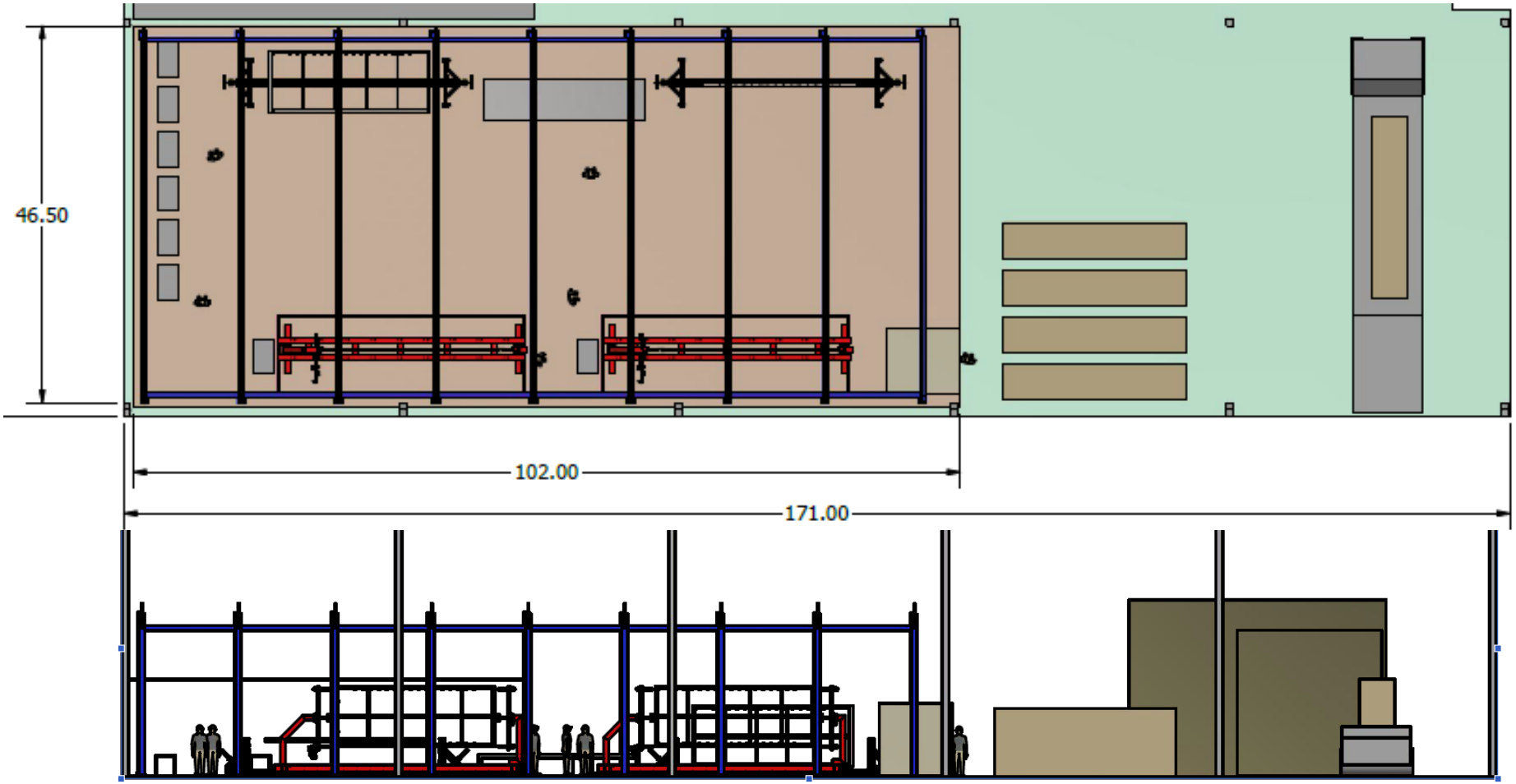
- Winding 235 m^2 + qc/prep area 116 m^2 = 351 m^2 (3,778 sf)
- Loading / storage area 170 m^2 (1,832 sf)

Factory layout – possible alternative location



A new high bay building is being planned which would offer numerous improvements over the Accelerator building. If approved, it is expected to be available for occupancy in March, 2021.

