# Effort needed to complete the Liquid Argon Purity Demonstrator

## Per Request of Particle Physics Division Head

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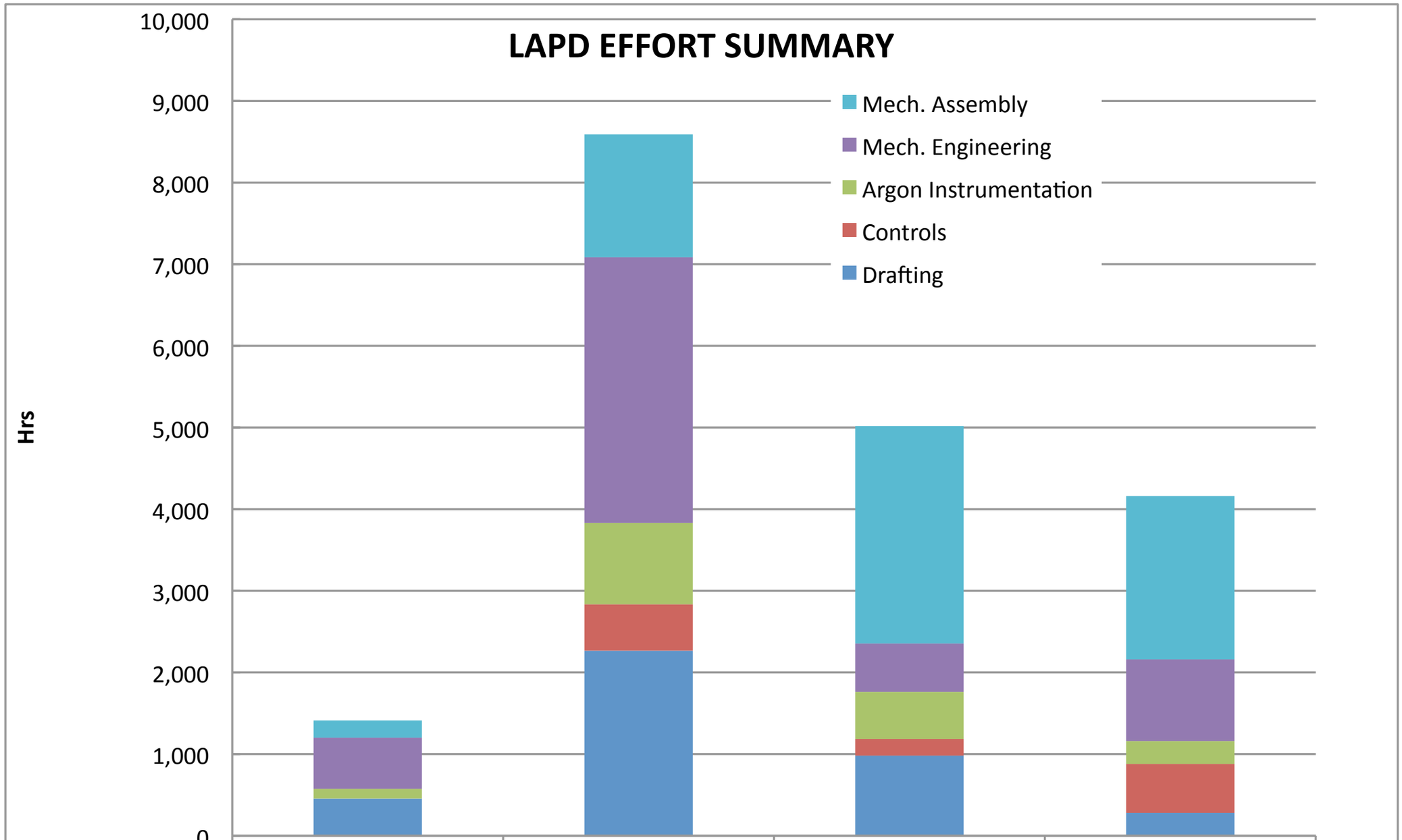
# Basis for the Estimate

