Performance Metrics Planning and Management

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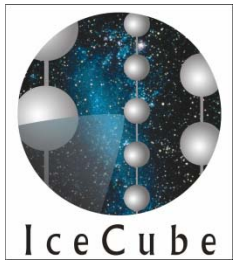
IceCube Project

May 4 - 7, 2010
NSF Large Facilities Workshop



Topics

NSF Large Facilities Workshop

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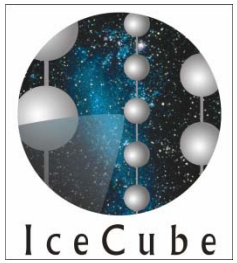
- IceCube Context
- Performance Metric Planning
- Project Performance – EV and Financial
- A Few Subsystem Specific Examples



About IceCube

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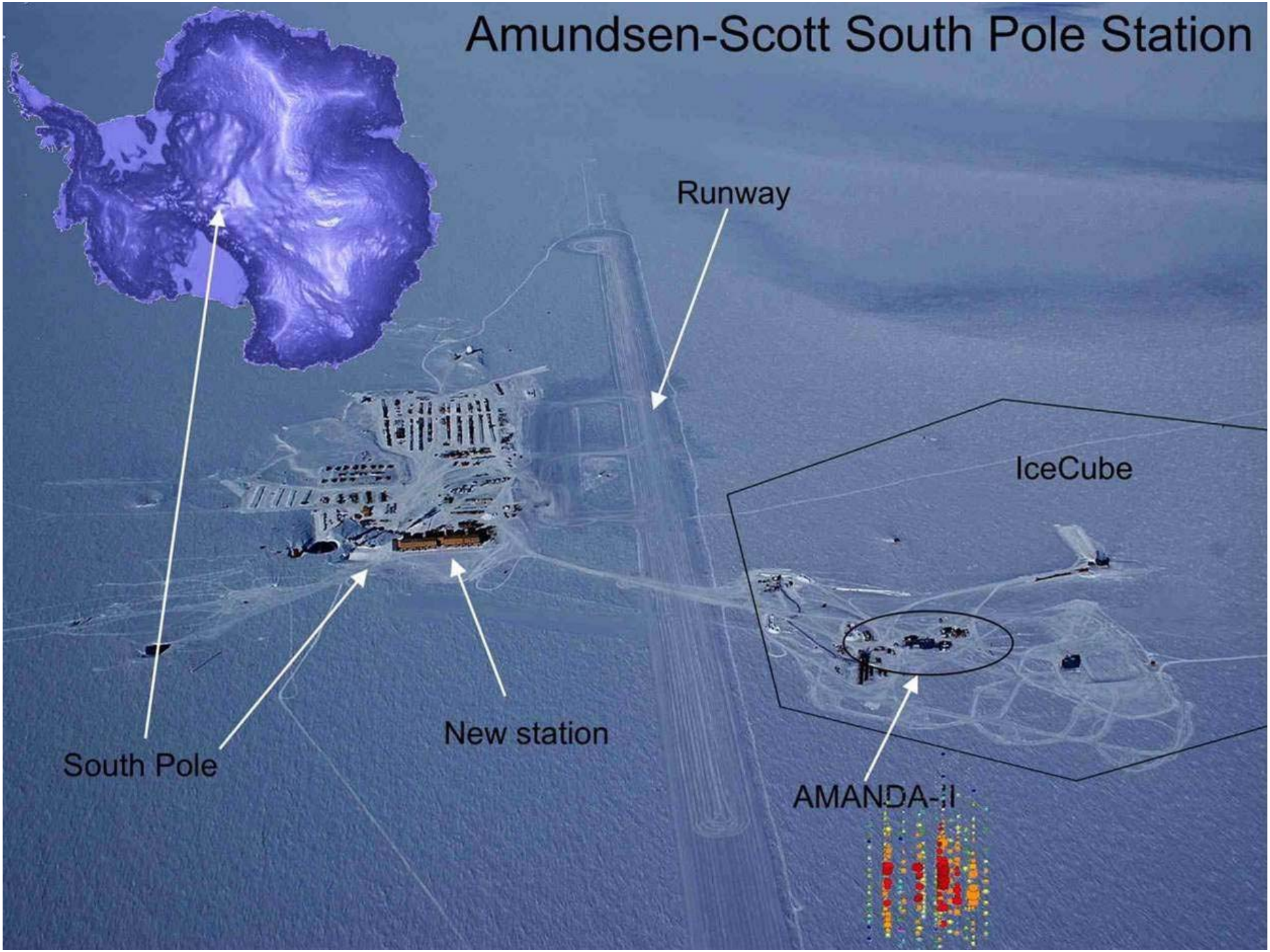
- IceCube is a $275M collaborative project - build a neutrino telescope at the South Pole
- Involves 34 institutions worldwide - UW is the lead (host lab)
- Funding
  - $242M from NSF
  - Non-US institutions are self-funded and make up the balance (>$30M)

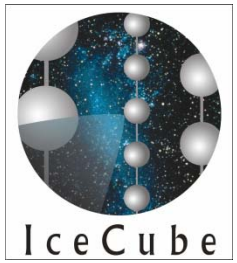
Basic Elements of IceCube

- Hot Water Drill
  - Drills holes in ice sheet 2.5 km deep and 60 cm in diameter
  - Uses hot water (~190F) at high pressure (~1000psi)
- Instrumentation
  - Deployed in holes on cable in regular array
  - 5000 optical modules with self-contained digitizing electronics
- Software and computing
  - Dedicated lab at SP for data filtering and storage
  - Software development for reconstruction of events and simulation


Amundsen-Scott South Pole Station
Runway
IceCube
South Pole
New station
AMANDA-II

Performance Metrics – Observations

- In general, project personnel don't like them – work through this and show they add value
- Earned value metrics part of the culture now – not everyone will be convinced of their value
- Good metrics work as a valuable tool at many levels to assess progress against plans
- Data should be easy to collect and understand – simple is better (of course not always the case)

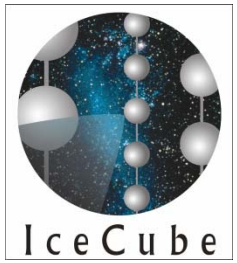


Performance Metric Planning

- Important to develop metrics from the bottom up – this approach will ensure buy-in, usefulness/meaning
- Metrics (key performance indicators) are traceable to one or more project goals
- Objective, quantifiable metrics are preferred over subjective measures
- Should be easy to understand
- Easy to collect data in a timely manner
- Simple metrics are best, e.g. electronics boards ready for shipment

Performance Metrics Planning (cont.)