Factory layout – possible alternative location



- Combined winding and qc/prep area 441 m^2 (4,742 sf)
- Loading / storage area 147 m^2 (1,581 sf)

Design status

For both the baseline and alterative location options:

- Workable factory floor plans.
- Simple CAD models of clean tents and bridge cranes.
- Detailed logically-linked projected schedules.

For the baseline option in the Accelerator building:

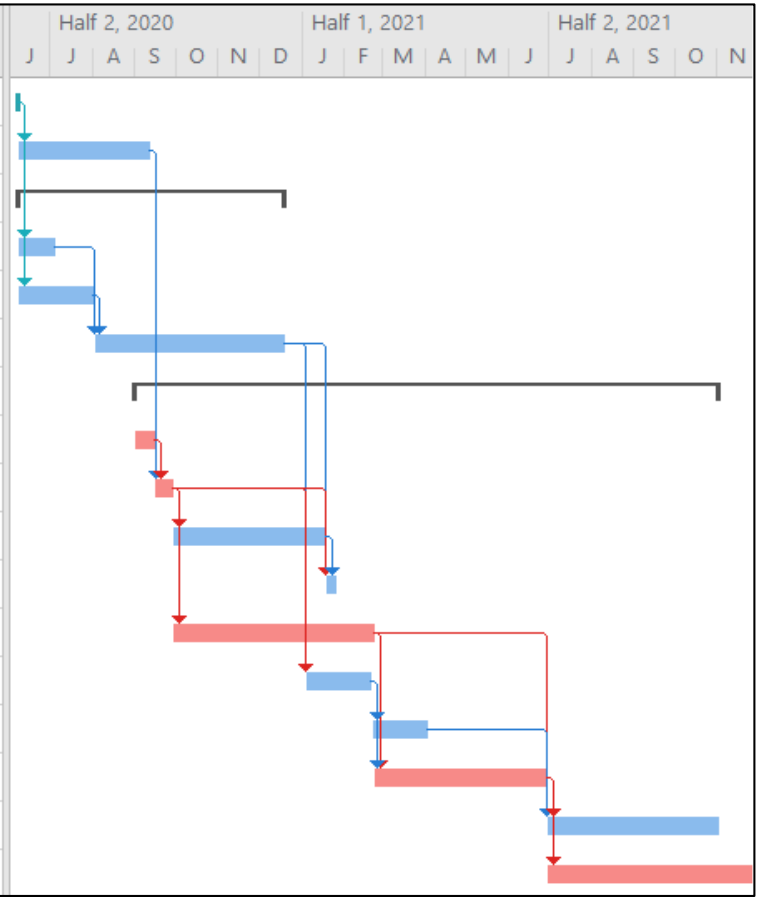
- A formal feasibility study and cost estimate for needed building modifications (mezzanine extension, stair cover, air duct modification, floor coating) by a contracted structural engineer.

For the possible alternative location:

- A building requirements document (space requirements, crane parameters, etc) which has been provided to the Dean's office.
- A "design brief" provided by a contracted architect.