- Collected effort reporting data from FY09, FY10, FY11; thanks to Sue Schultz who provided these numbers
- Used drawings and data available to calculate percent complete for each system in the project
- Separated effort by skill set and major systems to make estimates

| NAME | DEPT | SKILL | FY09 HRS | FY10 HRS | Q1 FY11 HRS | TOTAL HRS |
|---|---|---|---|---|---|---|
| KNAPP | MECH | CR | 0.0 | 37.0 | 0.0 | 37.0 |
| CATALANELLO | MECH | DR | 14.0 | 65.5 | 45.0 | 124.5 |
| CYKO | MECH | DR | 258.0 | 783.5 | 441.0 | 1482.5 |
| KINDELBERGER | MECH | DR | 0.0 | 181.5 | 16.0 | 197.5 |
| MAJDANSKI | MECH | DR | 0.0 | 44.0 | 0.0 | 44.0 |
| POLL | MECH | DR | 0.0 | 89.0 | 0.0 | 89.0 |
| RAUCH | MECH | DR | 164.6 | 165.0 | 5.0 | 334.6 |
| TILLMAN | MECH | DR | 19.0 | 346.0 | 474.5 | 839.5 |
| MULVEY | CONT | DR | 0.0 | 592.0 | 0.0 | 592.0 |
| MARKLEY | MECH | EE | 0.0 | 55.0 | 22.0 | 77.0 |
| HUFFMAN | ELEC | EE | 0.0 | 86.0 | 0.0 | 86.0 |
| MCNEAL | MECH | ET | 0.0 | 284.0 | 180.0 | 464.0 |
| GREEN | ELEC | ET | 0.0 | 20.0 | 2.0 | 22.0 |
| MARTIN | ELEC | ET | 0.0 | 123.0 | 0.0 | 123.0 |
| BAUMBAUGH | ELEC | IN | 8.8 | 0.0 | 0.0 | 8.8 |
| JASKIERNY | SITE | IN | 111.0 | 558.5 | 168.0 | 837.5 |
| RUSCHMAN | MECH | IN | 0.0 | 140.0 | 298.0 | 438.0 |
| KORIENEK | TCEN | IN | 0.0 | 112.0 | 88.0 | 200.0 |
| LINDENMEYER | TCEN | IN | 0.0 | 24.0 | 0.0 | 24.0 |
| NEWBY | TCEN | IN | 0.0 | 28.0 | 17.0 | 45.0 |
| SKUP | TCEN | IN | 0.0 | 134.0 | 5.0 | 139.0 |
| FANG | MECH | ME | 0.0 | 12.0 | 4.0 | 16.0 |
| SCHMITT | MECH | ME | 230.3 | 115.6 | 19.9 | 365.8 |
| TANG | MECH | ME | 136.0 | 120.0 | 0.0 | 256.0 |
