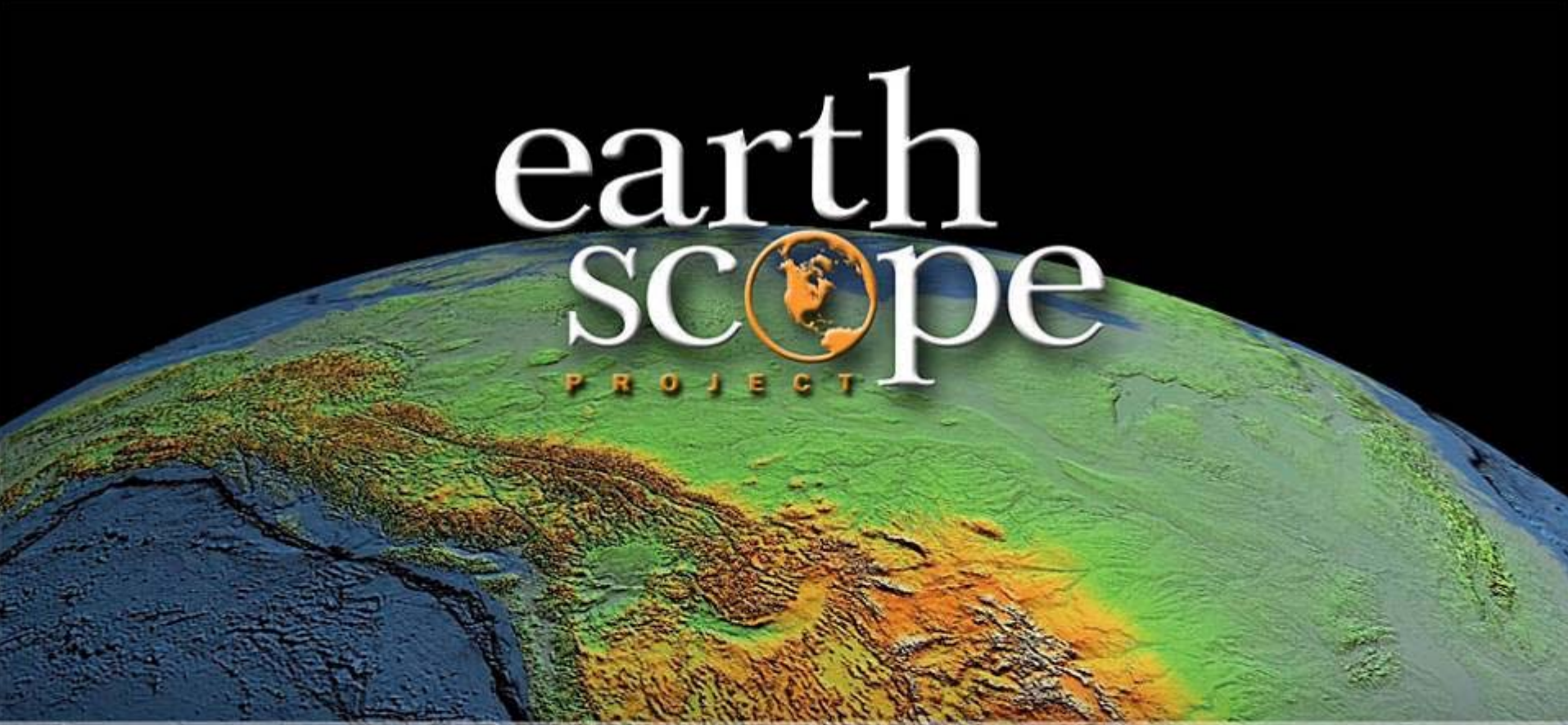


USArray EFEC Site Review

May 17, 2006

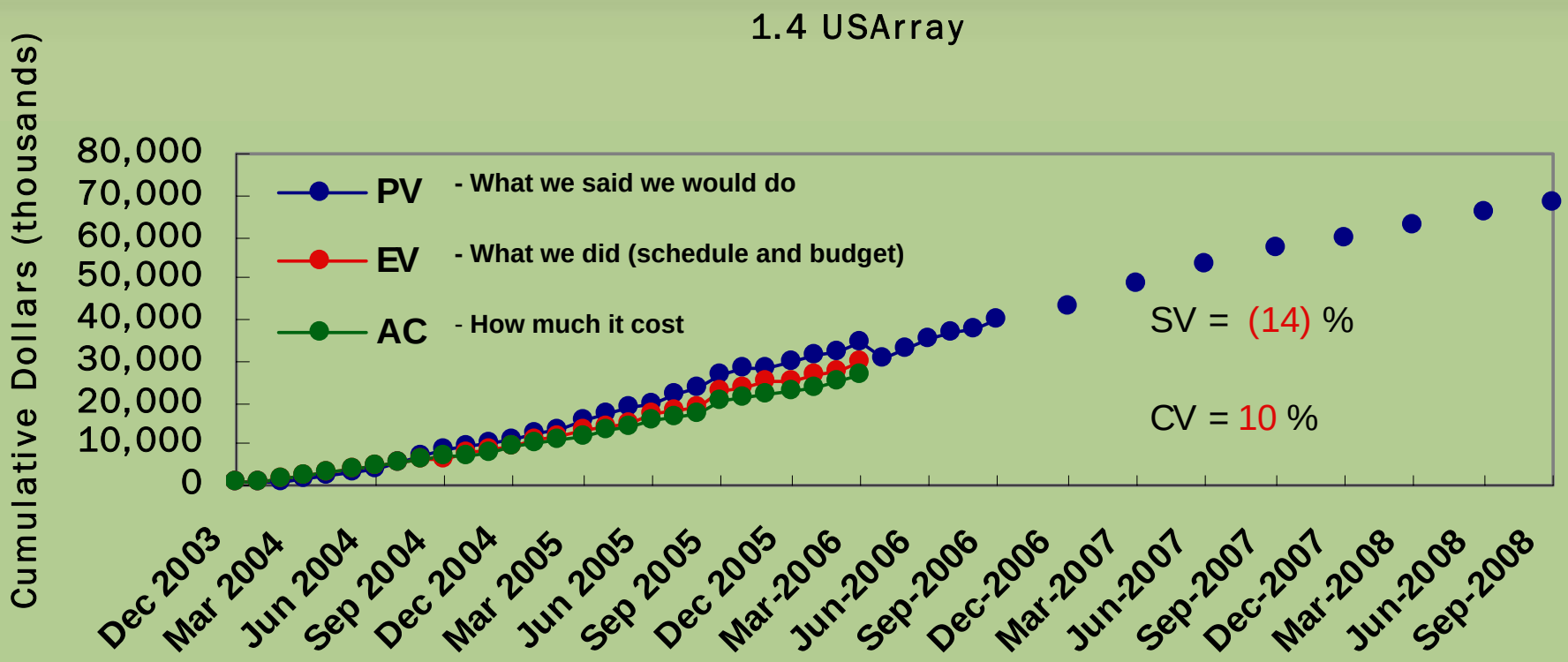
Outline

- USArray Overview
  - Agenda/Logistics
- USArray Facility Construction Update
  - Transportable Array – Bob Busby
  - Flexible Array – Marcos Alvarez
  - Permanent Array – Kent Anderson
  - Magnetotellurics – Shane Ingate
  - Data Management – Tim Ahern
- Conclusion – David Simpson

USArray Summary Status

- **Array Operations Facility (AOF)**
  - Supporting the Transportable and Flexible Arrays
- **Array Network Facility (ANF)**
  - Servicing over 160 Transportable Array stations and Flexible Array experiments with real-time telemetry
  - See displays/posters
- **Siting Outreach**
  - 1st quarterly *onSite* newsletter distributed to landowners (joint with UNAVCO and EarthScope E&O)
  - 6 Backbone sites identified for Museum Lite display
  - Training workshop for sites in Utah, Idaho, and Montana begins May 22
  - See posters

USArray Performance



Key USArray MREFC Milestones

- 39 Permanent Array stations by Sept 2006
- 400 operating Transportable Array stations by Sept 2007
- 2400 Flexible Array Instruments by Sept 2008
- 7 permanent and 20 transportable MT stations by Mar 2007
- Seismic station data availability of 85%

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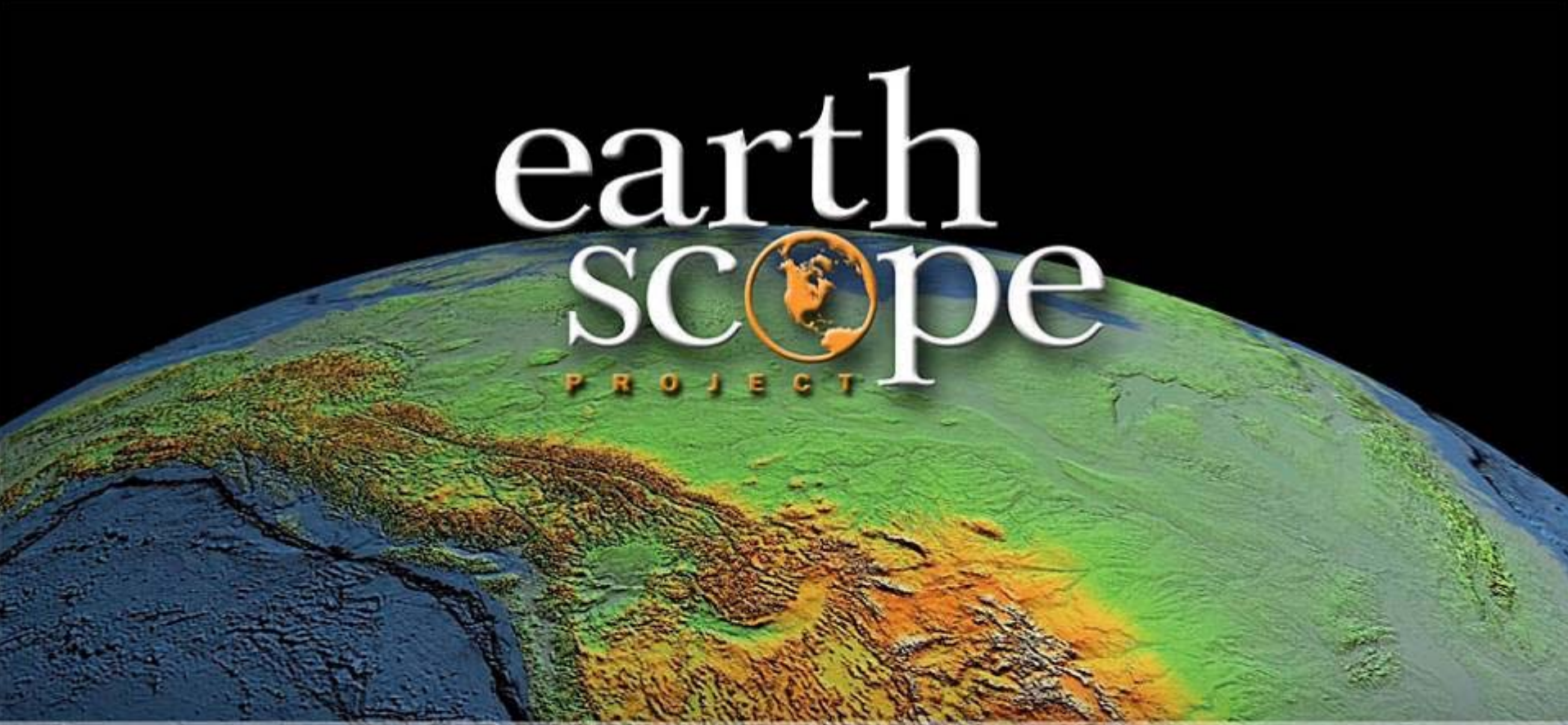


USArray Transportable Array

Robert Busby
Transportable Array Manager

EFEC Site Review
May 17, 2006

Transportable Seismic Array

- Review of Year 3 and MRE Goals
- Progress of the Array
- Performance
- Special Topics:
  - Operational Concerns
    - Construction and Installation
    - Crew Strength
  - Permitting Plans
    - Current Permit status

Transportable Array: Year 3 Goals

EarthScope Year 3 Oct 2005 - Sept 2006

- Permitting in eastern Nevada, Idaho, western Montana, Utah and Arizona
- Permit goal is
  - 16 per month
  - In-hand permits for about three month lead time on Construction, or 42 permits
- Routine deployment phase in Oregon, Washington and western Nevada
  - Installation
    10 stations per month
  - Construction
    14 stations per month

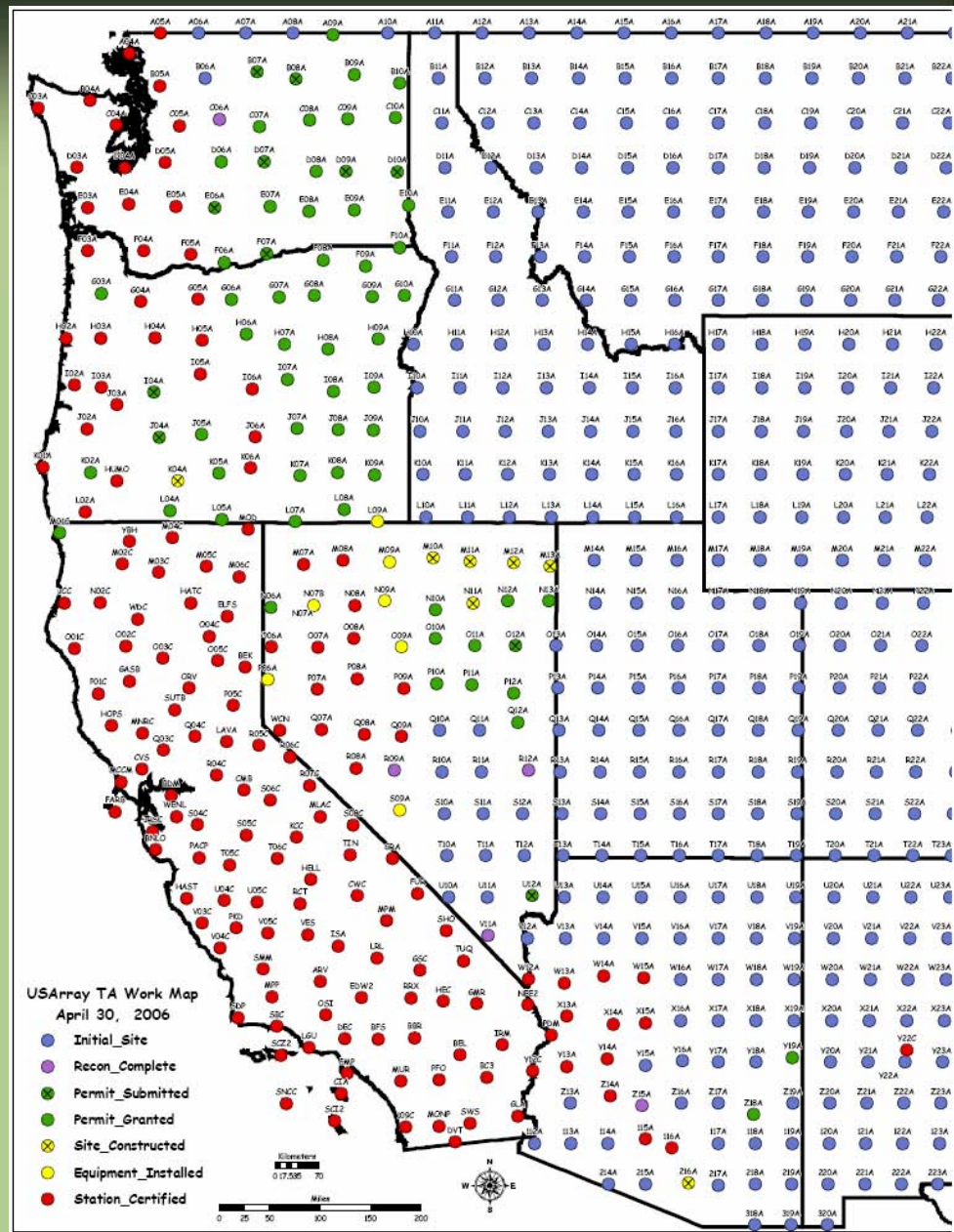
Transportable Array Status

- End of April 2006

  168 stations operating
  - 64 shared stations
  - 104 new stations

  - End of Quarter goal 200

  Near term Work Plan
  - Completing SE NV (24)
  - Construction / Installs in Oregon (33) to mid June
  - Construction / Installs in WA June / July