Year 1 factory setup schedule - baseline

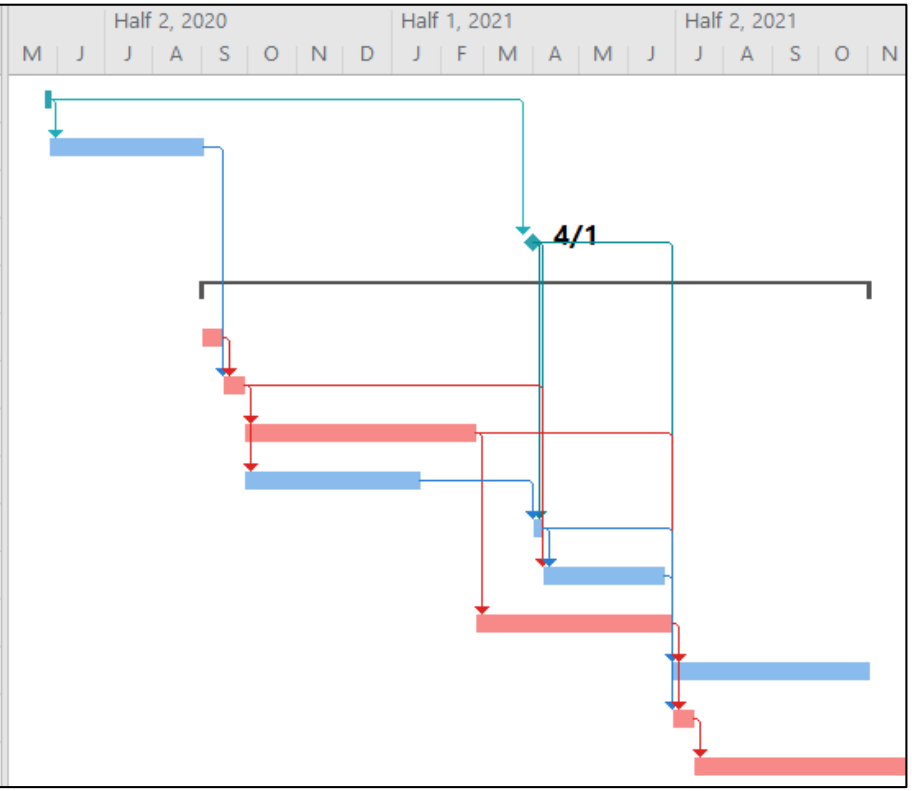
Task Name	Start	Finish	Duration
Location decision	Sun 6/7/20	Sun 6/7/20	1 day
Detailed factory design	Mon 6/8/20	Fri 9/11/20	70 days
Building Accomodations (Acc)	**Mon 6/8/20**	**Fri 12/18/20**	**140 days**
High bay cleanup	Mon 6/8/20	Fri 7/3/20	20 days
Building modifications - detail design	Mon 6/8/20	Fri 7/31/20	40 days
Building modifications - installation	Mon 8/3/20	Fri 12/18/20	20 wks
Year 1 - Factory Setup	**Tue 9/1/20**	**Mon 11/1/21**	**295 days**
Funding available	Tue 9/1/20	Mon 9/14/20	10 days
Procurement	Tue 9/15/20	Mon 9/28/20	10 days
Bridge crane fabrication	Tue 9/29/20	Mon 1/18/21	70 days
Bridge crane installation	Tue 1/19/21	Mon 1/25/21	5 days
Winders fabrication and delivery	Tue 9/29/20	Mon 2/22/21	95 days
Prep clean tent installation	Mon 1/4/21	Fri 2/19/21	35 days
Winder clean tent assembly	Mon 2/22/21	Fri 4/2/21	30 days
Winder 1 set up and testing	Tue 2/23/21	Mon 6/28/21	90 days
Winder 2 set up and testing	Tue 6/29/21	Mon 11/1/21	90 days
Factory Production	**Tue 6/29/21**	**Thu 7/31/25**	1068 days



- June 7, 2020 is latest location decision can be made without being on critical path.
- Fabrication, assembly, and setup of winders define critical path.
- Setup complete and ready for production on winder 1 eleven months after funding.