| TOPE | MECH | ME | 250.6 | 1062.0 | 429.0 | 1741.6 |
| VOIRIN, E | MECH | ME | 0.0 | 0.0 | 29.0 | 29.0 |
| WOODS | MECH | ME | 8.0 | 870.0 | 73.0 | 951.0 |
| ADAMOWSKI | CONT | ME | 0.0 | 1060.0 | 38.0 | 1098.0 |
| MORGAN | CONT | ME | 0.0 | 14.0 | 0.0 | 14.0 |
| ALVAREZ | MECH | MT | 0.0 | 48.0 | 46.0 | 94.0 |
| BARGER | MECH | MT | 0.0 | 18.0 | 11.0 | 29.0 |
| BLASYNSKI | MECH | MT | 0.0 | 29.5 | 0.0 | 29.5 |
| BREMER | MECH | MT | 0.0 | 9.0 | 32.0 | 41.0 |
| DAVIS | MECH | MT | 0.0 | 2.0 | 0.0 | 2.0 |
| HARDIN | MECH | MT | 0.0 | 43.0 | 32.0 | 75.0 |
| JOHNSON | MECH | MT | 0.0 | 0.0 | 78.0 | 78.0 |
| JUDD | MECH | MT | 0.0 | 24.0 | 0.0 | 24.0 |
| KENDZIORA | MECH | MT | 0.0 | 40.0 | 172.0 | 212.0 |
| KUBINSKI | MECH | MT | 0.0 | 309.0 | 359.5 | 668.5 |
| MINER | MECH | MT | 0.0 | 0.0 | 288.0 | 288.0 |
| OLSZANOWSKI | MECH | MT | 13.0 | 34.0 | 6.0 | 53.0 |
| SHOUN | MECH | MT | 90.5 | 5.0 | 4.5 | 100.0 |
| TAHERI | MECH | MT | 11.0 | 8.0 | 0.0 | 19.0 |
| TWEED | MECH | MT | 97.0 | 0.0 | 0.0 | 97.0 |
| GRIFFIN | TCEN | MT | 0.0 | 369.5 | 161.0 | 530.5 |
| BURKE | CONT | MT | 0.0 | 152.0 | 0.0 | 152.0 |
| DIAZ | CONT | MT | 0.0 | 144.0 | 0.0 | 144.0 |
| FORD,JOHN | CONT | MT | 0.0 | 0.0 | 504.0 | 504.0 |
| GRIFFIN,JEREM | CONT | MT | 0.0 | 90.0 | 24.0 | 114.0 |
| LOPEZ | CONT | MT | 0.0 | 0.0 | 456.0 | 456.0 |
| SEAT | CONT | MT | 0.0 | 60.0 | 489.0 | 549.0 |
| SPIES | CONT | MT | 0.0 | 120.0 | 0.0 | 120.0 |
| FEATHERSTONE | SITE | SD | 2.3 | 8.4 | 28.0 | 38.7 |
| FORD | SITE | SD | 0.0 | 6.0 | 0.0 | 6.0 |
| ERICKSON | MECH | TS | 0.0 | 104.0 | 120.0 | 224.0 |
| VOIRIN | MECH | TS | 51.0 | 45.0 | 15.0 | 111.0 |