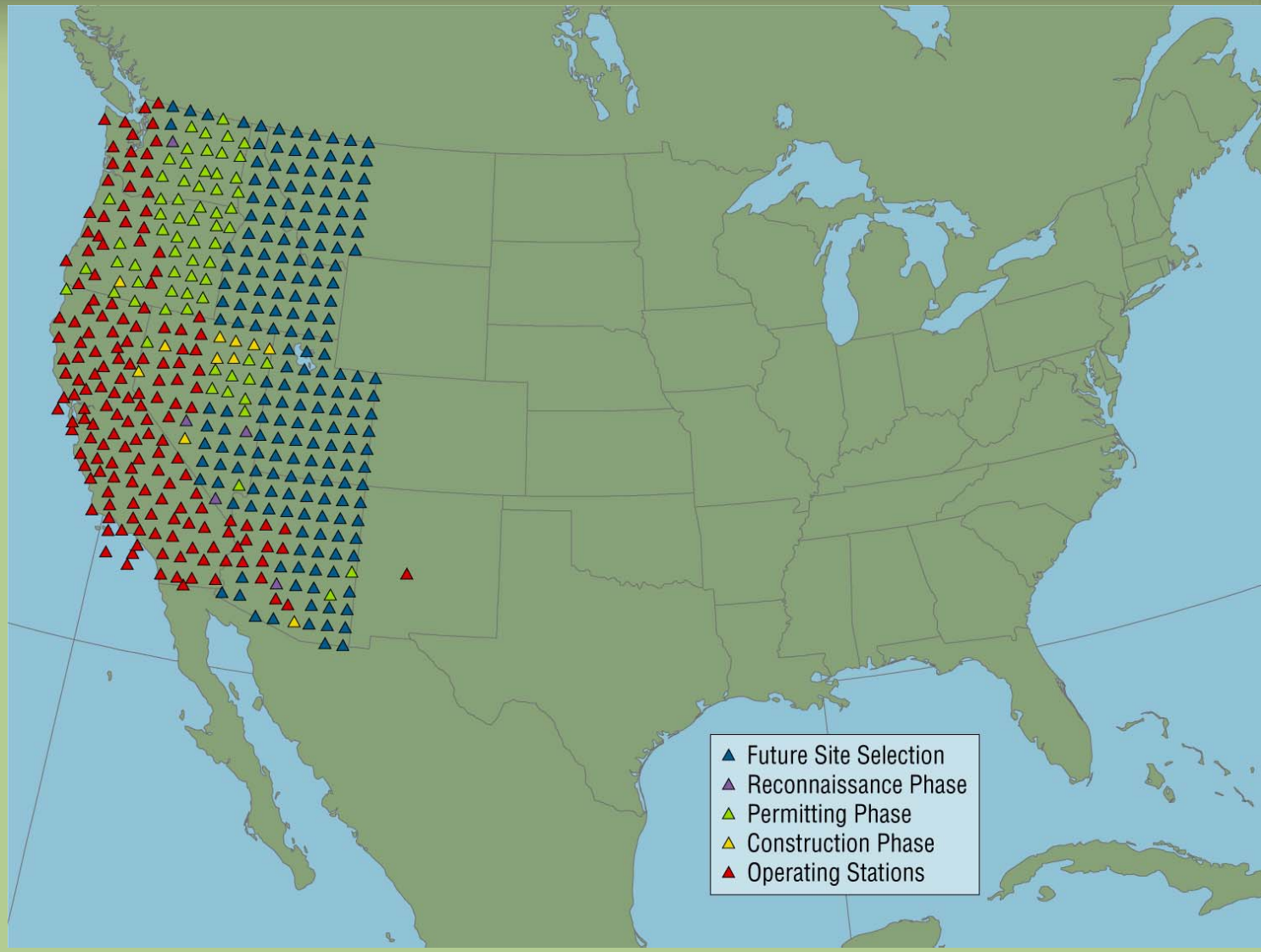


N1

MRE Goal

MRE goal is 400 operating stations by Sept 2007

Rolling of the Array begins under O&M in Jan 2008 with removal from Northern California and Cascades



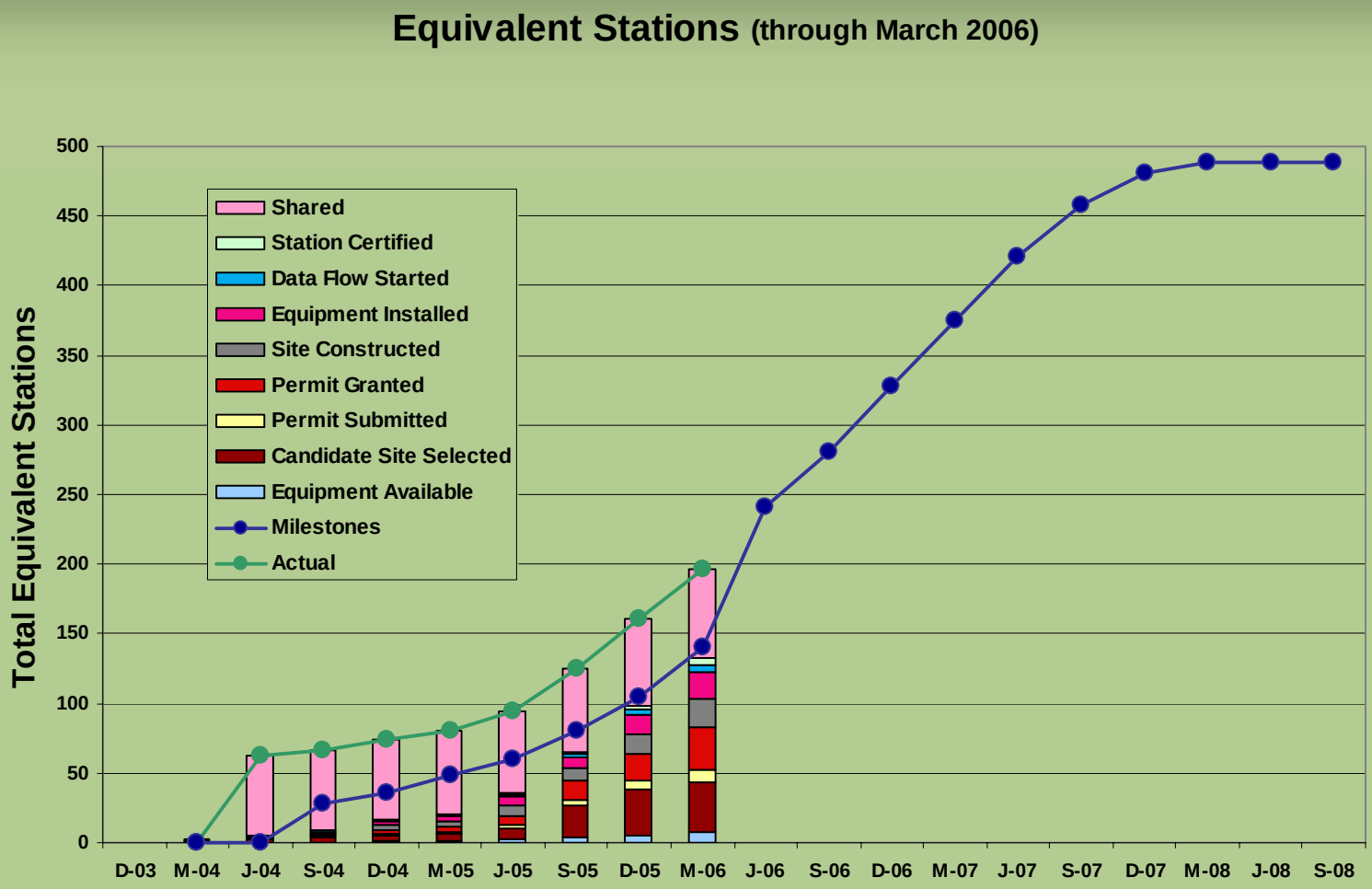
Measuring Progress

- EVM tracks budget and schedule in terms of dollar value
- Equivalent Station is an EarthScope measure of Schedule

TA Equivalent Station Model

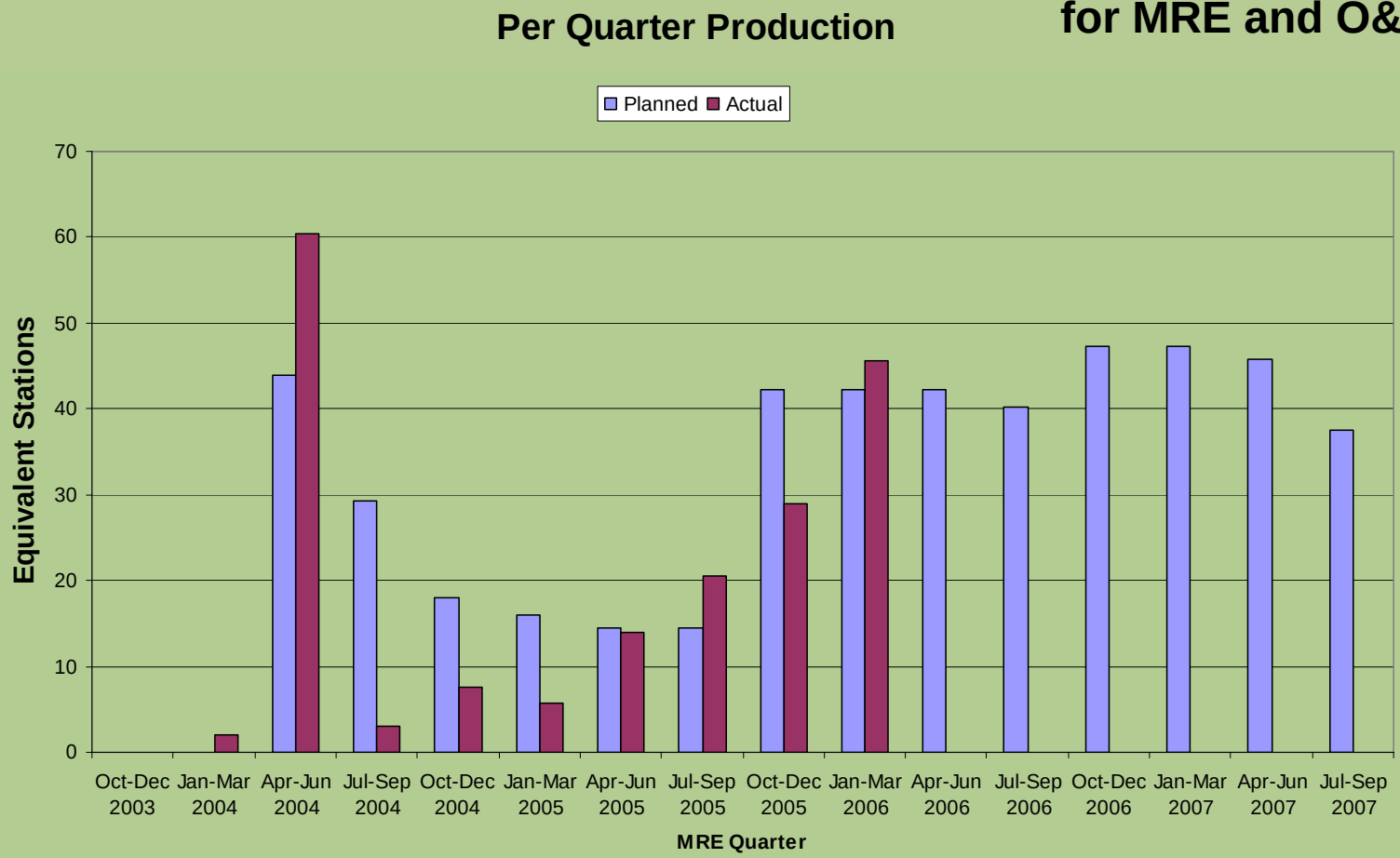
– Equipment available	5%
– Recon Complete	20%
– Permit submitted	5%
– Permit accepted	20%
– Site constructed	20%
– Equipment installed	20%
– Data flow started	5%
– Station certified	5%
==========	
Total	100%