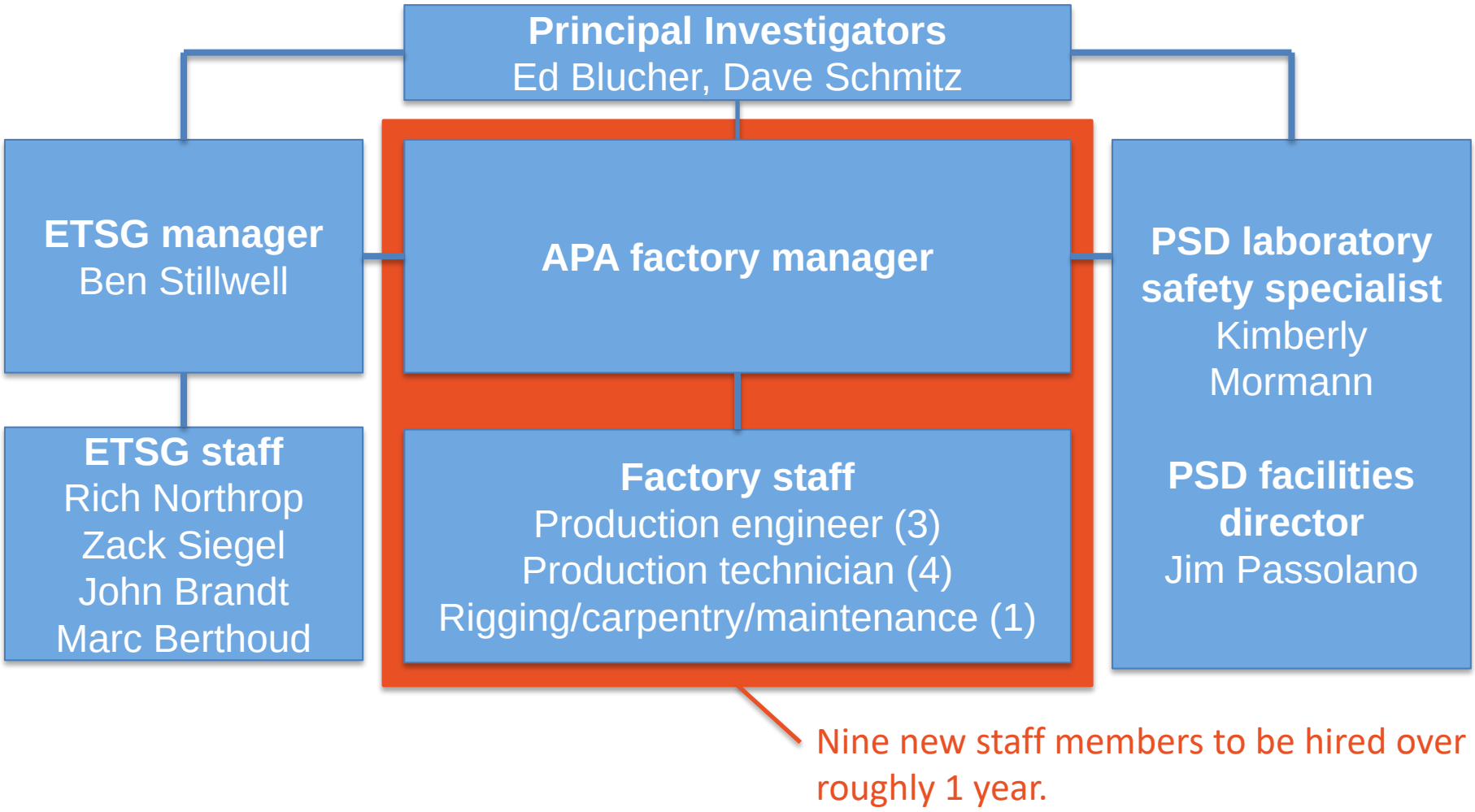
Year 1 factory setup schedule – alternative location

Task Name	Start	Finish	Duration
Location decision	Tue 5/26/20	Tue 5/26/20	1 day
Detailed factory design	Wed 5/27/20	Tue 9/1/20	70 days
Building Accomodations (New)	**Thu 4/1/21**	**Thu 4/1/21**	**0 days**
Beneficial occupancy	Thu 4/1/21	Thu 4/1/21	0 days
Year 1 - Factory Setup	**Tue 9/1/20**	**Mon 11/1/21**	**295 days**
Funding available	Tue 9/1/20	Mon 9/14/20	10 days
Procurement	Tue 9/15/20	Mon 9/28/20	10 days
Winders fabrication and delivery	Tue 9/29/20	Mon 2/22/21	95 days
Bridge crane fabrication	Tue 9/29/20	Mon 1/18/21	70 days
Bridge crane installation	Thu 4/1/21	Wed 4/7/21	5 days
Clean tent installation	Thu 4/8/21	Wed 6/23/21	55 days
Winder 1 set up and testing	Tue 2/23/21	Mon 6/28/21	90 days
Winder 2 set up and testing	Tue 6/29/21	Mon 11/1/21	90 days
Move winder 1	Tue 6/29/21	Mon 7/12/21	10 days
Factory Production	**Tue 7/13/21**	**Thu 7/31/25**	1058 days