# Basis for the Estimate




| | FY09 | FY10 | FY11 Q1 | LEFT |
|---|---|---|---|---|
| Mech. Assembly | 211.5 | 1505 | 2663 | 2000 |
| Mech. Engineering | 624.9 | 3253.6 | 592.9 | 1000 |
| Argon Instrumentation | 119.8 | 996.5 | 576 | 280 |
| Controls | 0 | 568 | 204 | 600 |
| Drafting | 455.6 | 2266.5 | 981.5 | 280 |

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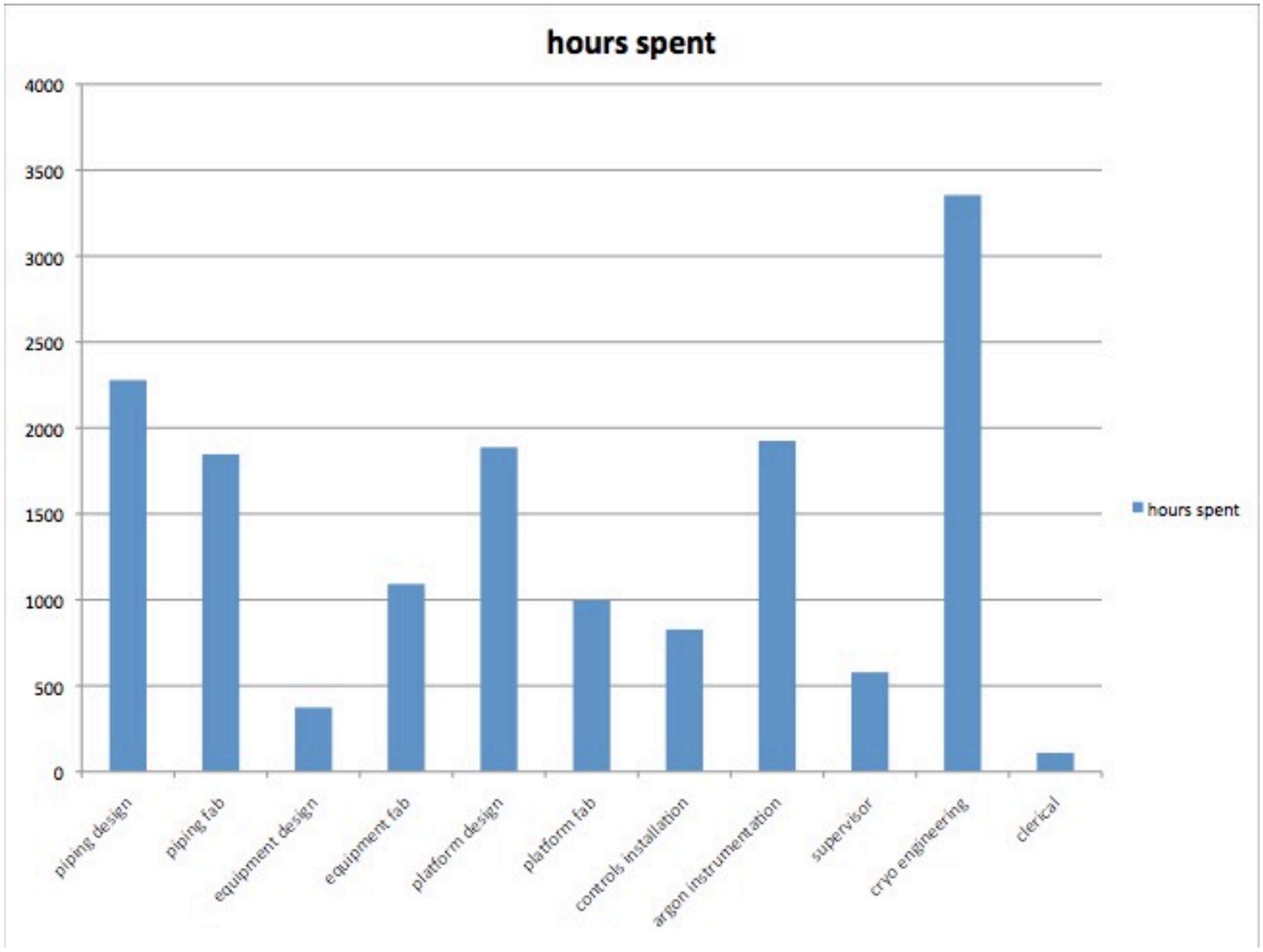
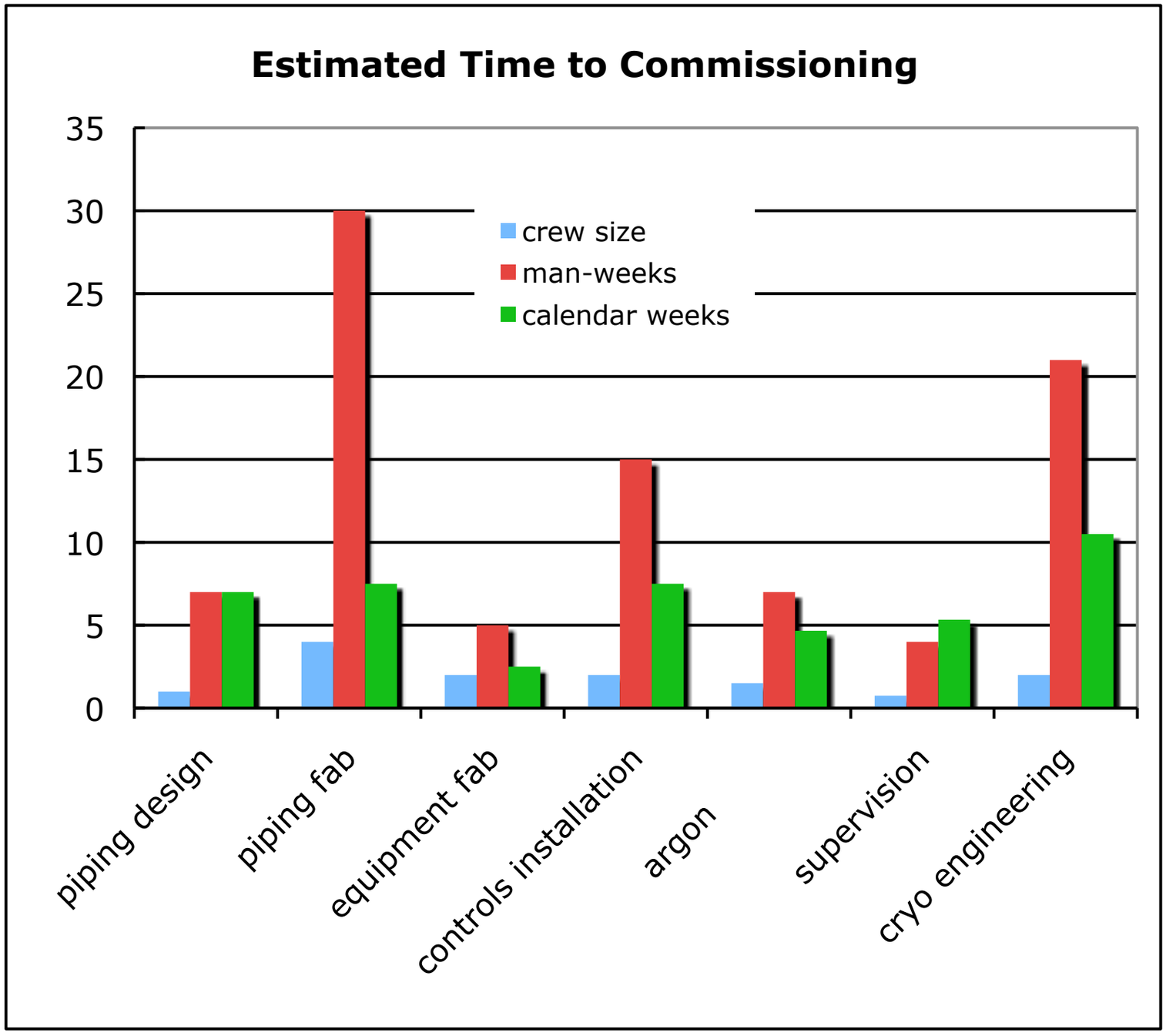