Transportable Array

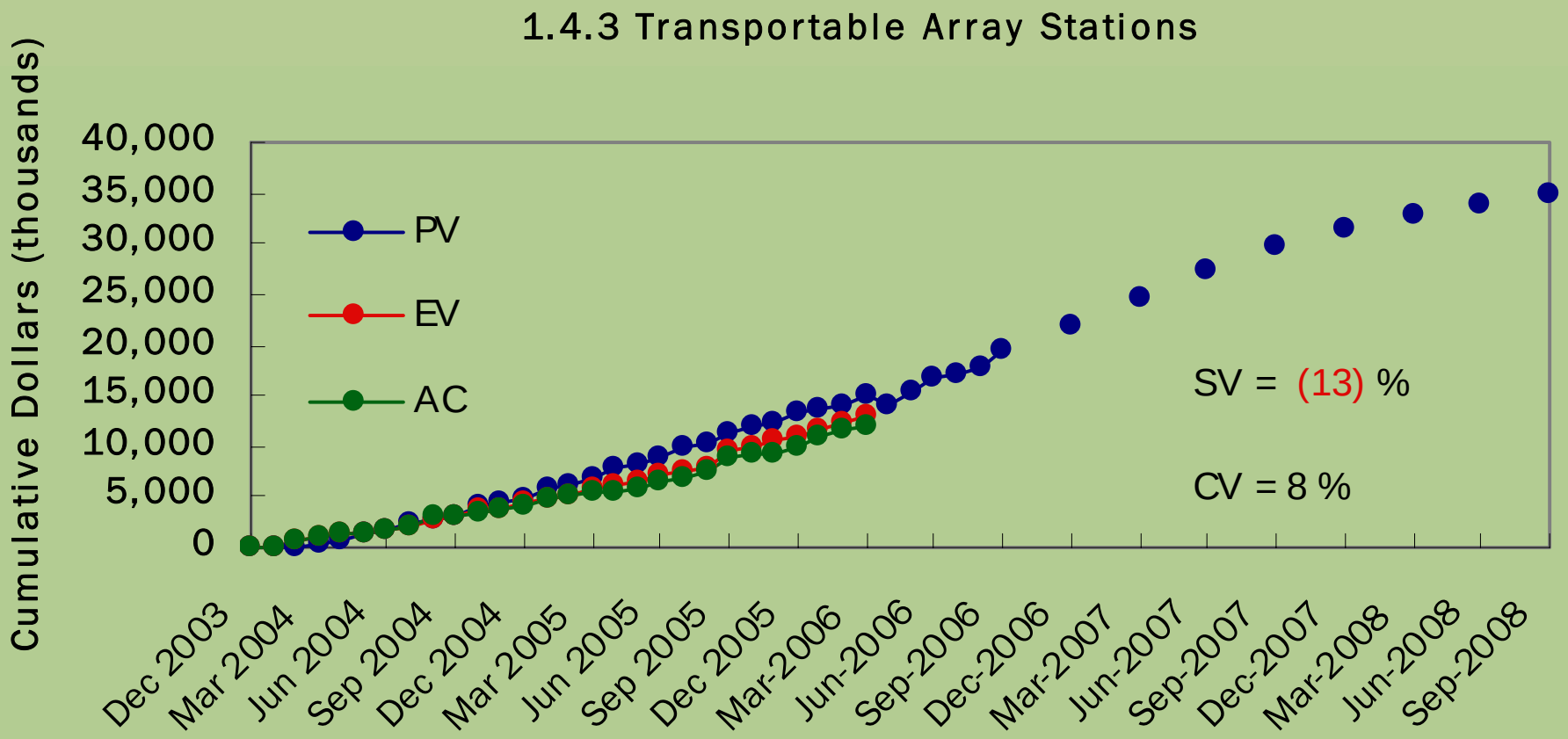


Transportable Array Production

Last Quarter matched production rate needed for MRE and O&M



Transportable Array EVM

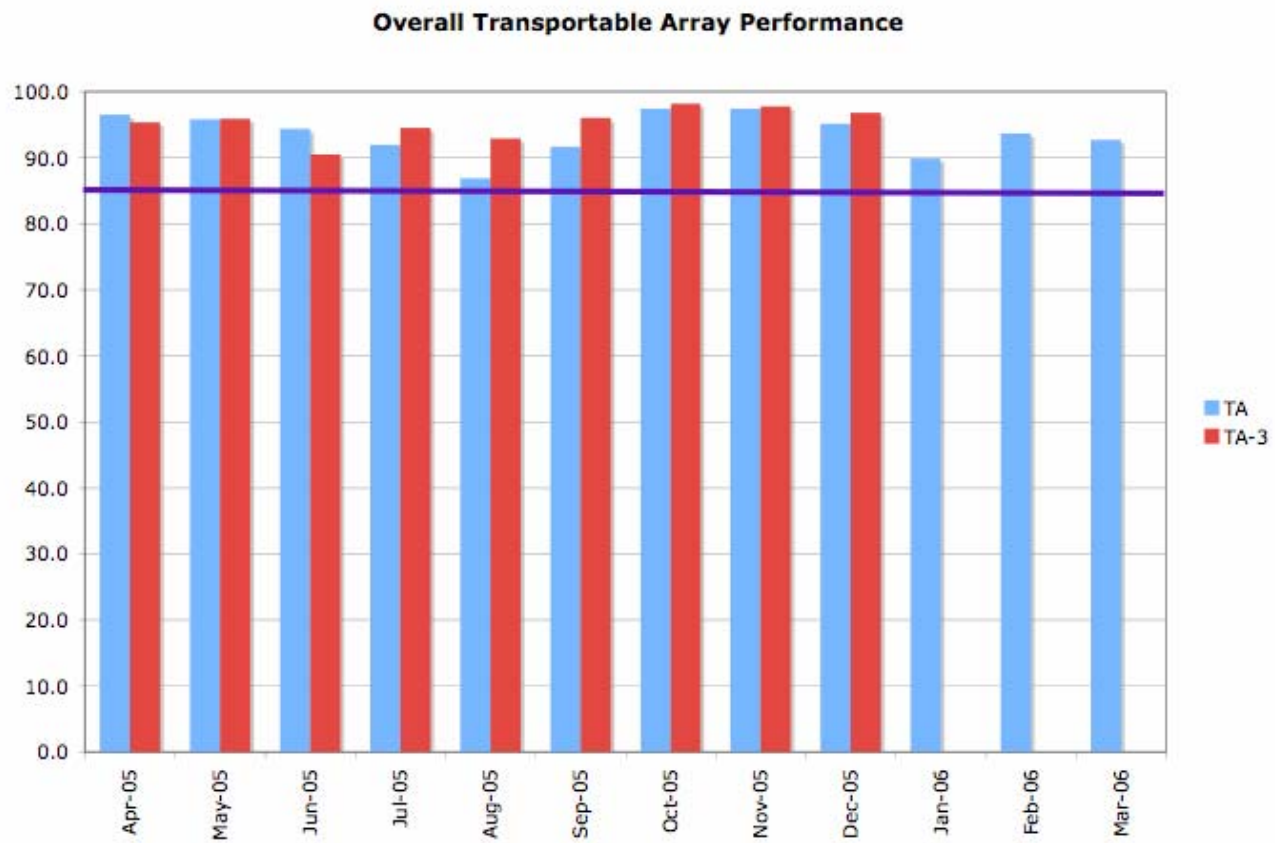


Budget Projections to Completion

- April 2006 Cost Baseline used revised unit cost estimates for station construction and installation. Flexible crew scheduling is new basis rather than turn-key staff contracts.

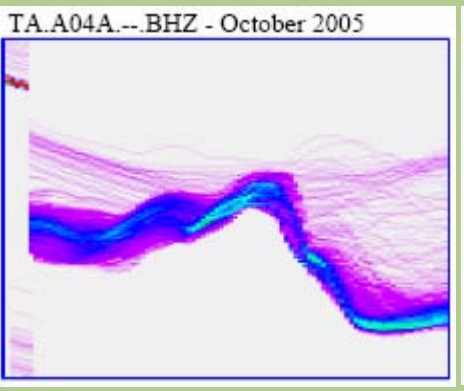
- Using current unit cost estimates and the planned production rate, we can complete the project for less.
  - Original Years 1-5 $34,366,195 - Current Est. $34,040,294

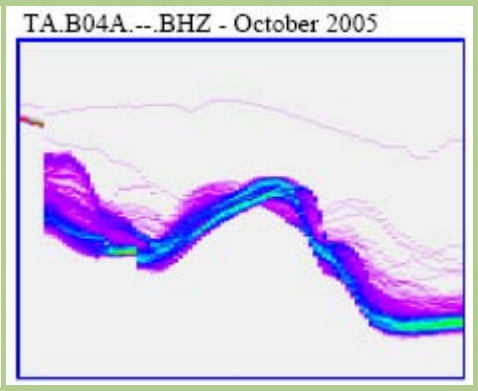
Facility Performance Metric

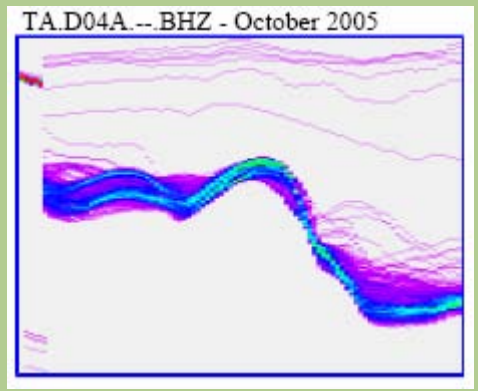


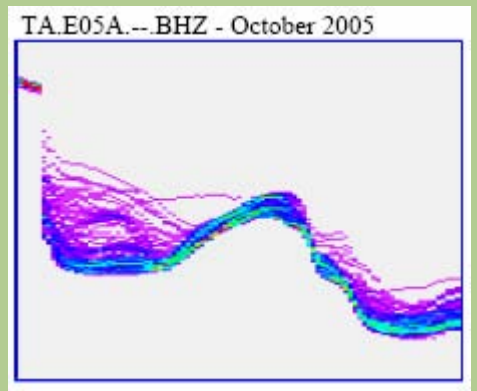
Broadband Performance Analysis

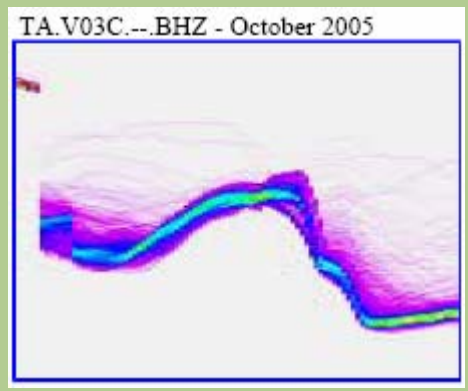
- Power Spectral Density (PSD) plots
- Overview of station response - 1 month at a time
  - Quickly shows any station problems
  - Can select and check any outliers

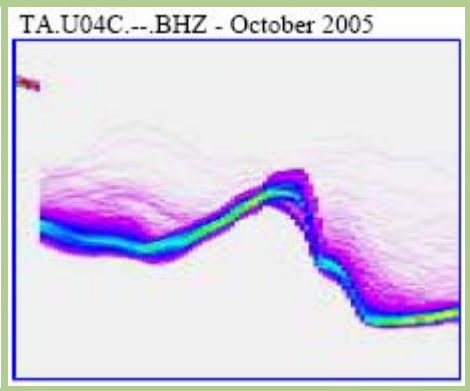


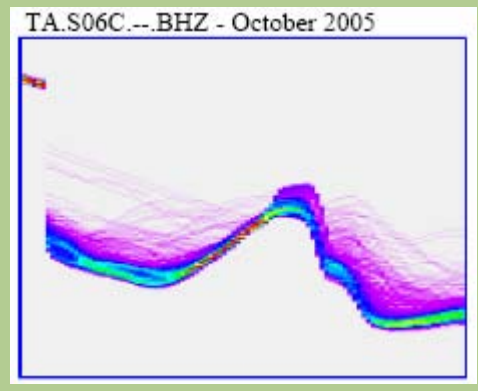


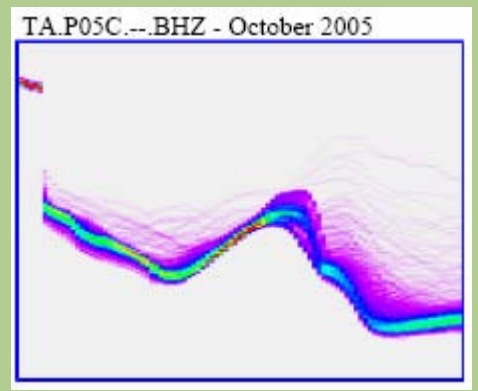












TA: Special Topics

Construction and Installation Crew Strength

- Construction contractor paid per site. Can add crews or stand down in bad weather
- Installation crew is Lead plus assist from shared pool. Can collapse to one team, expand to three.

Construction

42” dia. pipe set into 7’ deep pit with concrete on either side of rubber membrane

Current method; custom trailer with water tank, room for cement bags, and onboard mixer

Flex conduit was replaced with straight sticks reducing field time significantly. Wires are pulled during construction phase

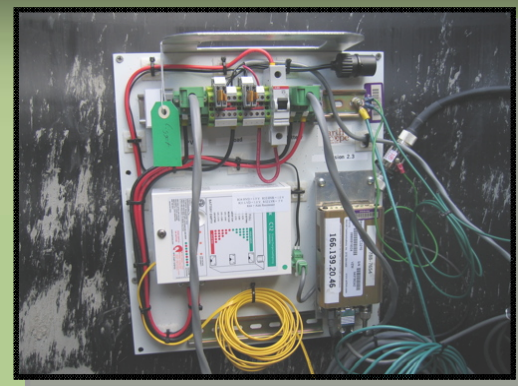
13 months of crew time annually at 16 sites per month


DEERE
310E
United Rentals

Installation

Lava Cap Winery. Site layout

Sensor alignment. Leveling and insulation takes over an hour



Power distribution panel. CDMA cell radio , Trace C12 charge controller, Phoenix terminal strip

2 two-person crews

View into vault. Sensor encased in sand, Q330 and baler on shelf, foam insulation

VSAT located in barn with AC power

Modularity in Communications

- Cellular Modem
- AC VSAT or BB provider
- Solar VSAT

Communications Variety

- 44% Cell modems
  - 40 Verizon, 4 Cingular
- 44% VSAT systems
  - 33 Wild Blue, 7 Hughes DirectWay, 4 SpaceNet
- 7% Broadband providers
  - 4 DSL, 1 Cable, 2 WiFi
- 5% Internet via Host
  - usually research campus

External Factors

- C05A Tolt Reservoir

11/17/2005 Construction

12/1/2005 Installation

More Sites http://www.flickr.com/photos/anfphotos/

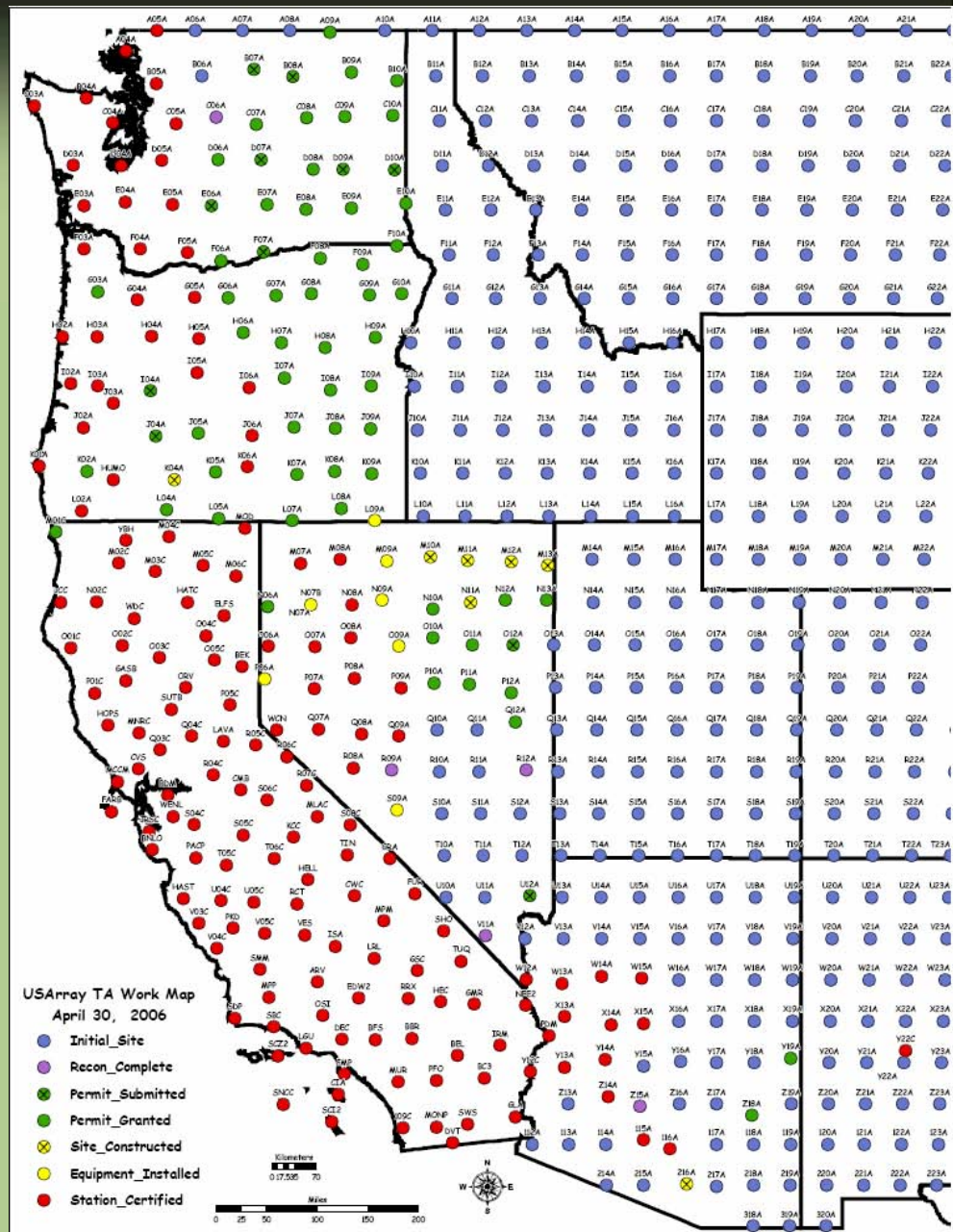
S08C White Mtn Research Sta C04A Brinnon, WA (below) N02C Big Bar, CA

TA: Permitting Process

Siting / Permitting Process:

- Office Reconnaissance
- Field scouting
- Recon Report
- Technical Review
- Verification visit
- Permit Submitted
- [Permit Conditions]
- Permit Accepted