- IceCube project office worked with each L2 and L3 manager to develop and report on metrics in their area of responsibility
- During construction execution phase reporting on metrics occurred at monthly status meetings
  - Initial metrics were refined in this forum
  - Metrics included EV, milestone progress, and unique measures appropriate to subsystem
  - Project controls can help by providing basic EV data by WBS
  - Milestone progress was subjective, could have been less so



Metrics from IceCube

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- Earned Value related metrics and reporting
  - CSSR
  - S-Curve
  - Cost Baseline
  - Variance report
  - Contingency status

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IceCube Project CSSR

IceCube Neutrino Observatory
Cost Schedule Status Report
Reporting Period Ending: 2/28/2006 [1]

OBS Structure L2	Cumulative To Date (AY K$)					At Completion (AY K$)			Complete (%)		
	Budgeted Cost [2]		Actual Cost of Work Performed	Variance		Budgeted AY $s	Latest Revised Estimate	Variance	Scheduled	Performed	Actual
	Work Scheduled	Work Performed		Schedule	Cost						
PROJECT SUPPORT	17169.4	17174.4	17278.8	5.0	-104.4	29904.8	30009.2	-104.4	57.4%	57.4%	57.8%
IMPLEMENTATION	21312.5	20990.6	21103.1	-321.9	-112.6	32388.6	32501.2	-112.6	65.8%	64.8%	65.2%
INSTRUMENTATION	38185.2	38267.1	38052.2	81.9	214.9	65432.7	65217.8	214.9	58.4%	58.5%	58.2%
DATA ACQUISITION	22299.8	22151.5	22467.6	-148.3	-316.1	32864.6	33180.7	-316.1	67.9%	67.4%	68.4%
DATA SYSTEMS	12483.3	11771.9	12169.9	-711.4	-398.0	25017.6	25415.6	-398.0	49.9%	47.1%	48.6%
DETECTOR COMM. & VERIFICATION	9605.8	9283.4	8929.6	-322.4	353.8	18825.0	18471.2	353.8	51.0%	49.3%	47.4%
RPSC SUPPORT	16189.7	11345.5	8087.3	-4844.2	3258.1	32022.1	28764.0	3258.1	50.6%	35.4%	25.3%
NSF	545.4	545.4	545.4	0.0	0.0	1263.0	1263.0	0.0	43.2%	43.2%	43.2%
Sub Total	137791.1	131529.7	128633.9	-6261.4	2895.8	237718.5	234822.8	2895.8	58.0%	55.3%	54.1%
Management Reserve											
Total Contingency						35,334.8	38,230.6	2,895.8			
Items Outside of Approved Baseline											
IceCube Neutrino Observatory [2]	137,791.1	131,529.7	128,633.9	-6,261.4	2,895.8	273,053.3	273,053.3	0.0	58.0%	55.3%	54.1%

Notes: 1 Incorporates approved and currently pending baseline changes.
2 Total Budget at Completion includes non-US contributions $1,283K over the amount in the post Hartill III baseline.
3 The budgeted contingency is: 33.3% of the Budgeted cost of work remaining.

S-Curve

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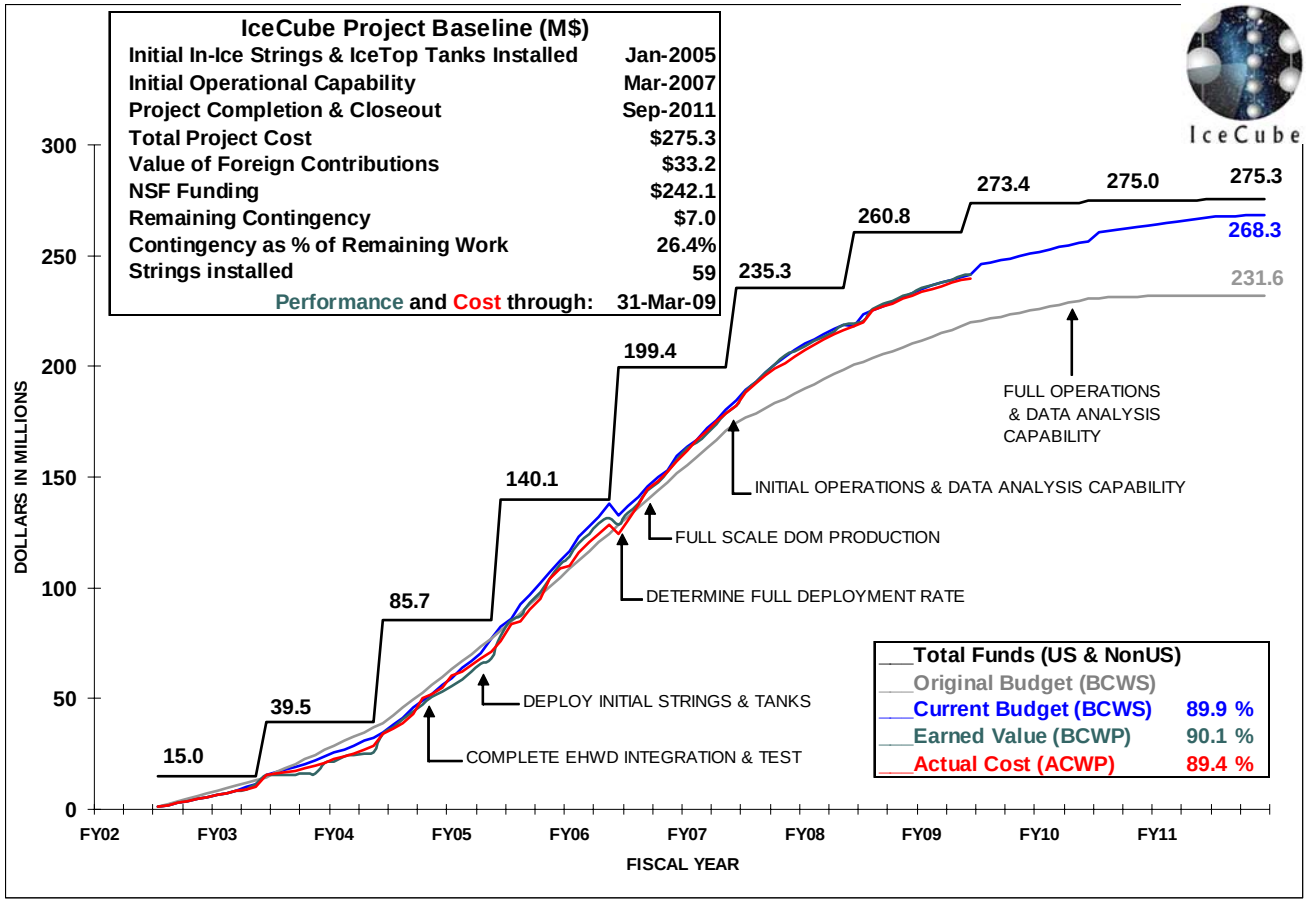


