



August 29, 2005

Mr. Harry Schnofinlotz  
Capital Projects  
A Really Big University  
6391 University Ave., Top Floor  
Waddle, Pennsylvania 16870

RE: A Really Important Research Cleanroom, Construction Phase Commissioning Services, Revision 2

Dear Jules,

Facility Dynamics Engineering is pleased to propose our engineering services to provide Commissioning services for the Really Big University Really Important Research Cleanroom project. The proposal is for construction phase commissioning services. Our scope of work is summarized below and detailed in the attached spreadsheets:

### **CONSTRUCTION PHASE CA SERVICES SCOPE OF WORK**

#### **TASK 1 – Project Management/Meetings and Commissioning Report**

1. Prepare, conduct and document a FPT scheduling meeting
2. Prepare, conduct and document a TAB coordination meeting.
3. Attend periodic project meetings. We have budgeted for a total of 26 meetings over the course of the project as follows:
  - Quarterly Meetings (6) from March 2006 through December 2007
  - Monthly Meetings (6) from January 2008 through June 2008
  - Bi-weekly Meetings (6) from July 2008 through August 2008
  - Weekly Meetings (12) from September 2008 through October 2008
  - Additional Meetings as necessary (2)
4. Manage the overall project commissioning effort.
5. Maintain a corrective action log.
6. Provide other contingency engineering related services as needed throughout the project (we have budgeted for an additional 8 hours of a Senior Mechanical Engineer and 8 hours of a Senior Electrical Engineer). Our experience has indicated that there are unplanned requirements for our services during construction. Time will not be charged against this budget unless requested by the Really Big University.
7. Develop a Final Commissioning Report. In general, this will include a summary discussion of key issues, and include site reports made during functional testing.

#### **TASK 2 – Submittal Review**

8. Review Electrical, HVAC Equipment, and HVAC Control submittals designated in the Commissioning Plan.
9. Provide comments/recommendations to the Design Engineer in a timely manner.

#### **TASK 3 – Construction Inspections/Start-up reviews**

10. Review Electrical, HVAC Equipment, and HVAC Control start-up procedures.
11. Provide comments/recommendations in a timely manner.
12. Visit the site to conduct HVAC and Controls commissioning “readiness” assessments. We have budgeted for 24 hours for this task.
13. Attend selected start-ups.

TASK 4 – Functional Performance Tests – Electrical/Lighting/Fire Protection – Coordinate, Witness and Document the following:

14. Develop detail tests and plans.
15. Review short circuit and coordination plan.
16. Spot check power system testing on cable work, switchgear, generators and power distribution system.
17. FPT of the power system regarding switching, simulated power outages, monitoring power quality.
18. FPT Fire Alarm System integration into HVAC.
19. FPT lighting control system.
20. Allowance for retesting (16 hours).

TASK 5 – Functional Performance Tests – HVAC/Controls - Coordinate, Witness and Document the following:

21. Develop detail tests and plans.
22. Review TAB reports, select 5-10% sample, witness.
23. FPT of hydronic components (strainers), 10% sample, review TAB and Pressure Tests
24. FPT Exhaust Fans (100% sample of 8)
25. FPT Supply Fans (100% sample of 5)
26. FPT HVAC Pumps (100% sample of 11)
27. FPT DHW System and Pumps
28. FPT Miscellaneous Terminal Units
29. FPT Main Air Handling Units (100% sample of 4)
30. FPT Clean Room A/C Units (100% sample of 26)
31. FPT Packaged Rooftop AC Unit (100% sample of 2)
32. FPT Computer Room AC Unit (100% sample of 1)
33. FPT Electric Centrifugal Chiller (100% sample 1)
34. FPT Steam Absorption Chiller (100 % sample of 1)
35. FPT Cooling Towers (100% sample of 2)
36. FPT Process Cooling Heat Exchanger (100% sample of 1)
37. FPT Tower Water Treatment System
38. FPT CHW Primary/Secondary Distribution System
39. FPT HW Secondary Distribution System
40. FPT Process CHW Distribution System
41. FPT Process CHW Pumps (100% sample of 2)
42. FPT Heat Exchanger (Steam-Water) (100% sample of 2)
43. FPT VAV Boxes (20% sample of 119)
44. FPT Exhaust Air Systems (100% sample of 2)
45. ATC - Analyze trends.
46. Verify EMS interface, software, graphics, and functions.
47. Check network communications capability.
48. Check interface with Chiller.
49. Check miscellaneous points.
50. FPT Smoke Control System Logic.
51. Allowance for retesting (96 Hours)
52. Conduct Off-Season Testing