54 permits in-hand



TA: Permitting Plans

Idaho

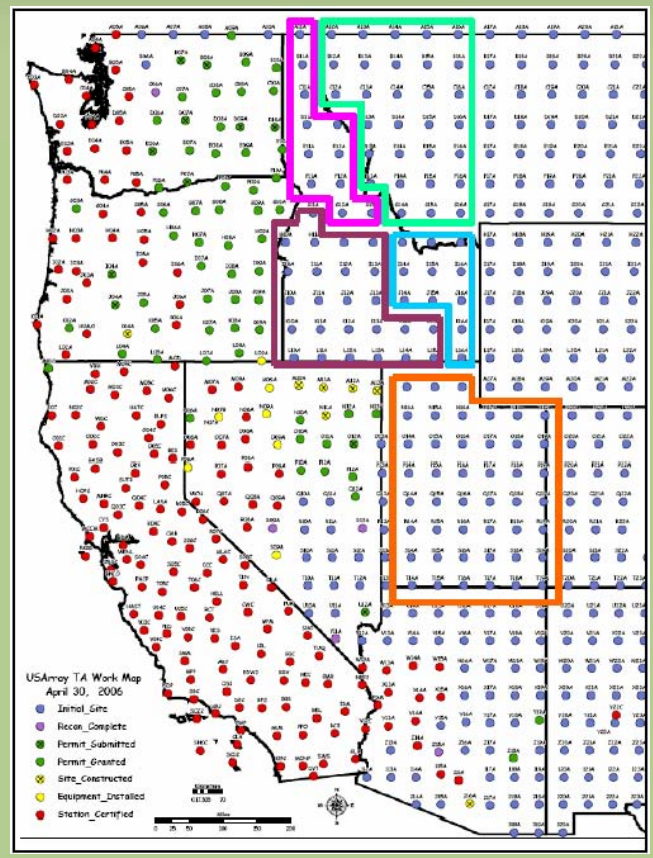
- Univ. of Idaho Moscow 16 sites, 2 students
- Boise State University 25 sites
- BYU Idaho 10 sites, 2 students

Montana

- Montana Tech, Butte 30 sites, 4 students

Utah

- Univ. of Utah 45 sites, 6 students



- Siting Workshop in Salt Lake City at Utah Seismological Station on May 22
- Siting through July with main focus on northern mountainous sites

Interactions with Regional Networks

- **Integration of USArray stations into networks**
  - Advance planning on siting and permit
  - Pick and choose from operating stations lowers risk
  - Provide advice on costs and procedures to adequately form budgets for obtaining resources
  - Work out a transition plan for hardware
- **Assisting in delivery of USArray data into regional network operations**
  - More eyes on more data
  - More advanced analyses that are automated

Conclusion: A Team with a Mission

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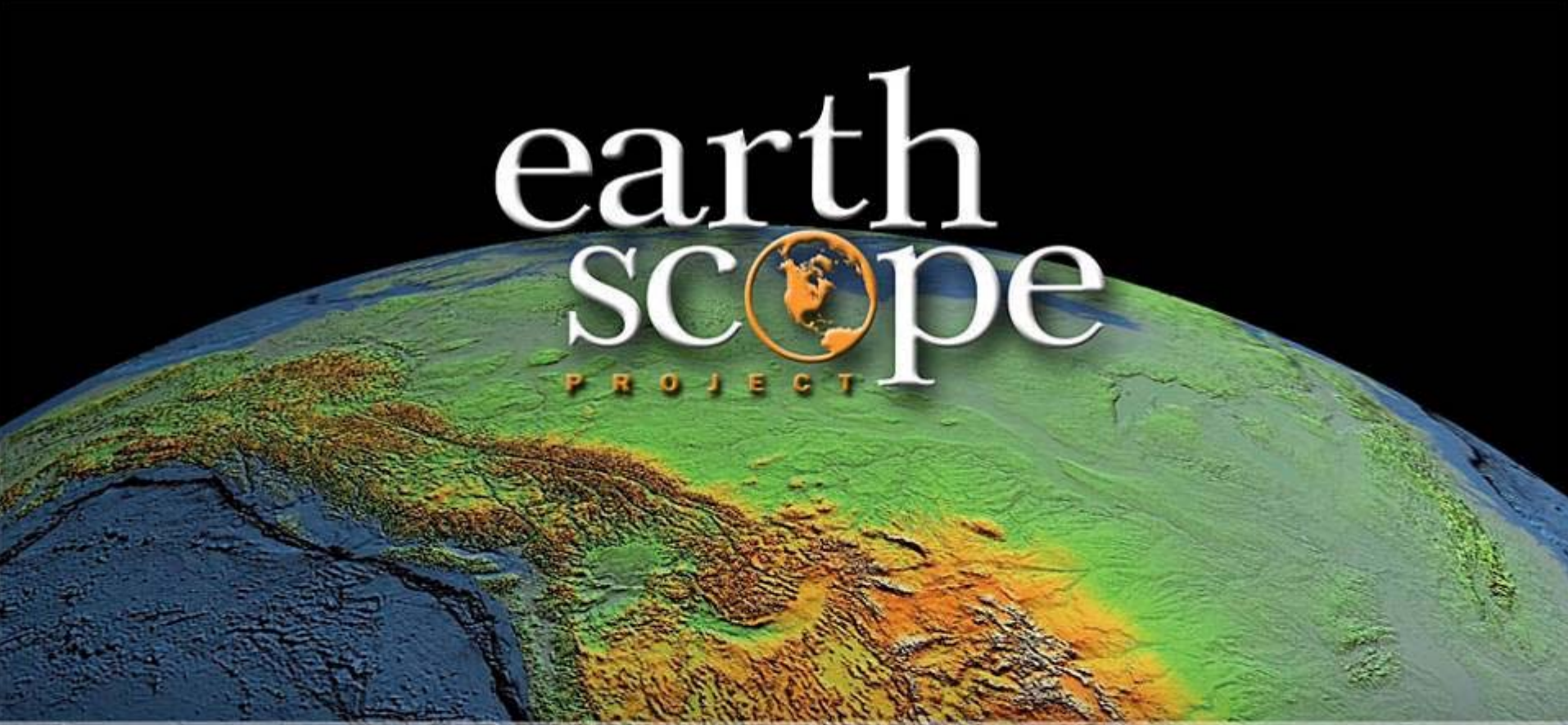


USArray Flexible Array

Marcos Alvarez
Deputy Program Manager

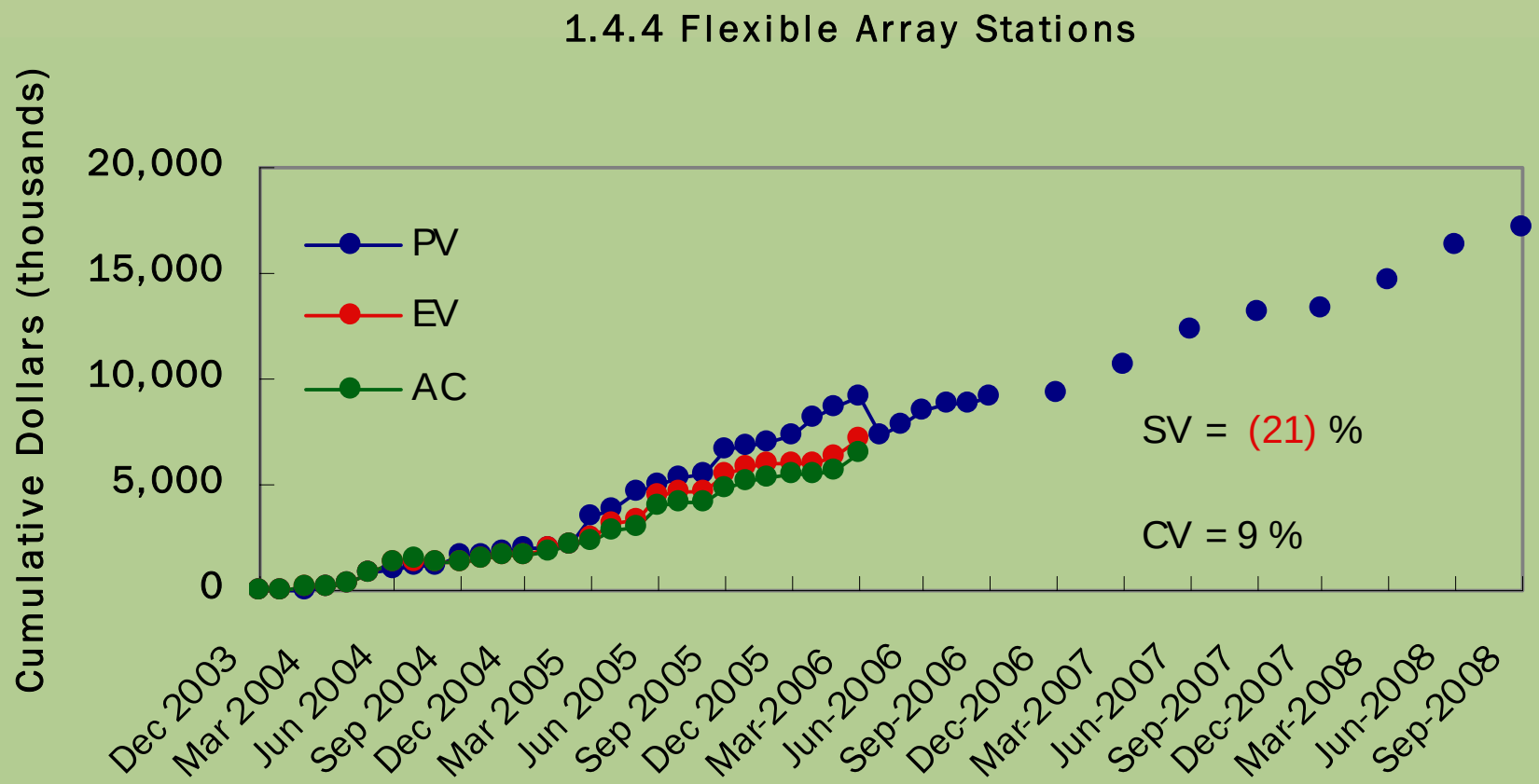
EFEC Site Review
May 17, 2006

Flexible Array

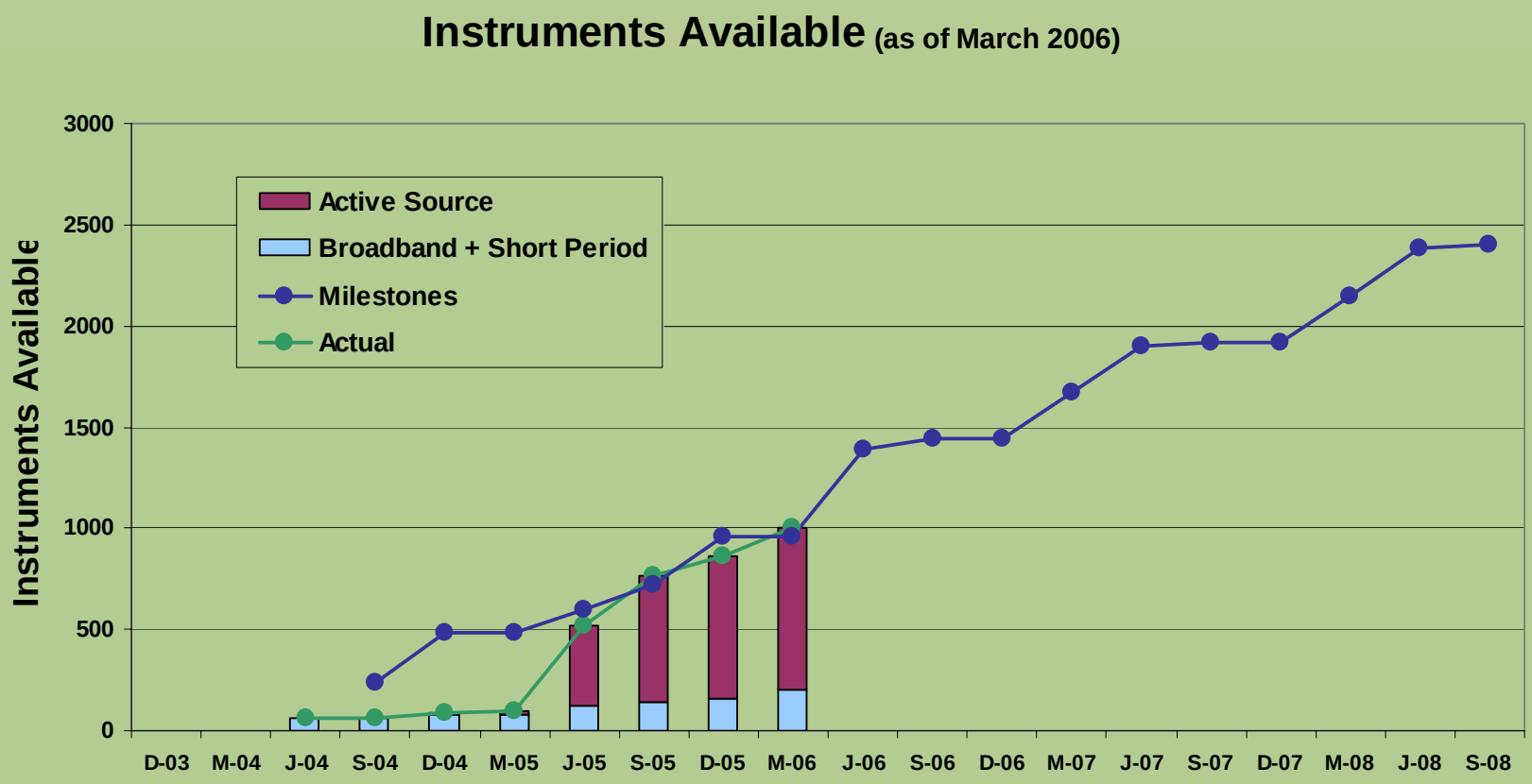
Topics

- Quantitative measure of progress
  (EVM as project management tool)
- Inventory and equipment
- Instrument use
- Experiments conducted and planned
- Array Operations Facility status

Flexible Array EVM



Flexible Array



Flexible Array Inventory

	2004	2005	2006	2007	2008
Broadband	40	80	120	160	200
Short Period	40	80	120	160	200
Active Source	0	700	1200	1600	2000

Current Inventory (5.2.06)

- Broadband station = 80
- Short Period station = 120
- Active Source station = 1045

FA Example of EVM as the Project Management Tool

- Start with a complete Work Breakdown Structure (WBS) definition, assumptions and basis of estimate

  "reflects our plan .. helps us keep the eye on the prize"

WBS Task 1.4.4.2: Flexible Array Procurement
Definition: Includes the purchase of components needed for the 2400 Flexible Array stations including sensors, data acquisition systems, and power systems.

WBS Task 1.4.4.2.1: Sensors
Definition: Includes 200 broadband sensors, 200 short-period sensors and 4000 active source sensors and their cables.
Assumptions: The broadband sensors purchased for the Flexible Array are Guralp CMG 3T, three component, 120-second period to 50-Hz flat velocity response or equivalent sensors. Each broadband sensor is purchased with an accompanying breakout box and cable. A handheld control unit is purchased for every 5 broadband sensors. Custom cables are required to connect the broadband sensor to the Reftek R130 (or equivalent). The short-period sensors purchased for the Flexible Array are Guralp CMG 40T-1, three component, 1-second period to 100-Hz flat velocity response or equivalent sensor. Custom cables are required to connect the short-period sensor to Reftek R130 (or equivalent). For each of the planned 2000 single-channel miniature recorders, two vertical geophones will be purchased. One of these geophones is the Geospace GS11D 4.5 Hz, amphibious land case and 3-inch spike or equivalent sensor. The other active - source sensor is the Sercel L-40A, 40 Hz, amphibious land case and 3-inch spike or equivalent sensor.
Basis of Estimate: IRIS purchase order number 06-00141 for the purchase of 40 CMG 3Ts was referenced as a basis for this estimate. IRIS purchase order number 06-00132 for the purchase of 40 CMG 40T-1s was referenced as a basis for this estimate. IRIS purchase order number 06-00284 for the purchase of 40 CMG 40T-1s was referenced as a basis for this estimate. IRIS purchase order number 05-00053 for the purchase of 175 Geospace GSC1267 15-foot Guralp to Reftek 130 cables was referenced as a basis for this estimate. IRIS purchase order number 06-00132 for the purchase of 400 Sercel L40A was referenced as a basis for this estimate.