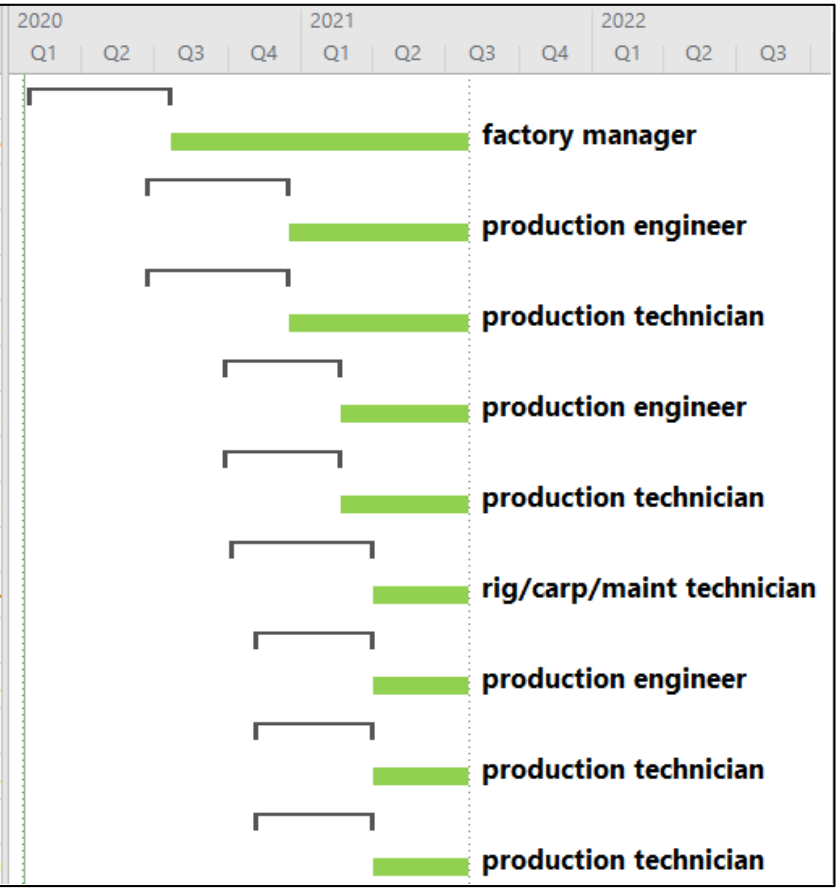
- May 26, 2020 is latest location decision can be made without being on critical path.
- Current construction schedule from architect anticipates occupancy Feb 26, 2021, 5 weeks prior to what is assumed here.
- Relative to baseline schedule, loss of 10 days before start of production due to moving of winder 1.

Transition to factory operations - organization



Transition to factory operations – staff hiring plan

Task Name	Duration	Start	Finish
Hire - factory manager	**135 days**	**Mon 1/27/20**	**Tue 7/21/20**
Active - factory manager	286 days	Tue 7/21/20	Fri 7/30/21
Hire - production engineer 1	**135 days**	**Mon 6/22/20**	**Tue 12/15/20**
Active - production engineer 1	174 days	Tue 12/15/20	Fri 7/30/21
Hire - production technician 1	**135 days**	**Mon 6/22/20**	**Tue 12/15/20**
Active - production technician 1	174 days	Tue 12/15/20	Fri 7/30/21
Hire - production engineer 2	**110 days**	**Mon 9/28/20**	**Thu 2/18/21**
Active - production engineer 2	124 days	Thu 2/18/21	Fri 7/30/21
Hire - production technician 2	**110 days**	**Mon 9/28/20**	**Thu 2/18/21**
Active - production technician 2	124 days	Thu 2/18/21	Fri 7/30/21
Hire - rig/carp/maint technician	**135 days**	**Mon 10/5/20**	**Tue 3/30/21**
Active - rig/carp/maint technician	94 days	Tue 3/30/21	Fri 7/30/21
Hire - production engineer 3	**110 days**	**Thu 11/5/20**	**Tue 3/30/21**
Active - production engineer 3	94 days	Tue 3/30/21	Fri 7/30/21
Hire - production technician 3	**110 days**	**Thu 11/5/20**	**Tue 3/30/21**
Active - production technician 3	94 days	Tue 3/30/21	Fri 7/30/21
Hire - production technician 4	**110 days**	**Thu 11/5/20**	**Tue 3/30/21**
Active - production technician 4	94 days	Tue 3/30/21	Fri 7/30/21



