

21F03 NPOI Capstone

Vacuum Manifold Project Management Summery

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Reflection

Successes

The following bulleted list identifies the key successes of the NPOI Capstone project from last semester. The team worked hard and exhibited significant progress; this list identifies the greatest achievements of the team during the Spring 2021 semester.

- Completed CAD design work of the manifold structure
- Performed analysis of structure to influence/optimize design
- Acquired ~95% of the components necessary for assembly
- Demonstrated manufacturability of “Team Interface” component
- Stayed on budget
- Adapted to shifting timetables per request of NPOI administration

Room for Improvement / Action Items

Last semester the NPOI Capstone team was operating, for most of the semester, under a compressed timetable. This semester, with additional time, the team has the opportunity to show improvement in the following areas:

- Organization of purchase orders/documentation structure for acquired hardware
 - **Create folder on Teams for purchase requests and shipping slips**
- Presentation succinctness
 - **Stick to what has changed between presentations, no recaps**
- Organization of team meeting notes
 - **Upload meeting notes to website**
- Regular trips to NPOI (especially prior to installation)
 - **Schedule to meet at NPOI every week**
- Coordination with NPOI facilities/access to machine shop
 - **Request email updates from Lowell about Covid policy change**
- Ensuring requested purchase orders go through Lowell Observatory on time
 - **After 2 days from request follow up with Dave Nobel**

Remaining Design Efforts

- Generate shop drawing for “interface adaptor ring”
- Generate shop drawings for electrical wiring harness
- Identify and model external support structure
- Design test plan for quality assurance/system effectiveness

Gantt Chart

To complete the first hardware check of the semester the team will have to have at least two of the six of the repeating sections of the manifold completely done. To achieve this goal two brass interfaces and their respective adapter plates that will be made by the team as well as the electrical pass through with the blanking plates will have to be finished being manufactured. In addition to those items that need to be finished being built, the electrical passthrough also need to get the ribbon cables attached to them properly. Figure 1,2 show the breakdown that the team plans to accomplish these goals by the hardware check on February 11, 2022. It should be noted that there is also the individual assignment that is due before the hardware check but because we have not all decided on topics yet the relevance to the hardware check is yet unknown.

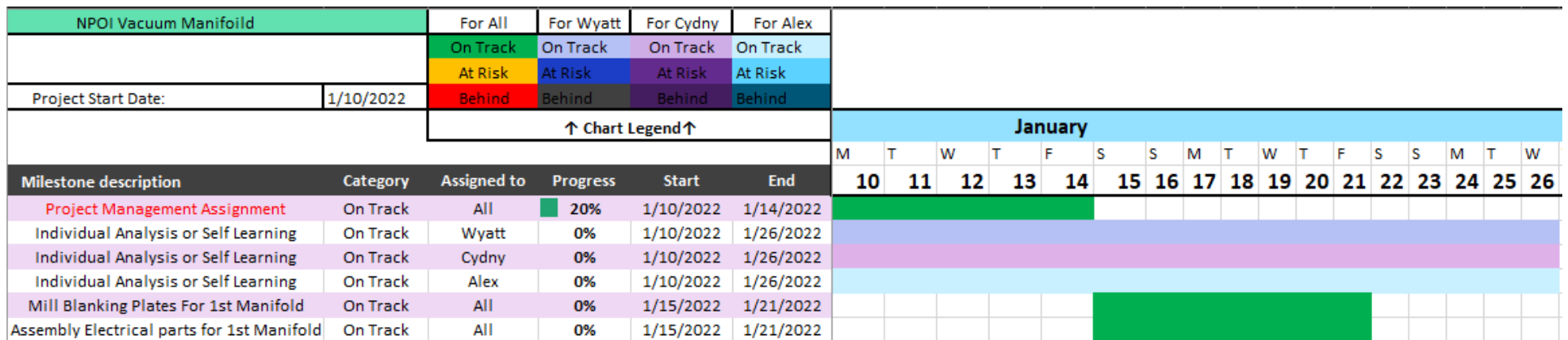


Figure 1: Gantt Chart for January 10-26

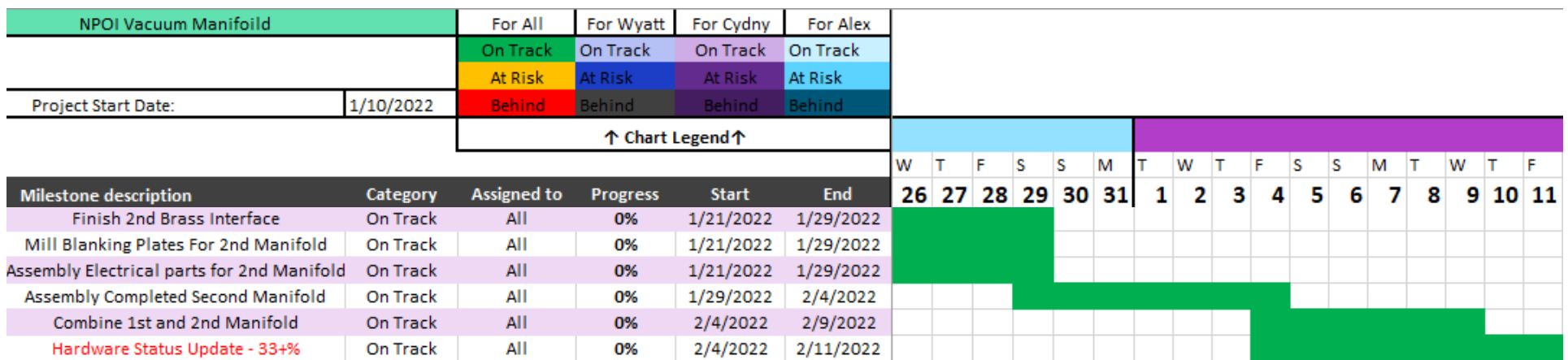


Figure 2: Gantt Chart for January 26 - February 11

Purchasing Plan

Currently with the team having already bought all the needed materials to complete the manifold the only remaining materials needed are for an external support structure. This support structure will be constructed with materials sourced locally (Home Depot/Home Co/ elsewhere). The team is waiting on design approval before purchase. Most of the project is purchased and accounted for. The remainder is waiting on a design review and approval before purchase. The team is on track and plans to have purchasing concluded before the first hardware status update.