FA Example of EVM as the Project Management Tool

- Use detailed budget and schedule to plan purchases and achieve milestones

WBS			Description		qty Y1	qty Y2	qty Y3	qty Y4	qty Y5	tot qty	unit cost	Accounting Code	Budget	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06
1.4.4	**.2**	**.0**	**Procurement**										**3,933,540**	**0**	**0**	**0**	**0**	**467,967**	**861,640**	**941,067**	**395,100**	**658,728**
1.4.4	**.2**	**.1**	**Sensors**									**2001-315**										
				BB (CMG-3T)	40	32	48	40	40	200	$16,000	2001-315-44-15	768,000					144,000		144,000		160,000
				#														9		9		10
				Short-period	20	60	40	40	40	200	$4,200	2001-315-47-10	168,000					33,600		33,600		33,600
				#														8		8		8
				Active source		1100	1300	800	800	4000	$200	2001-315-47-10	260,000						100,000			160,000
				#															500			800
				Sensor cables	80	80	80	80	80	400	$750	2001-315-47-11	60,000						15,000	15,000	15,000	15,000
1.4.4	**.2**	**.2**	**DAS**									**2001-316**										
				Hi-resolution	80	80	80	80	80	400	$8,700	2001-316-44-03	696,000						348,000	348,000		
				#															40	40		
				Texan		700	500	400	400	2000	$2,700	2001-316-47-55	1,350,000					270,000	270,000	270,000	270,000	270,000
				#														100	100	100	100	100
1.4.4	**.2**	**.3**	**Power**									**2001-317**										
			Solar panels, batteries, etc.		80	80	80	80	80	400	$2,250	2001-317-47-45	180,000						45,000		45,000	
			Lightning protection		40	40	40	40	40	200	$300	2001-317-47	12,000					12,000				
			Enclosures		80	80	80	80	80	400	$500	2001-317-47	40,000						10,000	10,000	10,000	10,000
1.4.4	**.2**	**.4**	**Communications**									**2001-318**										
			hardware			2	4	4	4	14	$800	2001-318-47-13	3,200							1,600		
			data transmission (VSAT)				4	4	4	12	$960	2001-318-56-20	3,840							960		960
			radio hardware			40	45	45	45	175	$1,500	2001-318-47-70	67,500							67,500		
1.4.4	**.2**	**.5**	**Other Station Equipment**									**2001-319**										
			miscellaneous materials		80	80	80	80	80	400	$350	2001-319-47-03	28,000							14,000		
			shipping cases		80	80	80	80	80	400	$600	2001-319-47-12	48,000						24,000	24,000		
			sensor vault		80	80	80	80	80	400	$200	2001-319-47-56	16,000						4,000	4,000		
1.4.4	**.2**	**.6**	**Additional Equip/Supplies**									**2001-320**										
			Data Concentrators		10	10	10	10	10	50	$8,000	2001-**320**-47-03	80,000						40,000			
			Networking Equipment								$20,000	2001-**321**-47-03	20,000						5,000		5,000	
			Lab Equipment								$33,000	2001-**322**-47-50	33,000					8,250		8,250		8,250
			Supplies & Services								$100,000	2001-**323**-47-03	100,000								50,000	

FA Example of EVM as the Project Management Tool

- Monthly inventory reports from the AOF are merged with invoices and expenses to calculate Cost Schedule Status Reports (CSSR)

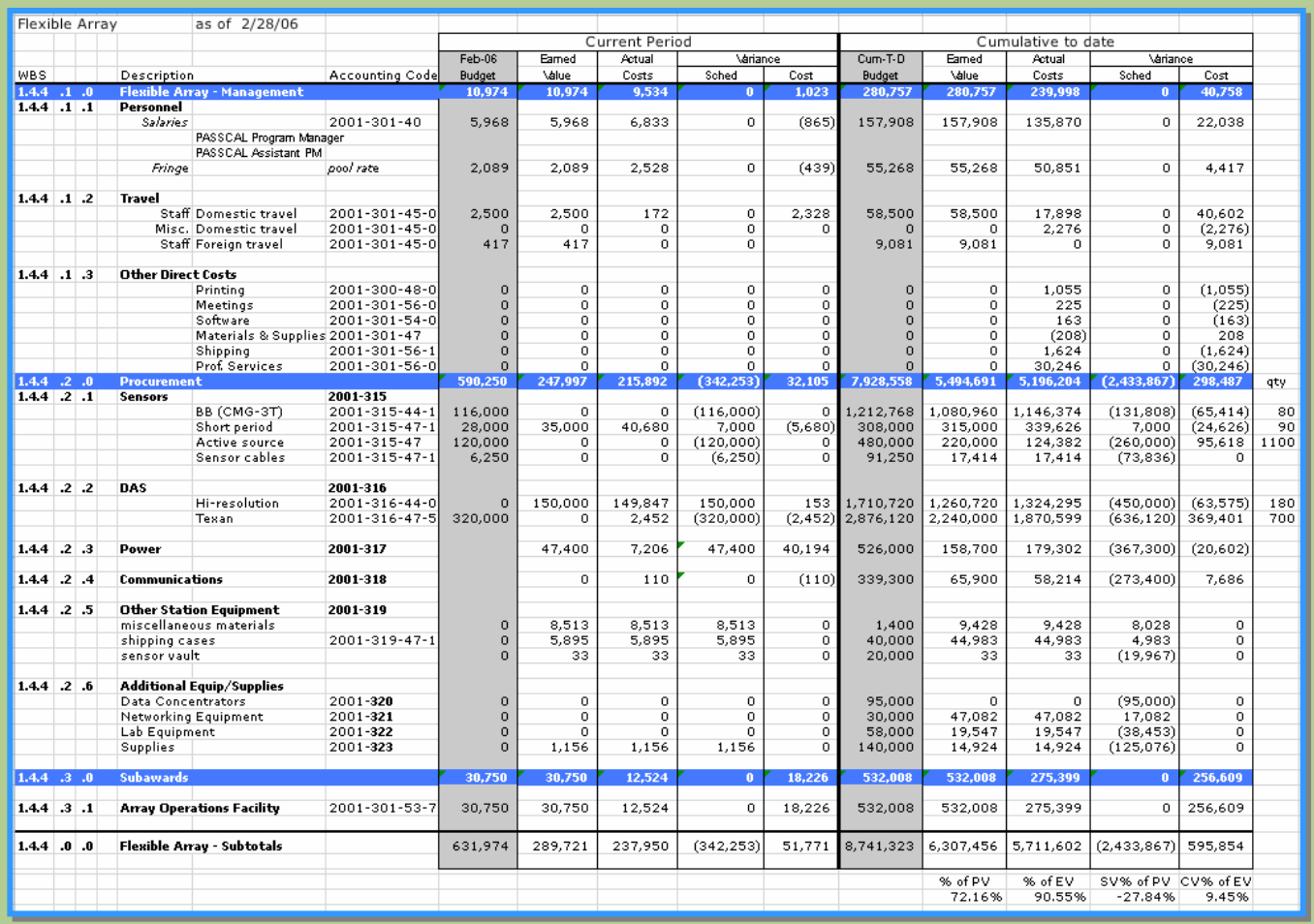
FA_inventory_March.xls

	A	B	C	D	E	F	G	H	I	J	K
1	**Flexible Array - Procurement Report**										
2											
3	Please enter quantities in inventory as of:				**3/31/06**						
4											
5	**cumulative-to-date**				**Quantities**		Yr 3		Planned Quantities		MRE-YR3
6					**Available**		unit cost		through MRE-YR3		Open Qty
7	**Sensors**		**2001-315**								
8		BB (CMG-3T)			**80**		$14,500		120		40
9		Short-period			**100**		$3,500		120		20
10		Active source			**1600**		$200		2400		800
11											
12	**DAS**		**2001-316**								
13		Hi-resolution			**180**		$7,500		240		60
14		Texan			**800**		$3,200		1200		400
15											
16											
17	**Power**		**2001-317**						(240 FA power stations)		
18		65 Watt Solar Panels			**180**		$390		360		180
19		mount brackets			**120**		$440		240		120
20		power boxes and cables			**160**		$230		240		80
21		enclosures (field)			**120**		$350		240		120
22											
23											
24	**Communications**		**2001-318**						(120 FA communications stations)		
25		Wilan radios, antennas and cables			**40**		$1,600		144		104
26		VSAT hardware system			**1**		$1,900		6		5

Nov 05 | Dec 05 | Jan 06 | Feb 06 | **Mar 06** | Cumulative Budgets

FA Example of EVM as the Project Management Tool

- Cost and schedule variances are reviewed with USArray Project Manager; actions taken when appropriate



Flexible Array				as of 2/28/06												
						Current Period					Cumulative to date					
						Feb-06	Earned	Actual	Variance		Cum-T-D	Earned	Actual	Variance		
WBS			Description		Accounting Code	Budget	Value	Costs	Sched	Cost	Budget	Value	Costs	Sched	Cost	
1.4.4	.1	.0	**Flexible Array - Management**			10,974	10,974	9,534	0	1,023	280,757	280,757	239,998	0	40,758	
1.4.4	.1	.1	**Personnel**													
			Salaries		2001-301-40	5,968	5,968	6,833	0	(865)	157,908	157,908	135,870	0	22,038	
				PASSCAL Program Manager												
				PASSCAL Assistant PM												
			Fringe		*pool rate*	2,089	2,089	2,528	0	(439)	55,268	55,268	50,851	0	4,417	
1.4.4	.1	.2	**Travel**													
			Staff	Domestic travel	2001-301-45-0	2,500	2,500	172	0	2,328	58,500	58,500	17,898	0	40,602	
			Misc.	Domestic travel	2001-301-45-0	0	0	0	0	0	0	0	2,276	0	(2,276)	
			Staff	Foreign travel	2001-301-45-0	417	417	0	0		9,081	9,081	0	0	9,081	
1.4.4	.1	.3	**Other Direct Costs**													
				Printing	2001-300-48-0	0	0	0	0	0	0	0	1,055	0	(1,055)	
				Meetings	2001-301-56-0	0	0	0	0	0	0	0	225	0	(225)	
				Software	2001-301-54-0	0	0	0	0	0	0	0	163	0	(163)	
				Materials & Supplies	2001-301-47	0	0	0	0	0	0	0	(208)	0	208	
				Shipping	2001-301-56-1	0	0	0	0	0	0	0	1,624	0	(1,624)	
				Prof. Services	2001-301-56-0	0	0	0	0	0	0	0	30,246	0	(30,246)	
1.4.4	.2	.0	**Procurement**			590,250	247,997	215,892	(342,253)	32,105	7,928,558	5,494,691	5,196,204	(2,433,867)	298,487	qty
1.4.4	.2	.1	**Sensors**		**2001-315**											
				BB (CMG-3T)	2001-315-44-1	116,000	0	0	(116,000)	0	1,212,768	1,080,960	1,146,374	(131,808)	(65,414)	80
				Short period	2001-315-47-1	28,000	35,000	40,680	7,000	(5,680)	308,000	315,000	339,626	7,000	(24,626)	90
				Active source	2001-315-47	120,000	0	0	(120,000)	0	480,000	220,000	124,382	(260,000)	95,618	1100
				Sensor cables	2001-315-47-1	6,250	0	0	(6,250)	0	91,250	17,414	17,414	(73,836)	0	
1.4.4	.2	.2	**DAS**		**2001-316**											
				Hi-resolution	2001-316-44-0	0	150,000	149,847	150,000	153	1,710,720	1,260,720	1,324,295	(450,000)	(63,575)	180
				Texan	2001-316-47-5	320,000	0	2,452	(320,000)	(2,452)	2,876,120	2,240,000	1,870,599	(636,120)	369,401	700
1.4.4	.2	.3	**Power**		**2001-317**		47,400	7,206	47,400	40,194	526,000	158,700	179,302	(367,300)	(20,602)	
1.4.4	.2	.4	**Communications**		**2001-318**		0	110	0	(110)	339,300	65,900	58,214	(273,400)	7,686	
1.4.4	.2	.5	**Other Station Equipment**		**2001-319**											
			miscellaneous materials			0	8,513	8,513	8,513	0	1,400	9,428	9,428	8,028	0	
			shipping cases		2001-319-47-1	0	5,895	5,895	5,895	0	40,000	44,983	44,983	4,983	0	
			sensor vault			0	33	33	33	0	20,000	33	33	(19,967)	0	
1.4.4	.2	.6	**Additional Equip/Supplies**													
			Data Concentrators		2001-**320**	0	0	0	0	0	95,000	0	0	(95,000)	0	
			Networking Equipment		2001-**321**	0	0	0	0	0	30,000	47,082	47,082	17,082	0	
			Lab Equipment		2001-**322**	0	0	0	0	0	58,000	19,547	19,547	(38,453)	0	
			Supplies		2001-**323**	0	1,156	1,156	1,156	0	140,000	14,924	14,924	(125,076)	0	
1.4.4	.3	.0	**Subawards**			30,750	30,750	12,524	0	18,226	532,008	532,008	275,399	0	256,609	
1.4.4	.3	.1	**Array Operations Facility**		2001-301-53-7	30,750	30,750	12,524	0	18,226	532,008	532,008	275,399	0	256,609	
1.4.4	.0	.0	**Flexible Array - Subtotals**			631,974	289,721	237,950	(342,253)	51,771	8,741,323	6,307,456	5,711,602	(2,433,867)	595,854	
												% of PV	% of EV	SV% of PV	CV% of EV	
												72.16%	90.55%	-27.84%	9.45%	

Flexible Array Standard Station Equipment

Spread-spectrum internet protocol radio system for 200 stations

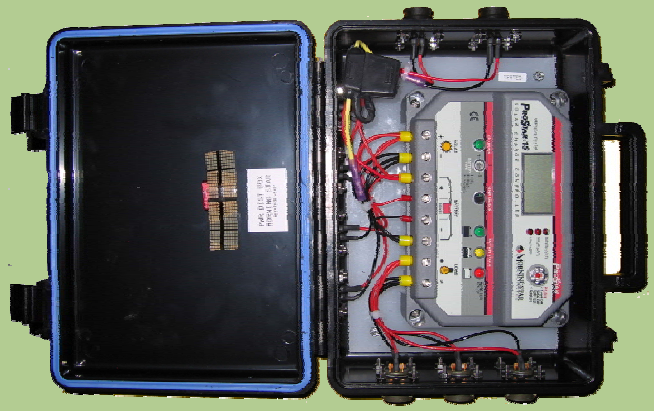
65 W x 1.5 solar modules and mounting systems for 400 stations

Instrument enclosure system

Flexible Array Standard Station Equipment

Sensor vault systems for 400 stations

Charge and power control systems for 400 stations



Insulated equipment enclosures for 400 stations

Sensor Quality / Performance

Has USArray had any trouble with the sensors?