TASK 6 – Validate Functional Performance Tests – Specialty Systems

53. Develop detail tests and plans.
54. Coordinate testing of Laboratory compressed air system
55. Coordinate testing of Laboratory vacuum system
56. Coordinate testing of RO/DI System
57. Coordinate testing of Lab Specialty Gas Systems (Nitrogen, Oxygen, Argon)

TASK 7 – O&M Manuals/Training Coordination

58. Review & Comment on the compilation of O&M Manuals
59. Review & Comment on proposed Training

## **FEES**

The following table summarizes the various tasks defined above. Details of the hourly breakdowns are supplied in the attached spreadsheets.

TASK	FEE	EXPENSES	TOTAL
Cx Plan, Mtgs, Contingency, PM, Report	\$50,960	\$4,858	\$55,818
Submittal Review	\$13,180	\$0	\$13,180
Start-up Review, Attendance, Pre-Cx	\$22,040	\$2,892	\$24,932
Electrical Systems	\$22,080	\$9,740	\$31,820
HVAC, Control, Lab Control Systems	\$128,540	\$29,909	\$158,449
Specialty Systems	\$14,080	\$2,781	\$16,861
O&M Manual, Training Review	\$8,080	\$166	\$8,246
<b>TOTAL</b>	<b>\$258,960</b>	<b>\$50,346</b>	<b>\$309,306</b>

The following clarifications are noted relative to the above fee and scope proposals.

Construction Phase Commissioning – Relative to the Construction Phase Commissioning services, the cost is largely a function of how much equipment is actually tested in the sample and who actually conducts the tests. I have taken a reasonable estimate based on our experience. Obviously, the sample size can be increased or decreased as appropriate for budget. The proposed fee includes a reasonable depth of cut on HVAC and controls. It uses the 20% sampling of terminal units. The fee includes some electrical system commissioning and also includes the use of our commissioning software tool (CACEA) to manage much of the information necessary for Commissioning electronically.

The following additional systems or additional services can be added or adjusted to the project scope and budget:

1. Attend Additional or less Project/Construction Meetings.
2. Use of CACEA for electronic O&M manual – as an option, our Cx management tool can link to any electronic data. The price varies depending on how much data is linked and whether the contractors/vendors provide or whether we must research and find.
3. Provide additional contingency engineering related services as needed throughout the project.

I would suggest further scope clarification and adjustments be made to better define the depth of cut in some of the scope items. For instance we have made assumptions in the following areas and they are covered by allowances detailed in the scope of work above:

TASK	FEE	REIMBURSABLES	TOTAL
Start-up Attendance	\$6,880	\$1,557	\$8,437
Contingency Engineering	\$2,000	\$1,280	\$3,280
Retesting	\$11,920	\$3,507	\$15,427
<b>Total</b>	<b>\$20,800</b>	<b>\$6,344</b>	<b>\$27,144</b>

FDE assumes that the general contractor (and its Subcontractors, as applicable) will contribute the appropriate Trade Specialists to participate in all required startup tests/checks and FPT's where appropriate. The above fee assumes the Facility Dynamics is conducting most of the HVAC & Controls related testing (per the Specifications). Facility Dynamics executes this type of Commissioning known as a 'hands on' approach to FPT related activities (relative to HVAC and the associated DDC system). As such, contractor participation is not necessary for all FPT's. This is an important distinction between various commissioning approaches. This approach dictates contractor participation in the first test of unique systems for practical purposes. This allows errors found in the first system to be corrected in subsequent systems. Contractor participation is not required on duplicate tests. We have found this method to be more cost-effective and also more efficient given the minimal calendar time typically available near

the end of a project. Our experience conducting tests will be helpful if we have problems with contractors conducting the tests or if they have underestimated their involvement in the testing of the various systems.

Give me a call if you need any further information or breakdown of costs. I would be glad to meet with you or any other Really Big University staff to review our cost estimate and scope for this project.

Sincerely,

FACILITY DYNAMICS ENGINEERING CORPORATION

A handwritten signature in black ink, appearing to read 'J. Santos', written over a faint, stylized graphic that resembles a triangle or a piece of paper.

J. Jay Santos, P.E.  
Principal