Cost Baseline

		Baseline (Hartill 02/04)	Current (Hartill 05/09)
Cost:	**TPC**	**$271.8 million**	**$275.3 million**
	NSF	**$242.1 million**	**$242.1 million**
	Non-US	**$ 29.7 million**	**$ 33.2 million**

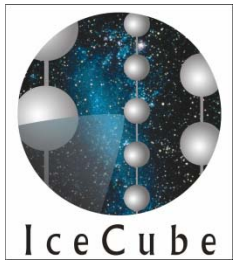
Earned Value: **$241.6 million (90.1%)**

Contingency (Cont. % of Remaining Work):

$ 40 million (23%) **$ 7 million (26.4%)**

Most Technical Risk Retired

Completion Schedule:	**4th Quarter, 2010**	**2nd Quarter, 2011**



Variances at the end of PY7

Schedule Variance is $385K

- This favorable variance is due to RPSC's FY2008 performance.

Cost Variance is $1,758K

- Implementation $498K: This variance is related to the summer training under-run, and senior engineers ramping down ahead of schedule.
- RPSC $992K: Favorable FY08 labor rate
- Pre Operations $172K: Mostly lagging invoices for Computing H/W.
- Instrumentation -$182K: DOM Production has been resumed in PSL, with the purchase of Materials and Equipments ahead of Schedule.

Contingency Status

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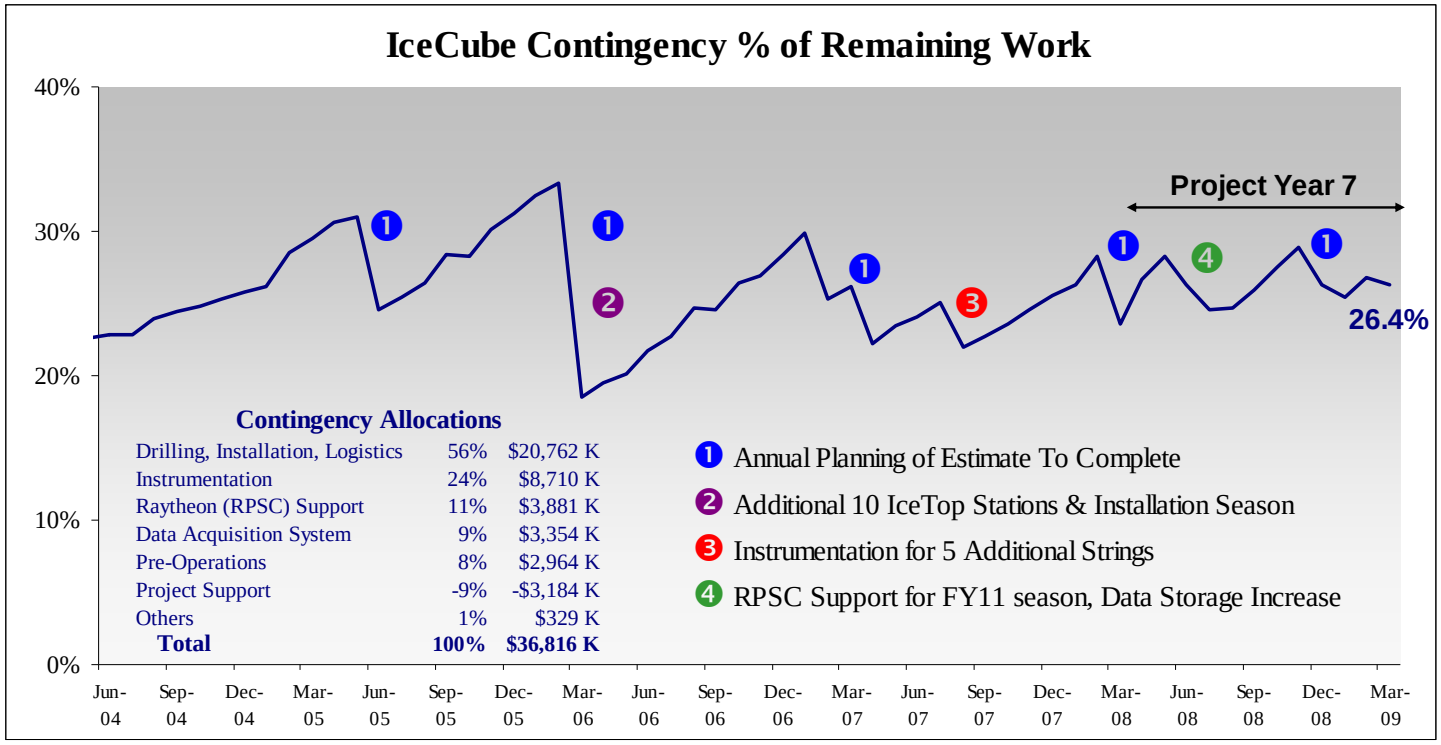
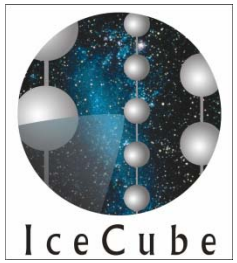
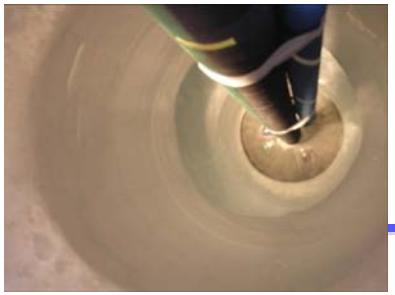