Guralp CMG 3T:

- 190 units received (TA & FA), 34 returned for RMA; **18 % rejection**
- New sensors are now being tested at the factory using AOF procedures before shipment
- Manufacturer delivered **on schedule** for Year 1 and Year 2
- Delivery delays for Yr3 have not affected campaign schedules

Guralp CMG 40T 1 Hz:

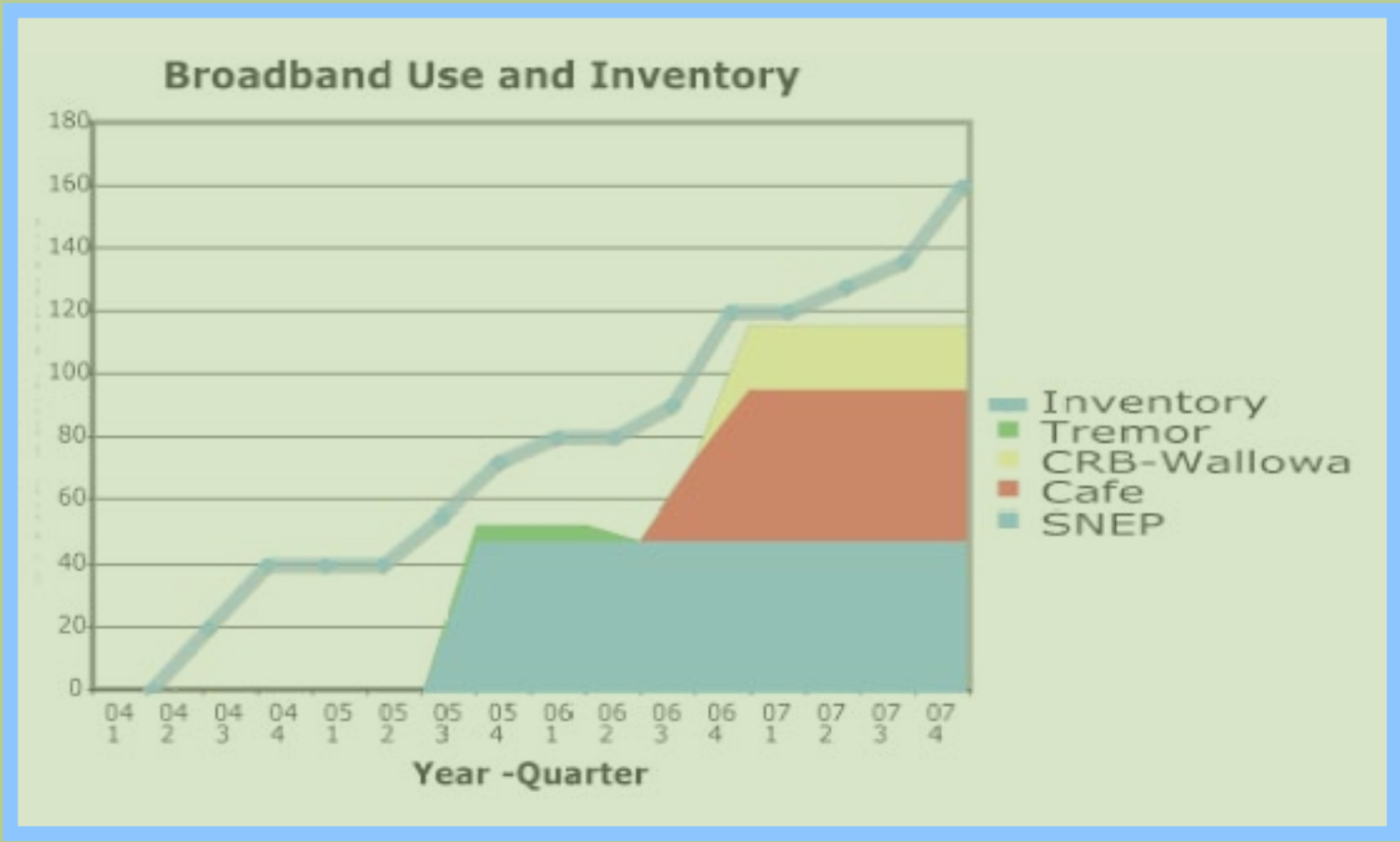
- 100 units received (FA), 2 returned for RMA; **2 % rejection**
- Deliveries have either been **on schedule** or ahead of schedule

Streckeisen STS2:

- 100 units received (TA), 3 awaiting returned for RMA; **3 % rejection**
- Manufacturer delivered **on schedule** for Year 1 and Year 2
- Delivery delays for Yr3 have not affected installation schedules

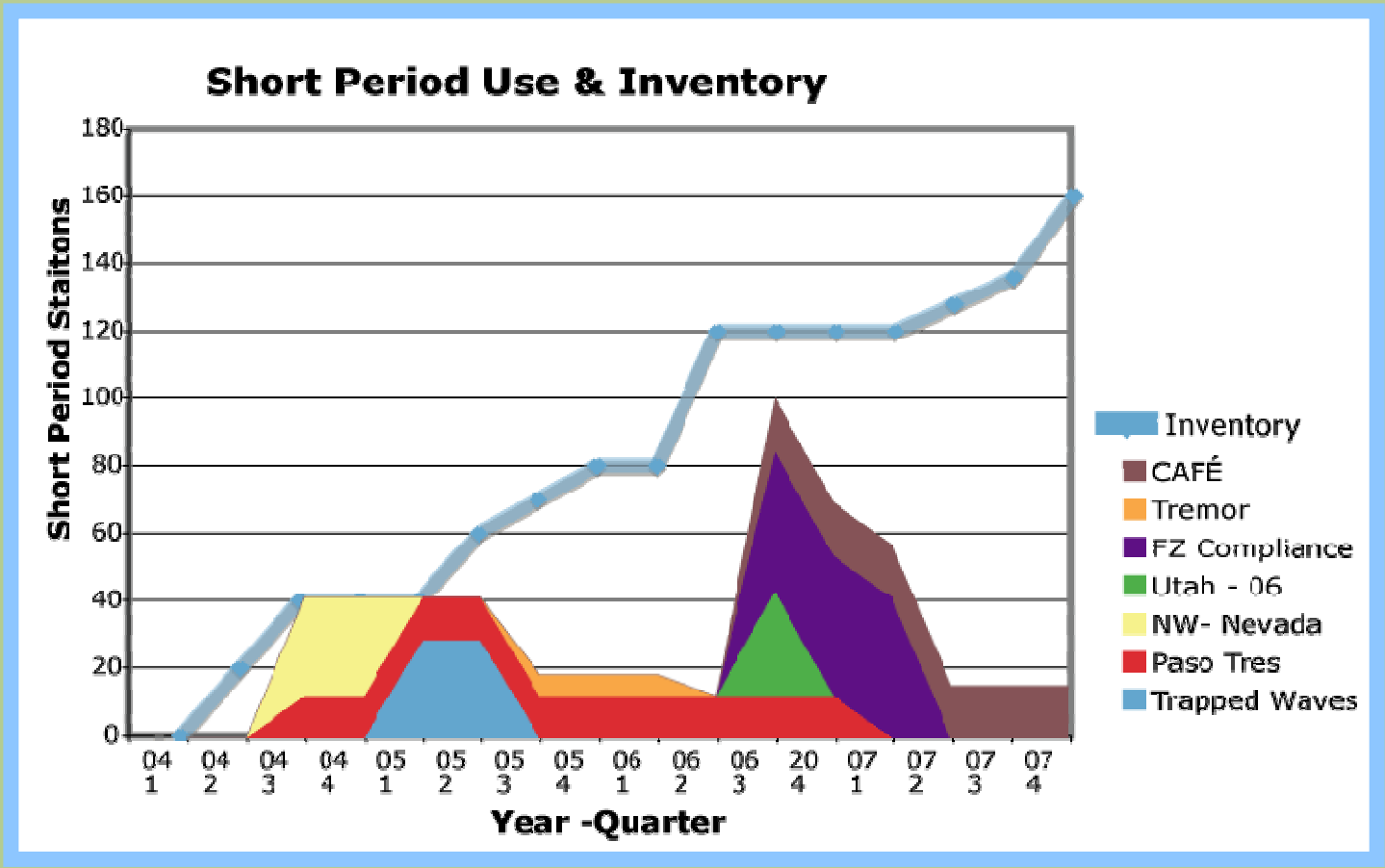
Broadband Station Use and Inventory

Is the USArray campaign pool over or under subscribed?



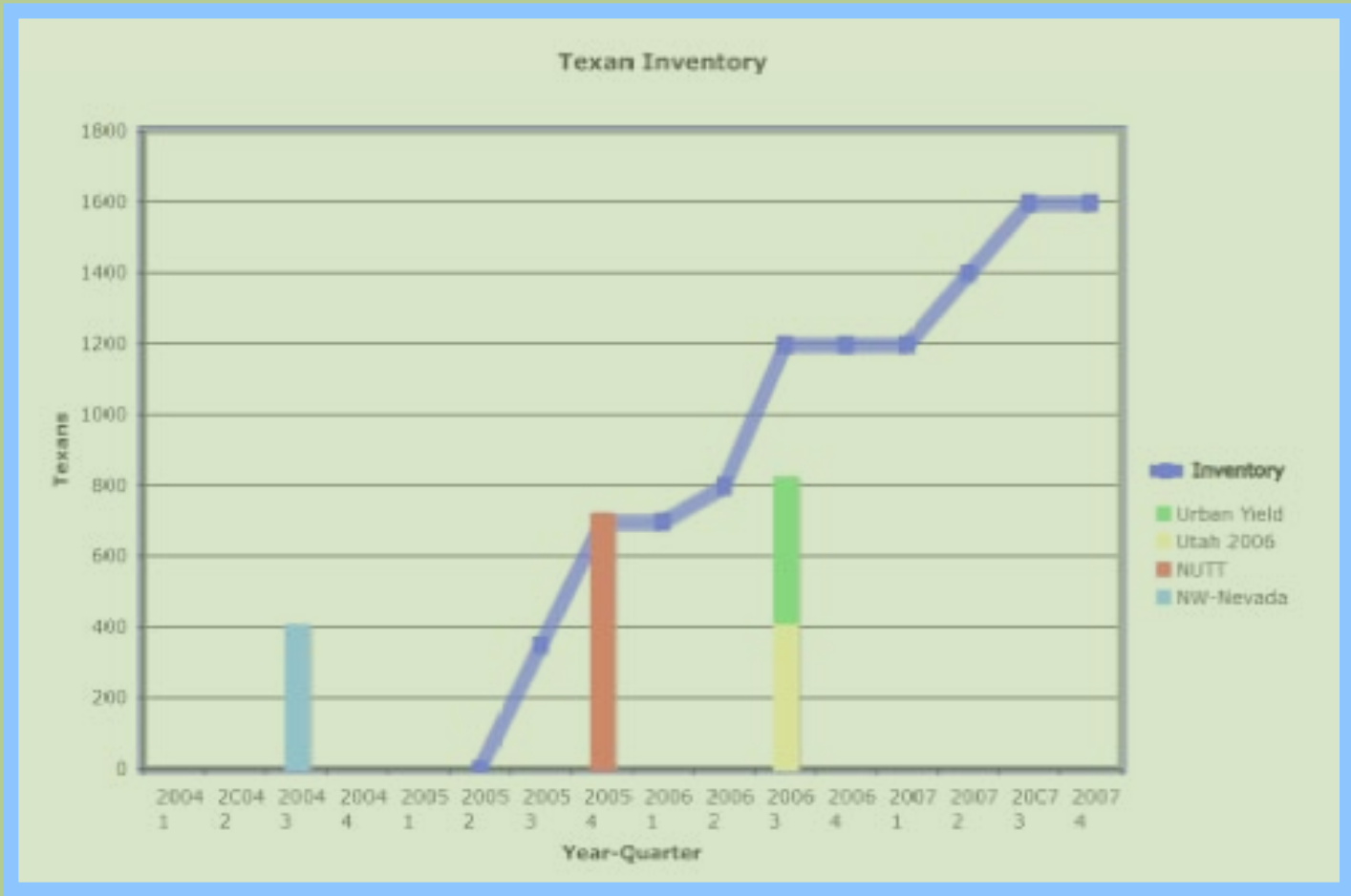
Short Period Station Use and Inventory

Is the USArray campaign pool over or under subscribed?



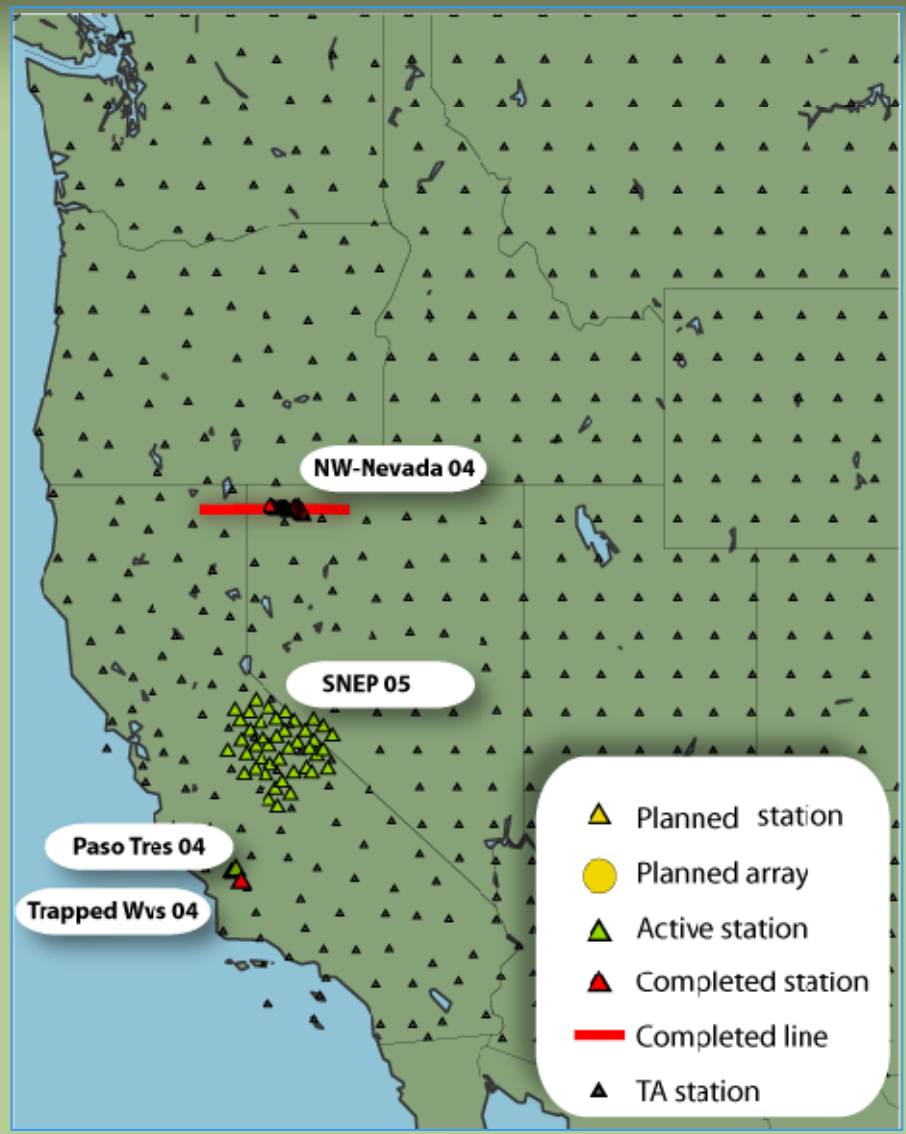
Texan Use and Inventory

Is the USArray campaign pool over or under subscribed?