- Total effort hours per plan above: 9,435.
- NSF proposal for technicians, engineers, and management year 1: 12,196.
- Effort to be provided by ETSG and other PSD resources: 2,761 (roughly 1.7 FTE).

Transition to factory operations – roles and responsibilities

Factory manager

- Responsible for all aspects of factory operations - personnel, budget, schedule, and safety.

Production engineer, technician – teams 1,2

- Winder operation, calibration, troubleshooting.
- Gluing of boards and quality checks between winding operations.

Production engineer, technician – team 3

- Initial QC inspection and cleaning of frames, meshes, and other materials.
- Mesh installation.
- Initial and final board gluing.
- Clean packaging of APAs for shipment.
- Fill-in for teams 1 and 2 when needed / feasible.

Production technician – float

- Help production teams 1,2,3 as needed.

Transition to factory operations – roles, responsibilities

Rigging/carpentry/maintenance technician

- Hoisting and rigging operations.
- Coordination of incoming and outgoing shipments.
- Shipping crate assembly.
- Waste stream management.
- Maintenance of clean-tent equipment operation.
- Inventory tracking, ordering, and stocking.

ETSG staff

- Design, construction, and setup of factory with work gradually transferred to new staff as they are available.
- Initial training of new factory staff (hopefully with help from of PSL?)
- Fill-in and supplement factory staff as-needed to maintain production schedule.
- Mechanical design for new hardware or modifications that may be needed.

Transition to factory operations – training

Late Feb, 2020 – completion of PSL pre-production APA

ETSG staff will conduct regular visits to PSL to learn all aspects of:

- Winder assembly and setup
- APA fabrication
- Finished APA QC
- Frame assembly and QC (just in case…)

Feb, 2021 – June, 21

ETSG staff (with help from PSL?) trains incoming factory staff

- Winder assembly and setup initially a team-effort then gradually handed over to new factory staff as they become knowledgeable.
- Build practice APA using “prototype” frame?

Safety – oversight

- The University **Occupational Health, and Safety program** issues policies that govern how work is to be done and provides personnel for more specific assistance and oversight.
- The **Office of Research Safety** provides additional safety support for research activities.
- The Physical Sciences Division **laboratory safety specialist (LSS)** interfaces with the above and helps to provide specific solutions for work within the Division.
- **APA factory manager**
  - Issues factory specific policies and procedures.
  - Authorizes work on employee and/or task basis.
  - Ensures employee training.
  - Interfaces with University and Divisional safety.

Safety – controls

- Adherence to relevant University policies:
  - Crane Operation
  - Electrical Safety
  - Fall Protection
  - Hand and Portable Power Tools
  - Hazard Communication
  - Institutional Roles and Responsibilities for Safety Culture
  - Lockout Tagout
  - Machine Guarding
  - Powered Industrial Trucks
  - Temporary Stairways, Ladders, and Portable Ladders
  - Temporary Structures, Grandstands, or Buildings
- Training through University-offered courses or as advised by LSS.
- Procedures and/or checklists developed in coordination with other factories and in consultation with LSS.
- PPE per University policies, or as otherwise deemed necessary, in consultation with LSS.

Next steps

- Continue to provide input and feedback on design of possible new high bay building for APA factory use.
- Work with LSS to determine if any additional equipment is needed to perform work safely.
- Complete detail design of clean tent(s) and compile parts lists.
- Begin engineer visits to PSL to learn the finer aspects of winder assembly and setup, and APA fabrication.
- Draft job description for factory manager and post.