Metrics from IceCube

- Quantitative metrics that measure technical performance
  - String installation
  - Drill performance
  - Instrumentation production
    - Integration, test, yield



String and IceTop Installation

Strings (*Actual* & Plan)	***04/05***	***05/06***	***06/07***	***07/08***	**08/09**	**09/10**	**10/11**
Annual Baseline	***1***	***8***	***13***	***18***	***19†***	**18†**	**9**
Cumulative	***1***	***9***	***22***	***40***	***59***	**77**	**86**
†Deep Core (*Actual* & Plan)					***1***	**5**	
†Cumulative					***1***	**6**	

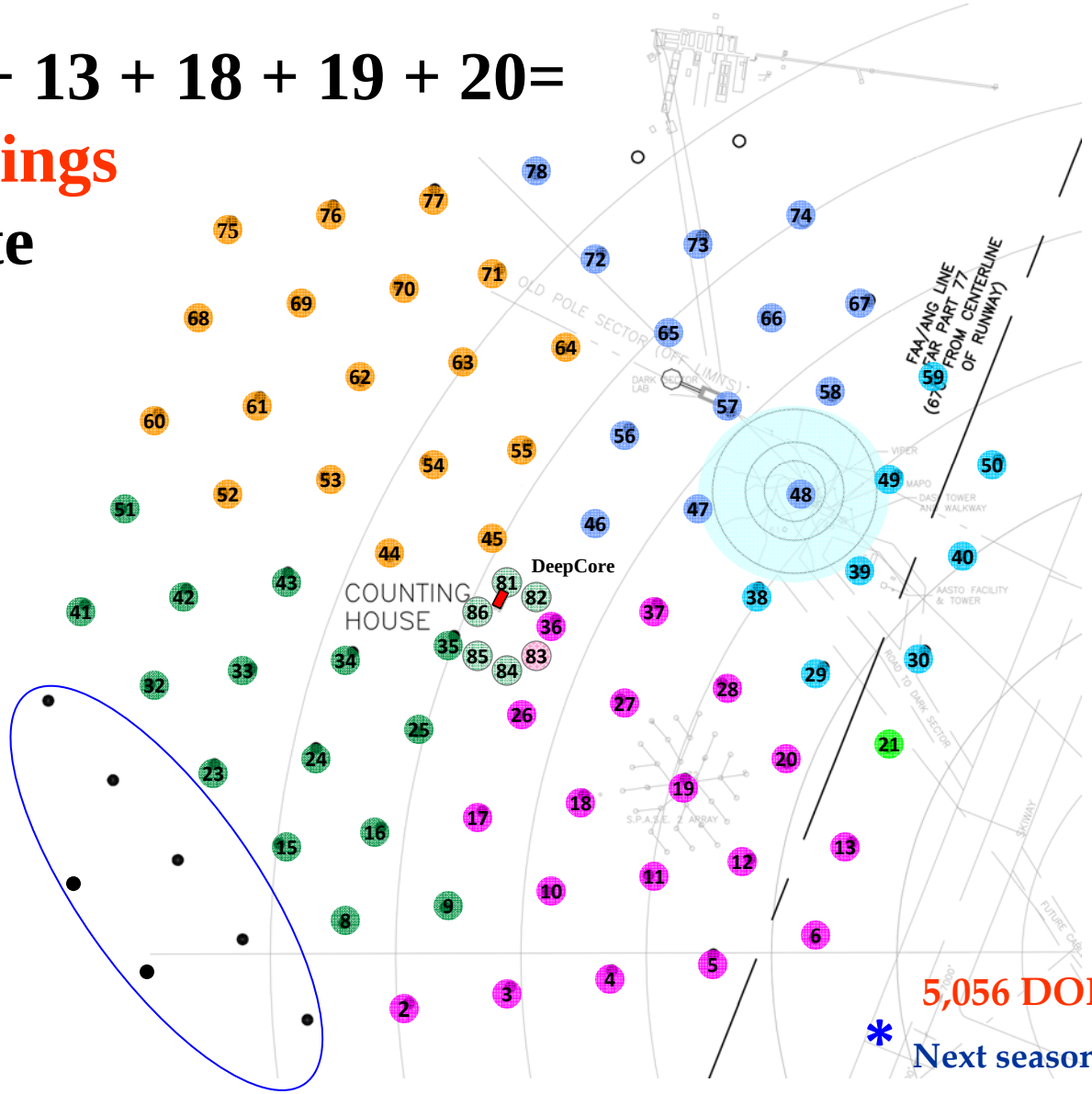
IceTop Stations (*Actual*/Plan)	***04/05***	***05/06***	***06/07***	***07/08***	**08/09**	**09/10**	**10/11**
Annual Baseline	***4***	***12***	***10***	***14***	***19***	**14**	**7**
Cumulative	***4***	***16***	***26***	***40***	***59***	**73**	**80**