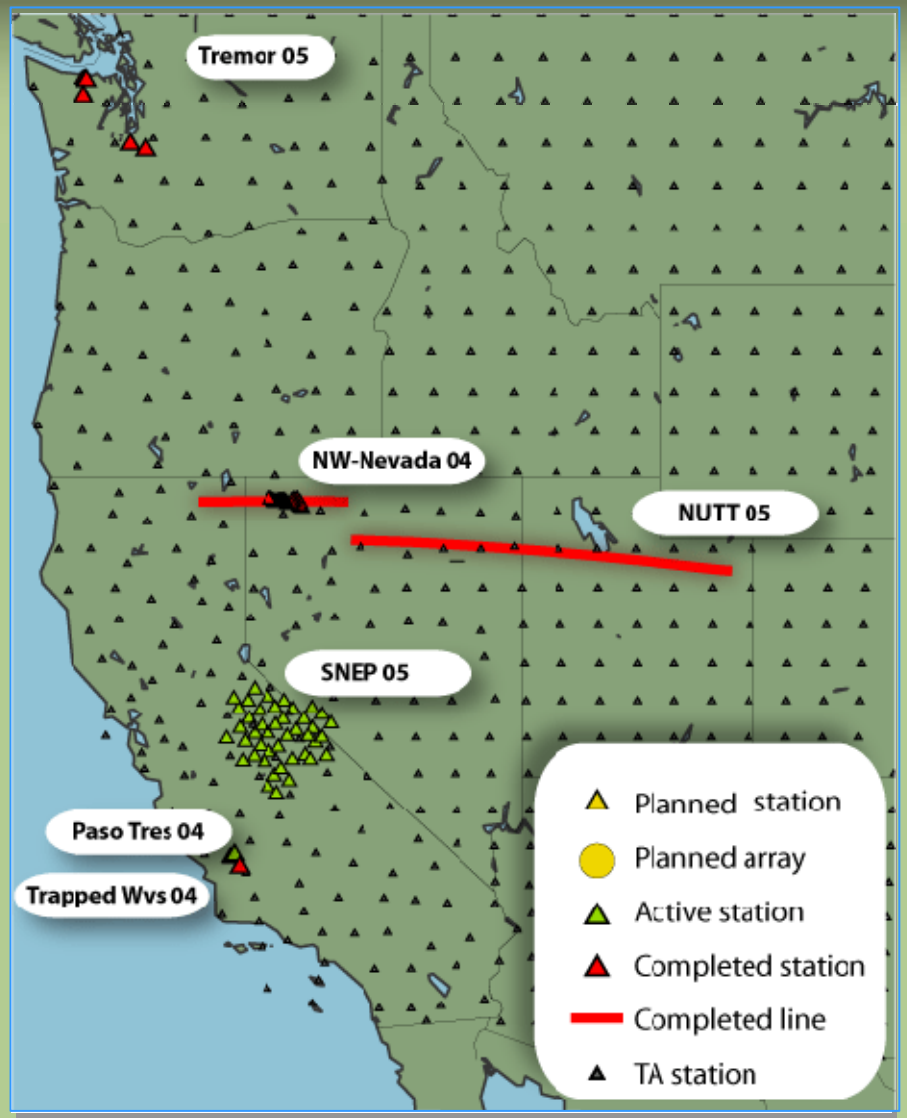
Experiments Conducted 2004

Name	PIs	Type	#
Trapped Waves	Y.G. Li	Short Period Stand alone	40
Paso Tres	Roecker/ Thurber	Short Period Telemetered	12
NW - Nevada	Klemperer	Active Source Short Period	700 100



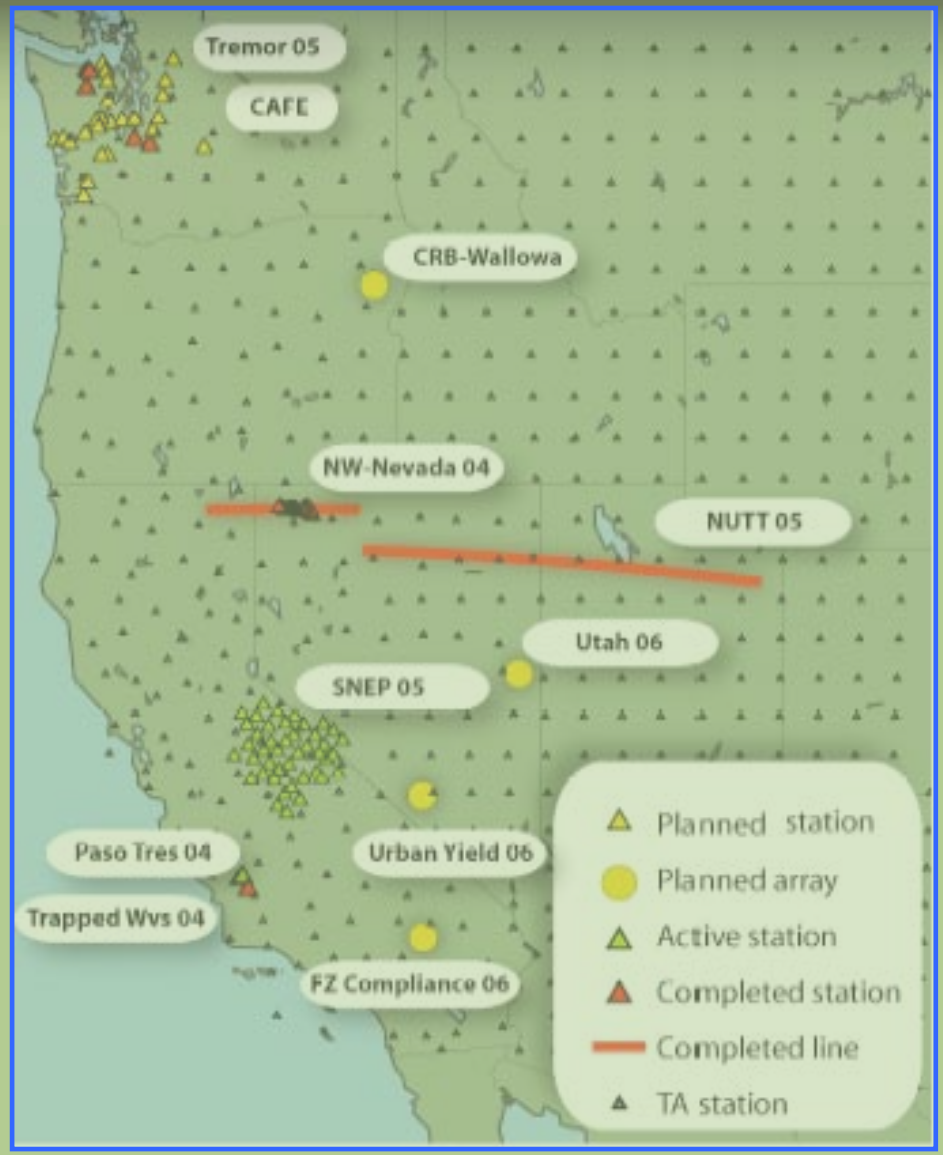
Experiments Conducted 2005

Name	PIs	Type	#
SNEP	Owens/ Jones/ Zandt/ Gilbert	Broadband Stand alone	48
Tremor	Creager	Broadband Short Period	5 6
NUTT	Louie	Active Source	700



Experiments Planned 2006

Name	PIs	Type	#
CAFE	Creager/ Rondenay/ Abers	Broadband Short Period Stand alone Telemetered	48 15
CRB-Wallowa	Humphreys	Broadband	20
Urban Yield	Snelson	Active Source	400
Utah 06	Stump	Active Source Short Period	400 30
FZ Compliance	Y.G.Li	SP	40



USArray Functions at the Array Operations Facility

Transportable Array

TA Coordinating Office
- Coordinate field logistics
- Produce GIS products
- Coordinate permits
- Maintain data base

Testing
- Sensors
- DAS's
- Communications
- Power systems

Station Kitting
- Assemble construction, power and comms

Instruments & Equipment
- Procure
- Receive
- Inventory

Shipping
- Pack and ship to field locations and depots

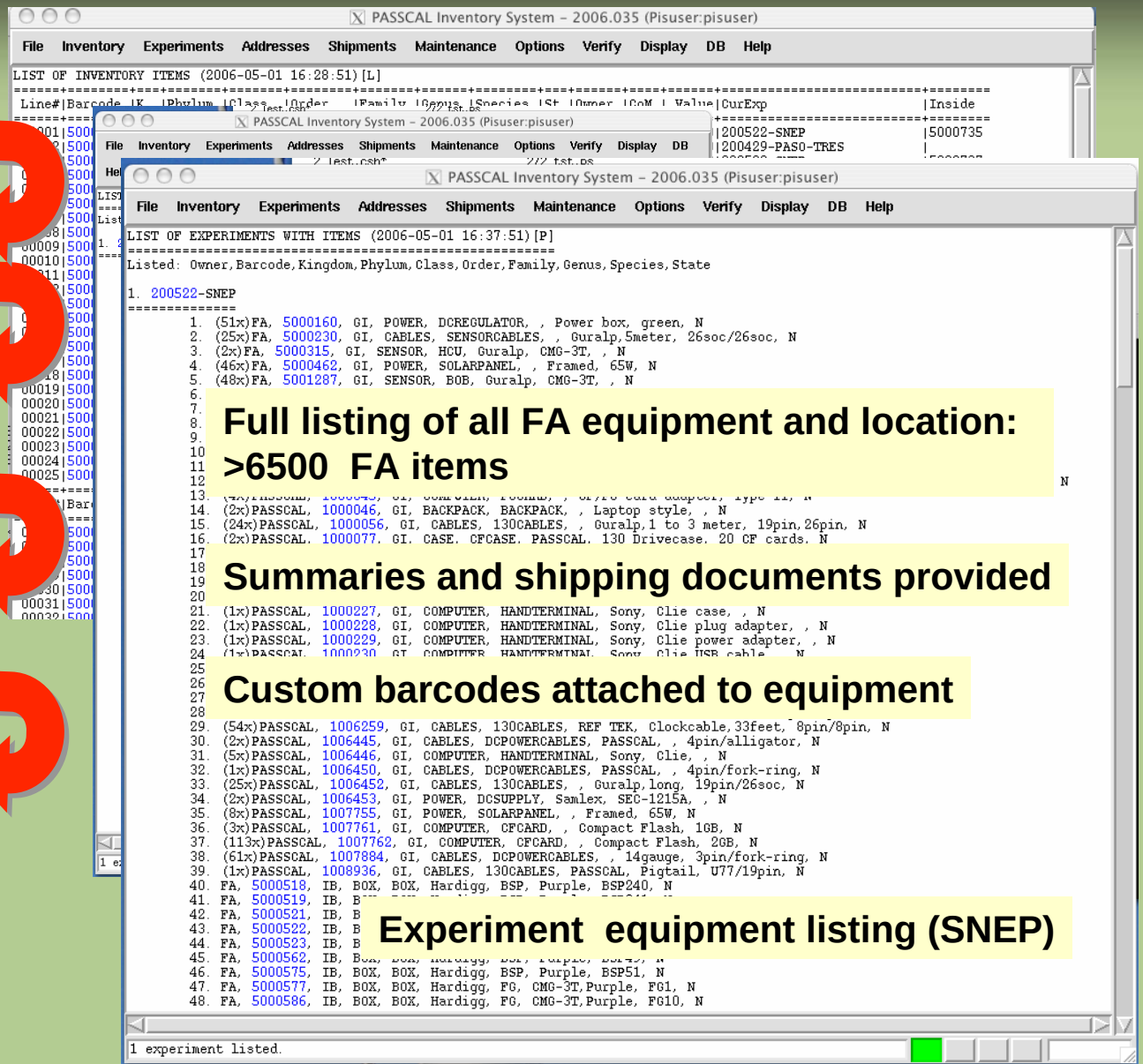
Flexible Array

Experiment Support
- Provide training to PIs
- Coordinate field logistics with PIs
- Provide limited field support

Data Archiving Support
- Receive raw and meta data from field
- Archive data at DMC
- Monitor real-time data

Inventory System for Flexible Array Equipment

- Receive, barcode and input into data base all new equipment at AOF
- Maintenance records added to data base
- Experiment code assigned, shipping list provided with experiment
- Equipment summaries used to track and schedule
- Equipment reconciled at end of experiment



Inventory Information Cycle

Array Operations Center
- barcode new equipment
- input all info into db (in-house)
- track maintenance
- produce shipping & status docs
- reconcile & update database from field and ANF info
- reports to IRIS HQ

Bulk Ship

TA - Field Depots
- receive shipment, confirm pallets

TA - Field Deployment Teams
- pick-up equipment from depots
- install equipment
- document serial numbers & station locations in installation reports

email report

orb2orb, metadata

email, phone communication

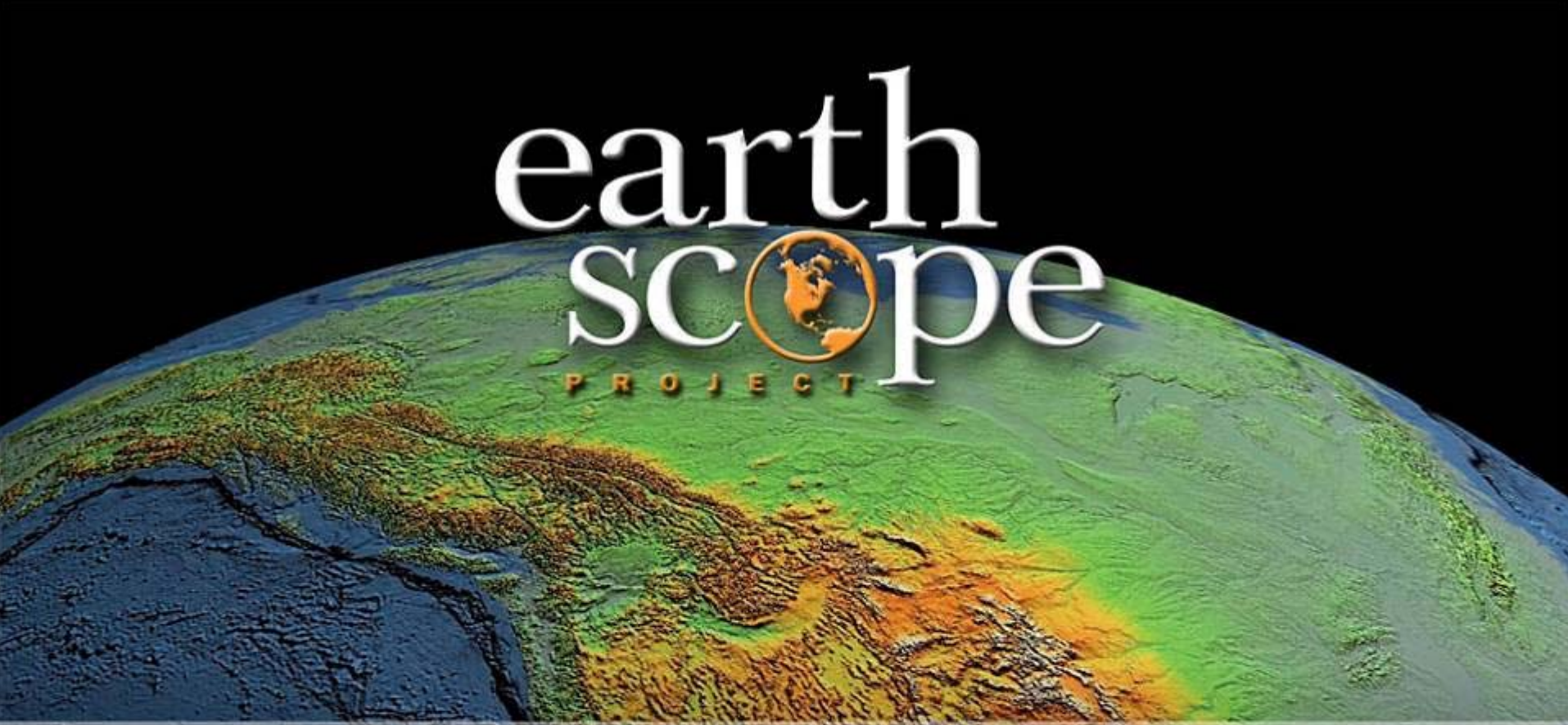
FA - Field Campaigns
- AOF personnel and PI on-site to receive shipment, confirm pieces

ANF
- input metadata from TA field installation reports into real-time data monitoring system

Personnel

Outline

- USArray Overview
  - Agenda/Logistics
- USArray Facility Construction Update
  - Transportable Array – Bob Busby
  - Flexible Array – Marcos Alvarez
  - Permanent Array – Kent Anderson
  - Magnetotellurics – Shane Ingate
  - Data Management – Tim Ahern
- Conclusion – David Simpson