# Remaining Effort Required

- Used effort reported to determine fraction completed and time necessary to finish each system
- Piping fabrication requires the most effort, but also has most dedicated effort assigned
- Estimate10 more calendar weeks to finish the project



# Current Technician Effort

- In last 2 weeks we have added 4 technicians working on the cryogenic piping for a total of 5
  - 2 from Erickson's group
  - 1 from Kendziora's group
  - 1 from AD, Scott McCormick's group

- 1 welder services 2 teams in PC4, additional welder available in PAB for work that can be done outside of PC4

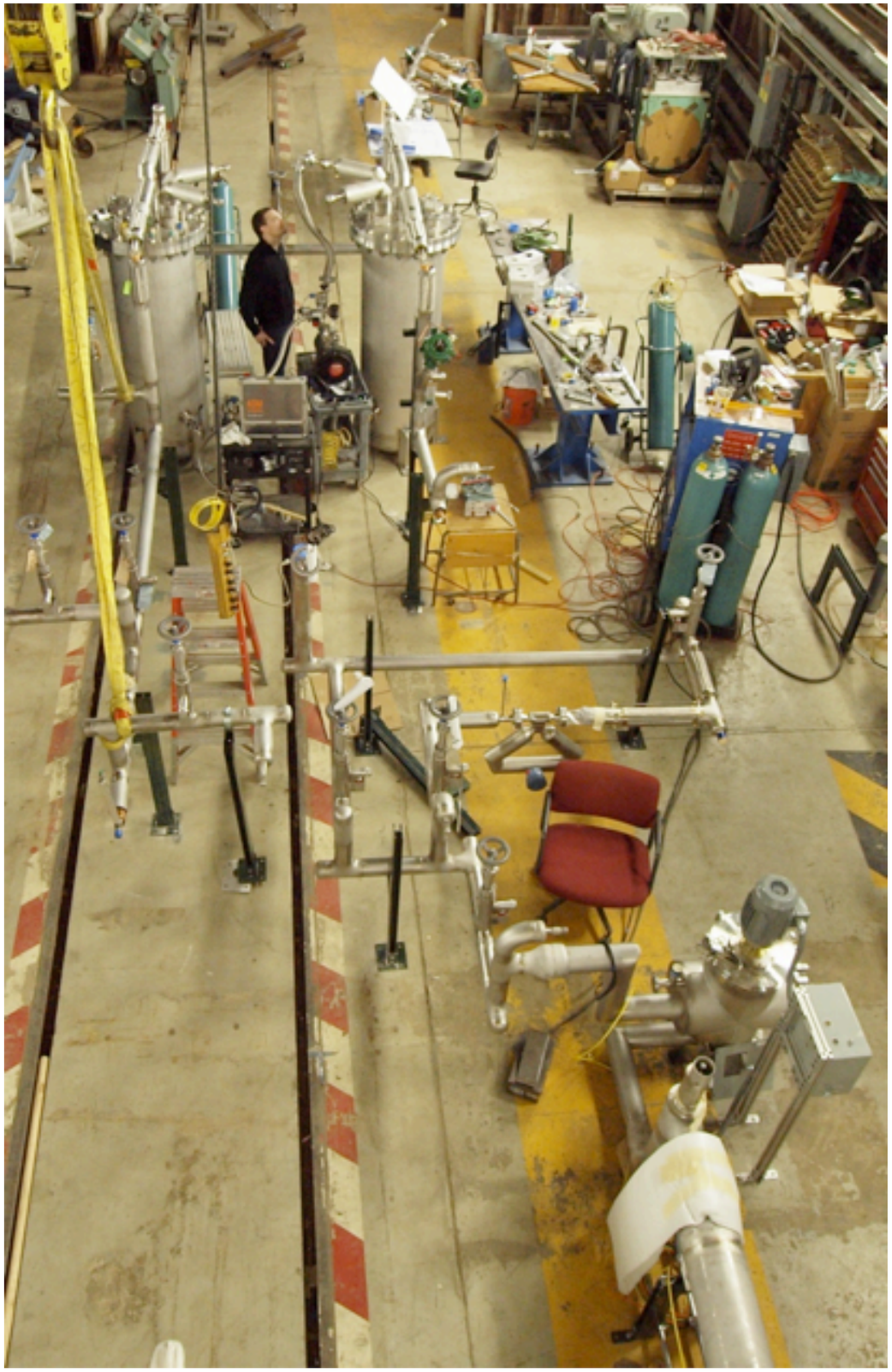
- The remaining 5 technicians in Kendziora's group are providing support exclusively for LAPD

# The Critical Path

- The vacuum jacketed cryogenic piping fabrication is no longer the critical path
  - Warm piping work is closely tied to the vacuum jacketed cryogenic piping and lags it by a week
  - Also need to finish liquid nitrogen and liquid argon supply piping
  - Estimate 30 FTE weeks to finish the task, but we have people to fill all necessary tasks
- Engineering is the new critical path, includes
  - Piping design and management
  - Programing and wiring the controls systems - Dan Markley is working on this to relieve Terry
  - Safety analysis and documentation

# State of the Assembly as of January, 4 2011

# Progress Since January 4, 2011



# Project Evolution

- Because this is an R&D project, certain aspects of it were not fully understood when we began

- Some aspects of the design and implementation required effort beyond what was initially imagined

- We know that LAPD is a resource for future large liquid argon purification systems, so we are keeping a running list of lessons learned

# Some Lessons Learned

- Piping:
  - Cryogenic piping should be modeled in 3D
  - Estimates require 3D model of cryogenic piping well in advance of construction
  - We have recognized issues related to using large cryogenic valves
- Supervision: ownership of the construction should be given to a group rather than relying on engineering making a group from various locations
- Access Issues: need to be understood and estimated properly up-front

Mechanical department and project managers intend to continue looking for lessons