String Installation Status and Plans

1+ 8 + 13 + 18 + 19 + 20=

79 strings

to date



AMANDA

IceCube string deployed 01/05

IceCube strings deployed 12/05 – 01/06

IceCube string and IceTop station deployed 12/06 – 01/07

IceCube Laboratory commissioned

IceCube strings deployed 12/07 – 01/08

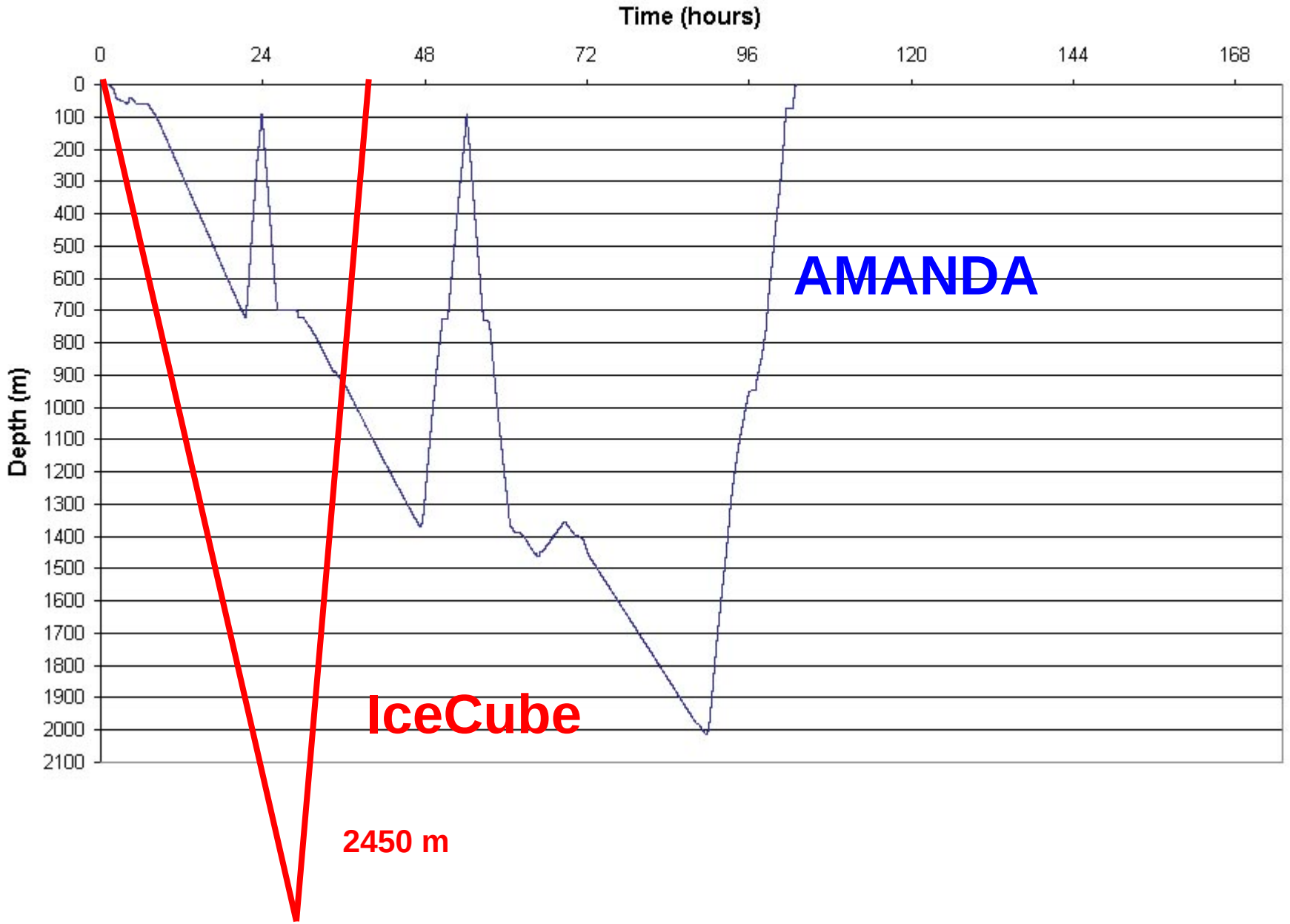
IceCube strings deployed 12/08 – 01/09

IceCube strings deployed 12/09 – 01/10

5,056 DOMs deployed to date.