Description	Make or Buy	Primary Vendor	Part No.	Lead Time	Quantity Ordered	Unit Cost (\$)	Cost (\$)	Part Status	Amount Received
QF 50 Blanking Plate, Stainless Steel	Buy	Kurt J. Lesker	QF50-200-SB	In Stock	19	20	380	Received	19
QF 50 Tee, Stainless Steel, 2" OD	Buy	Kurt J. Lesker	QF50-200-T	In Stock	12	146	1752	Received	12
QF 50 Cross, Stainless Steel, 2"OD	Buy	Kurt J. Lesker	QF50-200-X	KJLC will contact	6	220	1320	Received	6
QF 50 Clamp Aluminium	Buy	Kurt J. Lesker	QF50-200-C	In Stock	61	17	1037	Received	61
QF 50 Non Mitred 90° Elbow, Stainless Steel, 2"O	Buy	Kurt J. Lesker	QF50-200-E90	In Stock	1	95	95	Received	1
QF 50 Mitred 90° Elbow, Stainless Steel, 2"OD	Buy	Kurt J. Lesker	QF50-200E90M	In Stock	6	86	516	Received	6
6" Bellows, Stianless Steel, 2" ID, .012" Wasll	Buy	Kurt J. Lesker	MH-QF-D06	In Stock	6	123	738	Received	6
QF 50 Centering Ring, Aluminium	Buy	Kurt J. Lesker	QF50-200-ARV	In Stock	61	12	732	Received	61
QF50 TO QF25 Reducing Nipple, Stainless Steel	Buy	Kurt J. Lesker	QF50XQF25C	In Stock	6	81	486	Received	6
QF 50 12.6" Pipe, Stainless Steel, 2" OD	Buy	Kurt J. Lesker	QF50-200-NL	In Stock	6	89	534	Received	6
QF 25 Valve, Stainless Steel, FKM SEALED	Buy	Kurt J. Lesker	SA0100MVQF	In Stock	6	335	2010	Received	6
QF 25 Clamp, Aluminium	Buy	Kurt J. Lesker	QF25-100-C	In Stock	6	9	54	Received	6
QF 25 Centerning Ring, Stainless Steel	Buy	Kurt J. Lesker	QF25-100-SRV	In Stock	6	9	54	Received	6
KF 25 Pressure GAUGE	Buy	Kurt J. Lesker	KJL275196	In Stock	6	175	1050	Received	6
Smooth-Bore Seamless 304 Stainless Steel	Buy	McMaster-Carr	89895K794	In Stock	1	230.6	230.6	Ordered	0
Flexible Coolant Hose	Buy	McMaster-Carr	5727K53	In Stock	3	20.66	61.98	Ordered	0
Worm-Drive Clamps for Firm Hose and Tube	Buy	McMaster-Carr	5416K58	In Stock	2	14.47	28.94	Ordered	0
Threaded-Rod-Mount Clamping Hanger	Buy	McMaster-Carr	2615T19	In Stock	6	3.15	18.9	Ordered	0
Quick-Clamp High-Vacuum Fitting	Buy	McMaster-Carr	4518K14	In Stock	1	109.57	109.57	Ordered	0

Figure 3: Items from The BOM That Will/Have Benn Bought by The Team

Manufacturing Plan

The “Team Interface” works to connect the new manifold to the existing Fast Delay Line tanks. This interface will be made at NPOI using their lathe. The component will be machined from solid brass stock as discussed in previous reports. The brass was purchased by the team and is available to machine. Additionally, an adaptor ring between the interface and the existing vacuum tank will be made of brass at NPOI utilizing stock purchases for this project. The electrical feedthrough hole in the blanking plates will be completed at NPOI using blanking plates purchased and received from Kurt J Lesker.

Despite best efforts the team understands interfacing between the existing tanks, the new manifold, and the existing vacuum pump will require adjustability in the final connection. To optimize cost saving a 6 ft section of vacuum pipe will be cut to size on site during the installation process. This connection will utilize rubber hose as the vacuum seal. The hose and pipe have been ordered from McMaster-Carr and are reportedly delivered to Mars Hill. NPOI has the tools and facilities necessary to alter these components.

All manufacturing will be performed by the NAU Capstone students under the supervision of NPOI staff.

Description	Make or Buy	Primary Vendor	Part No.	Lead Time	Quantity Ordered	Unit Cost (\$)	Total Cost	Part Status	Amount Received
3in DiaBrass Stock (3.75in segments)	N/A	N/A		N/A	6	Donated	0	Received	6
TankToKF50 Interface	Make	N/A		8hrs Per Part	6	0	0	Being Manufactured	2
Electrical Feedthrough	N/A	N/A		N/A	12	Donated	0	Received	12
Electrical Feedthrough Blanking Plate	Make	N/A		30min Per Part	12	0	0	Being Manufactured	2

Figure 4: Items That Will Be Made by The Team