* **Next season's goal is 7 strings.**

AMANDA vs. IceCube Drilling



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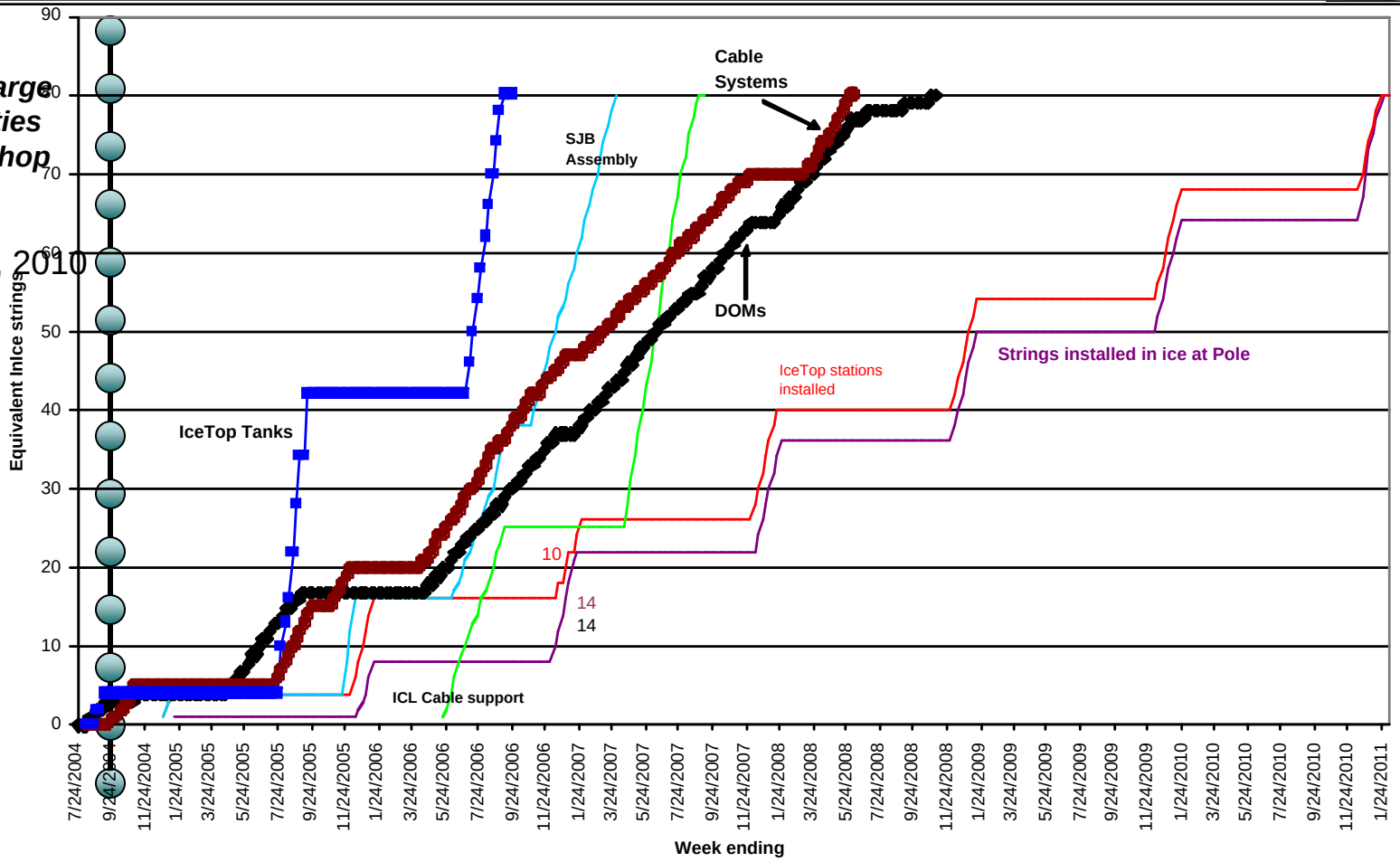
Instrumentation Production

Instrumentation Production CY2004 - CY2008 for 80 strings installed



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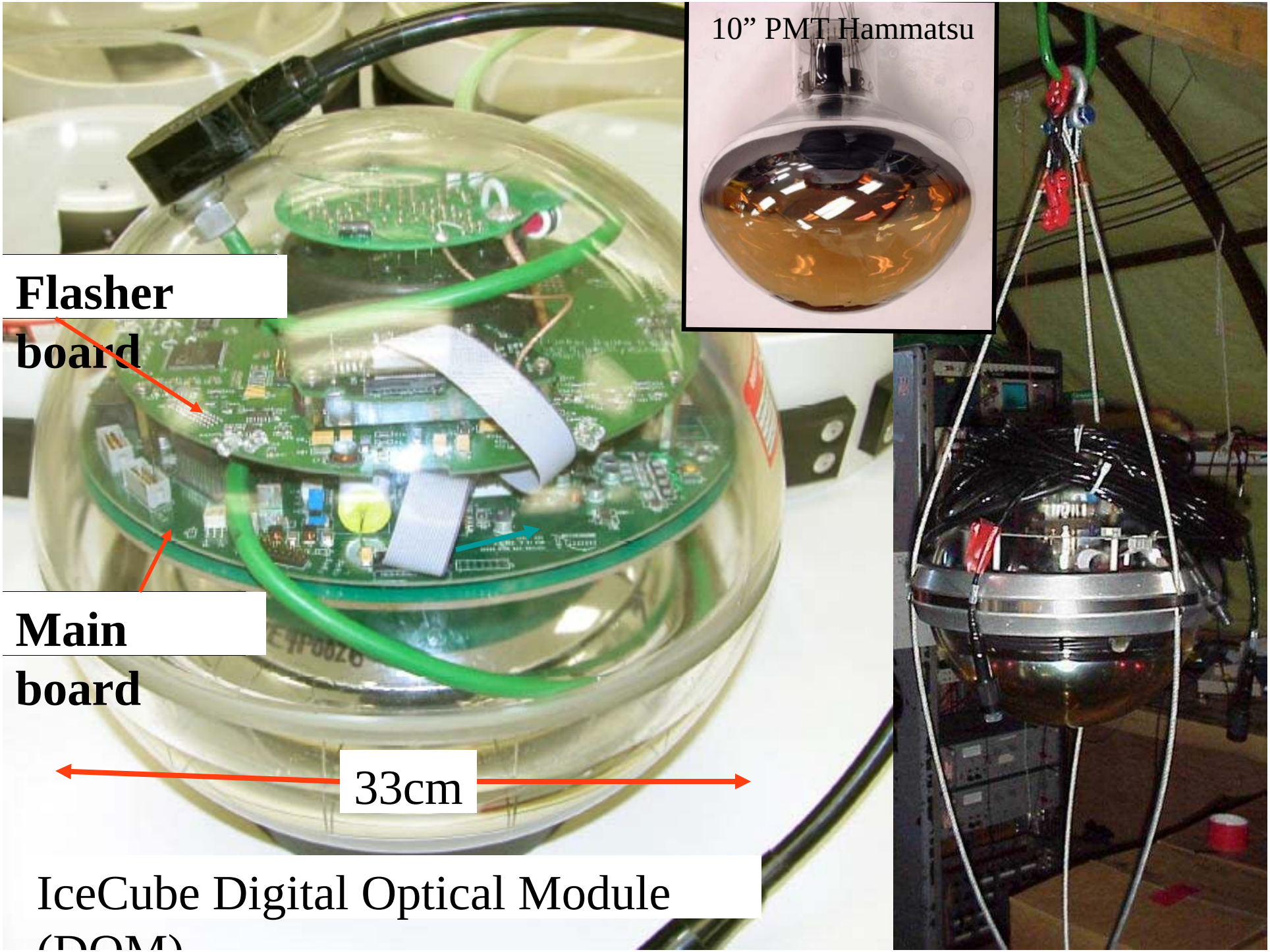
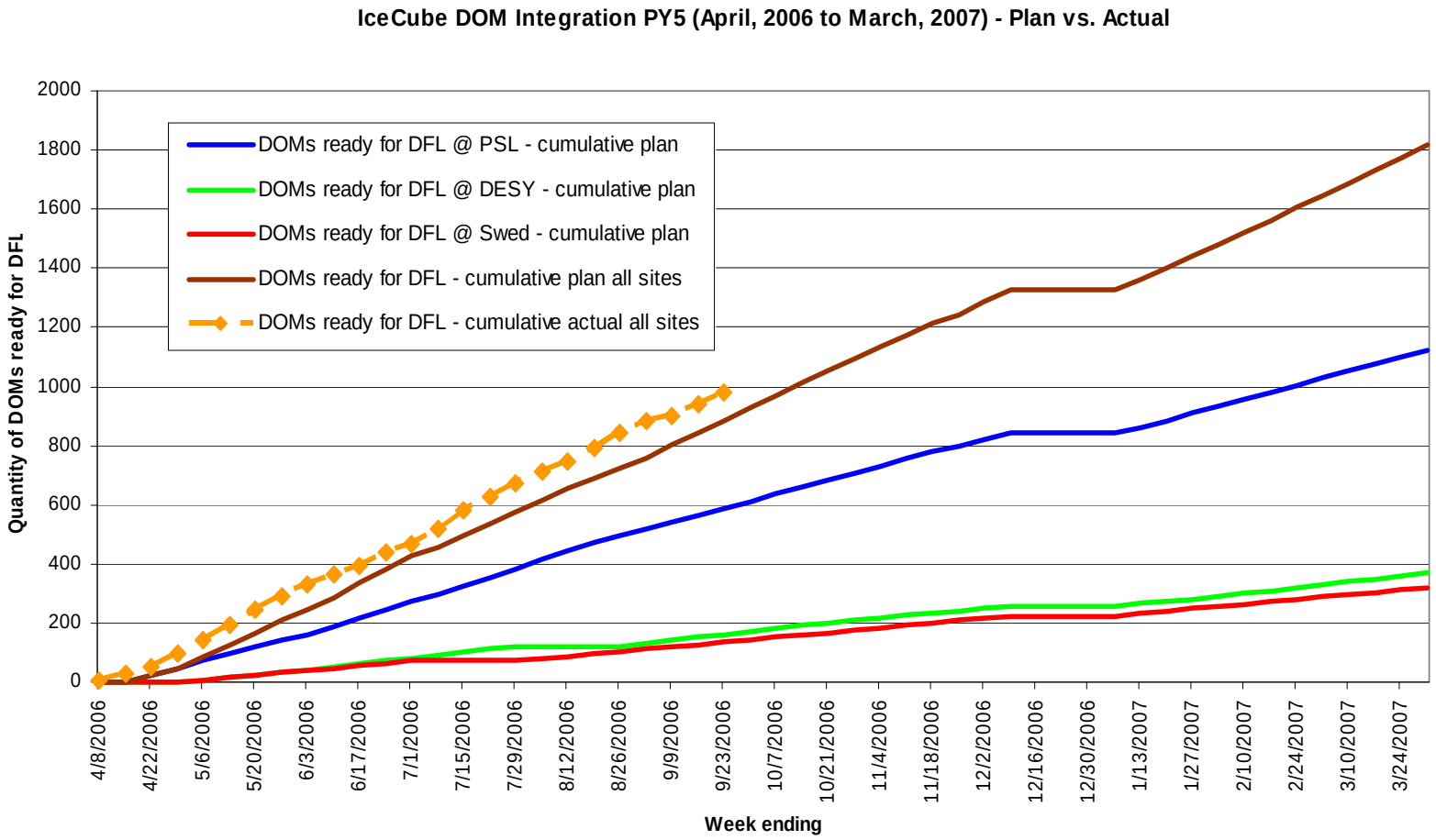
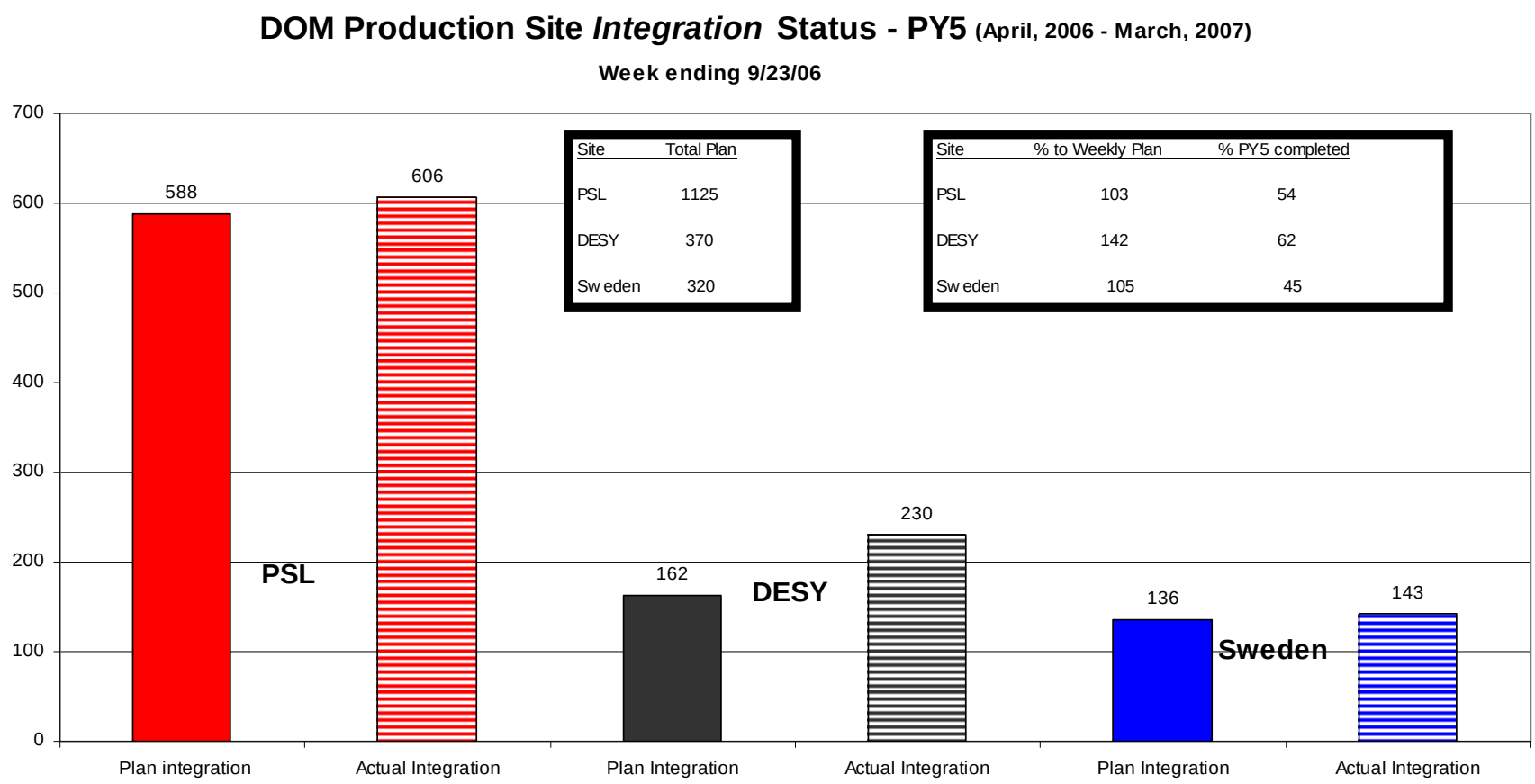


IceCube Digital Optical Module (DOM)

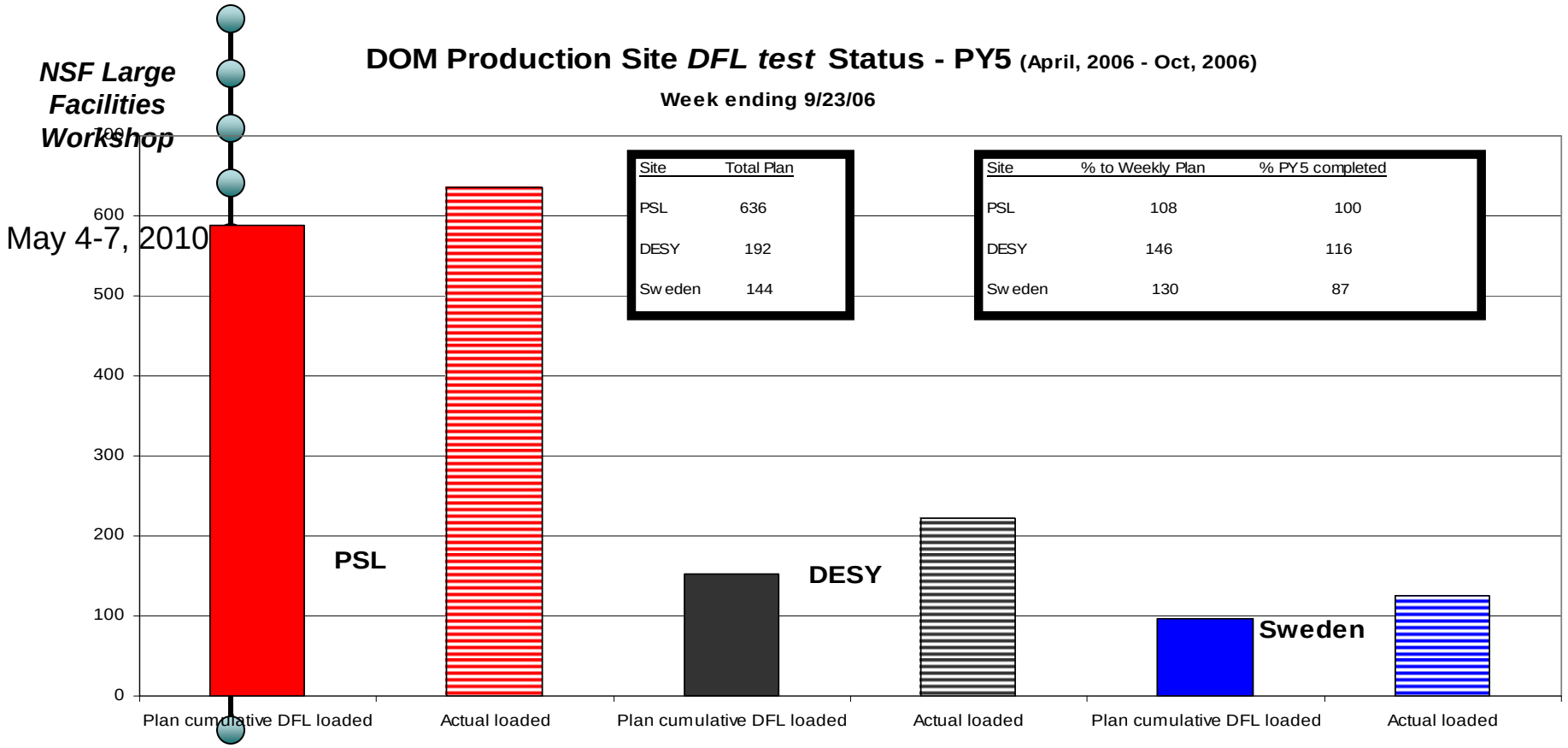
DOM integration 2006



DOM integration 2006 by production site



DOM test by prod site – CY2006



Final Acceptance Test Yield - 2006