USArray Permanent Array

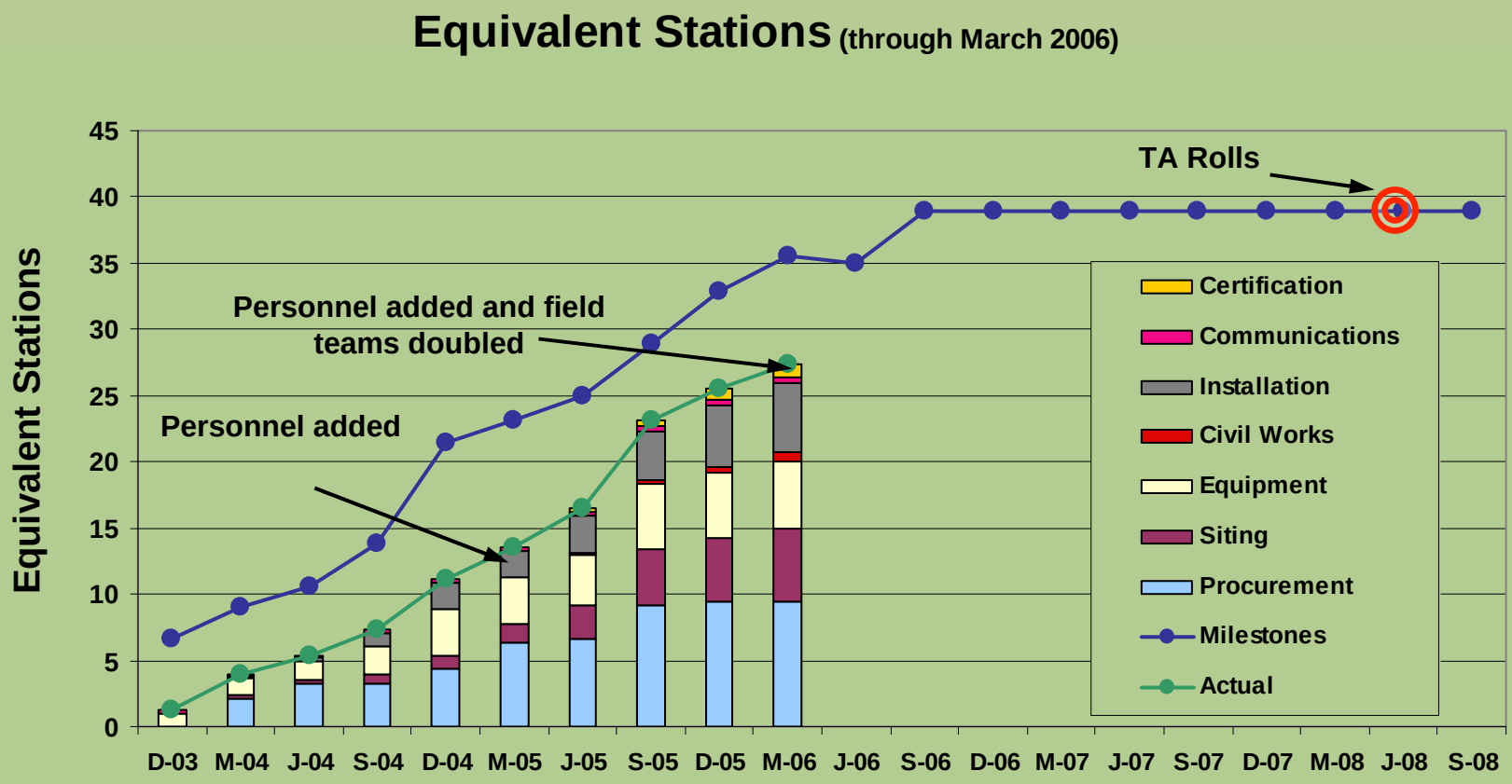
Kent Anderson
Permanent Array Program Manager

EFEC Site Review
May 17, 2006

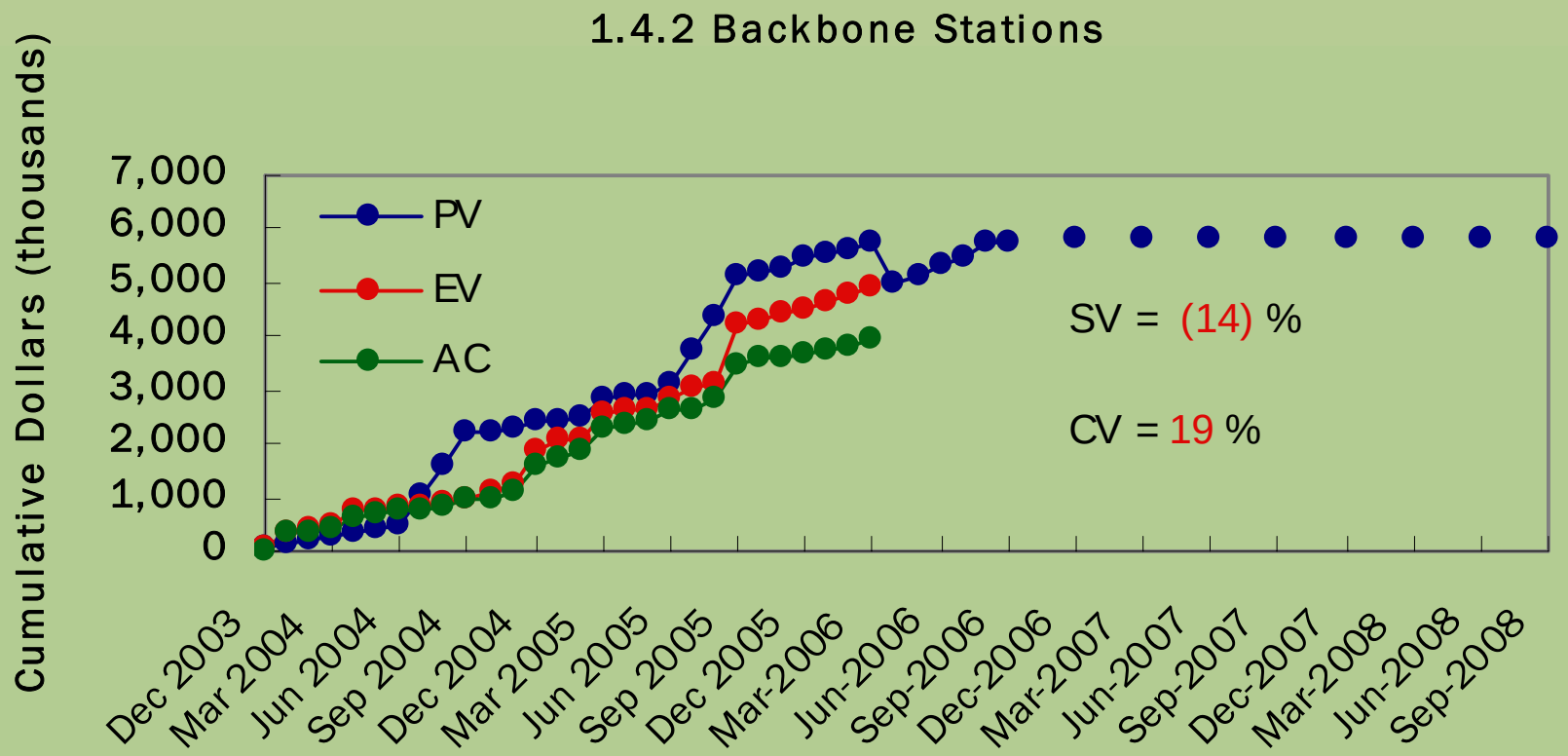
Topics

- Status
  - Work accomplished
  - Data quality
  - Synergy
- Plan for completion
  - Current position on baseline
  - Remaining tasks

Permanent Array

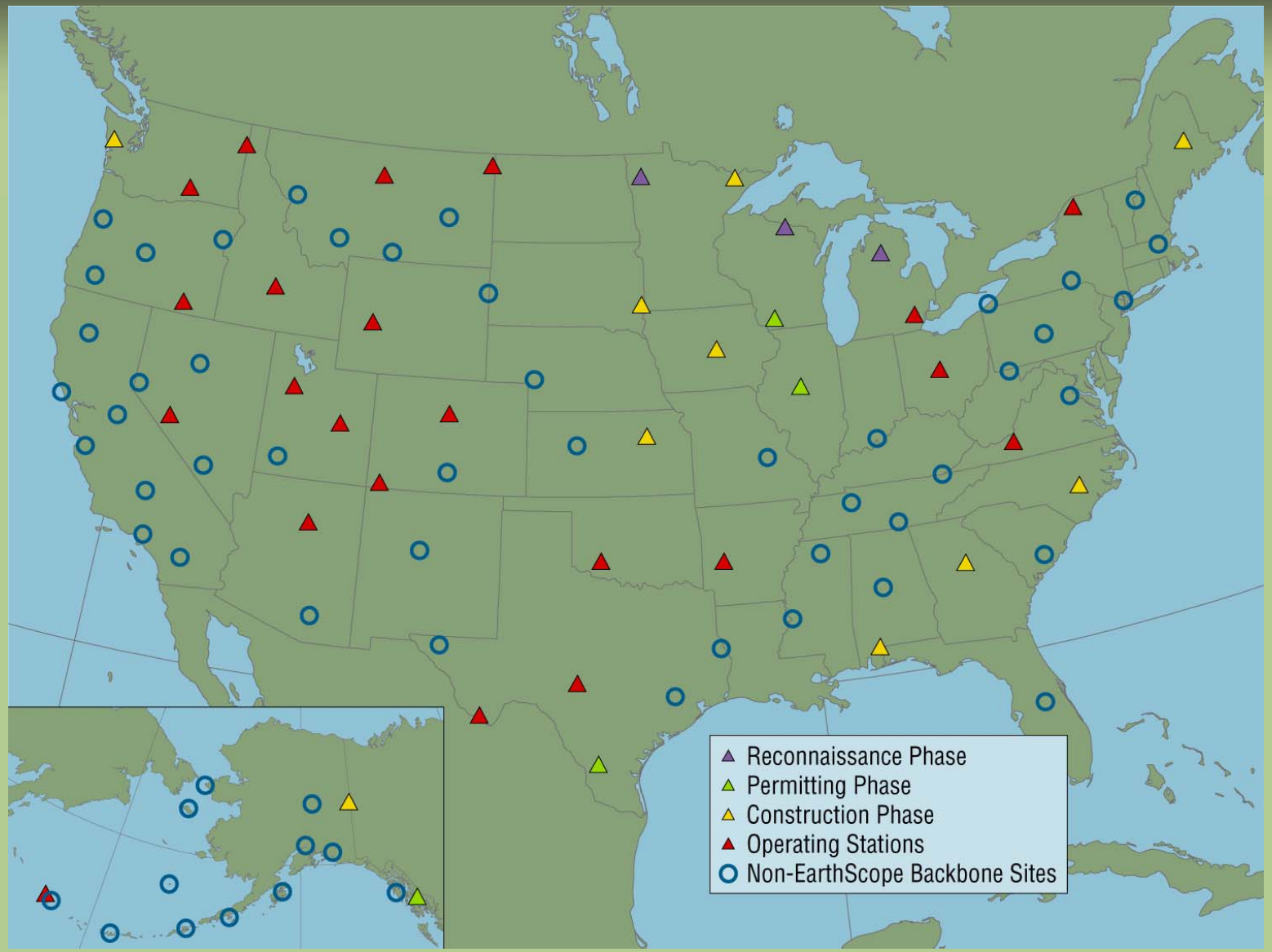


Permanent Array EVM

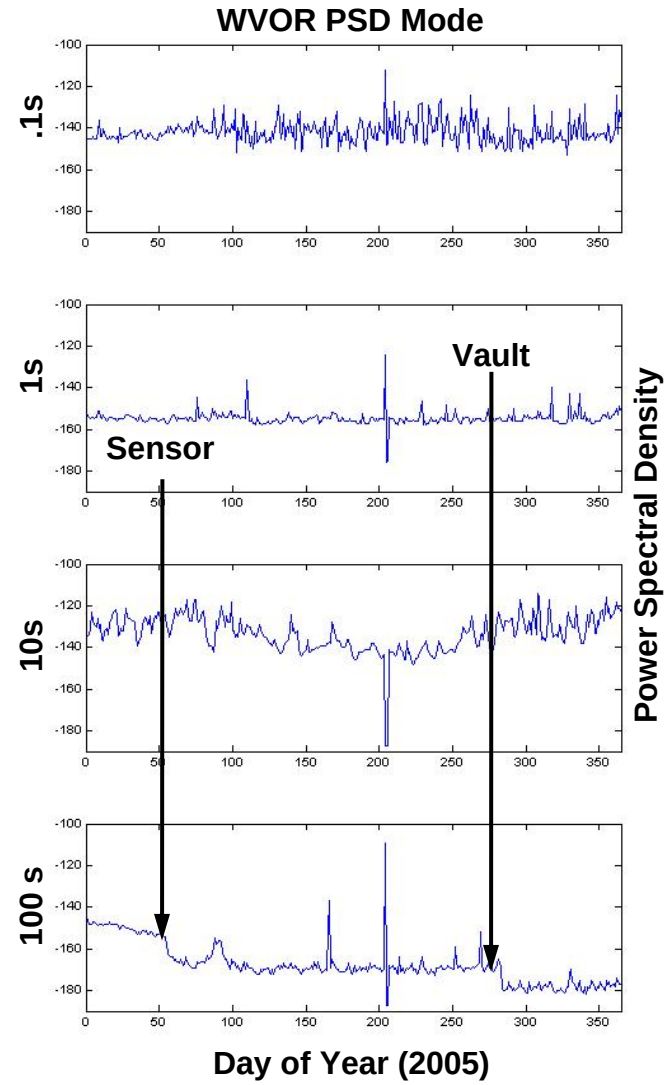


Permanent Array Component of the Backbone

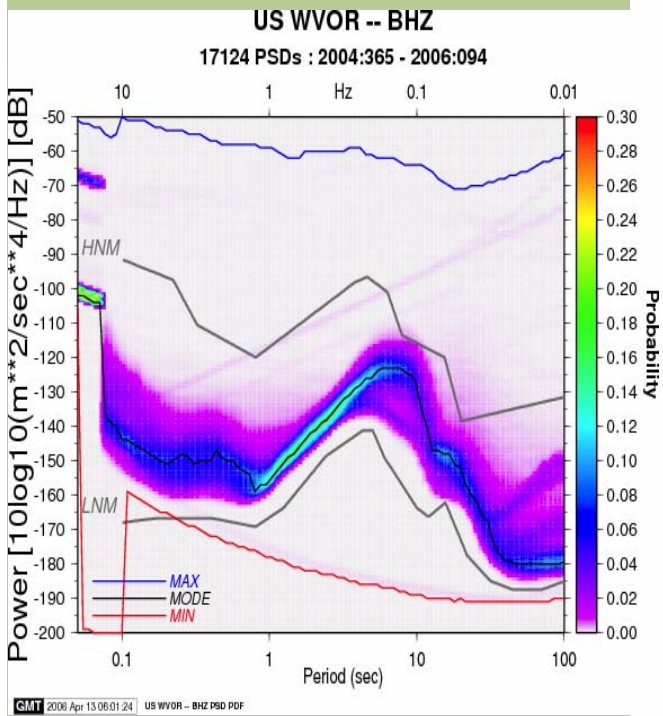
Backbone Sites

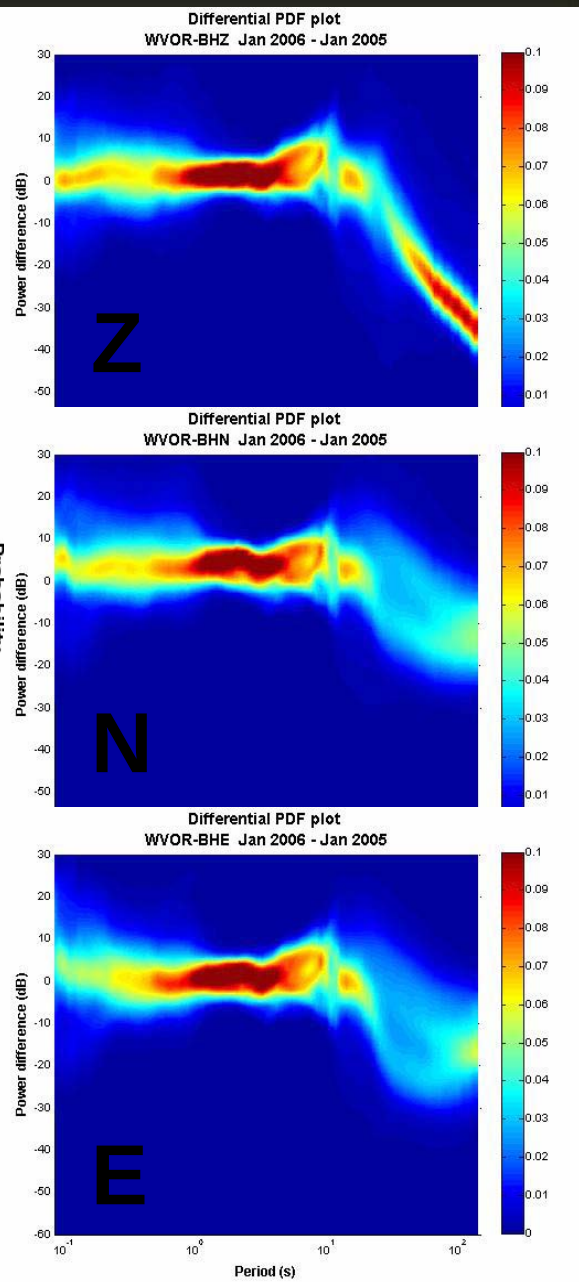


Backbone Improvements



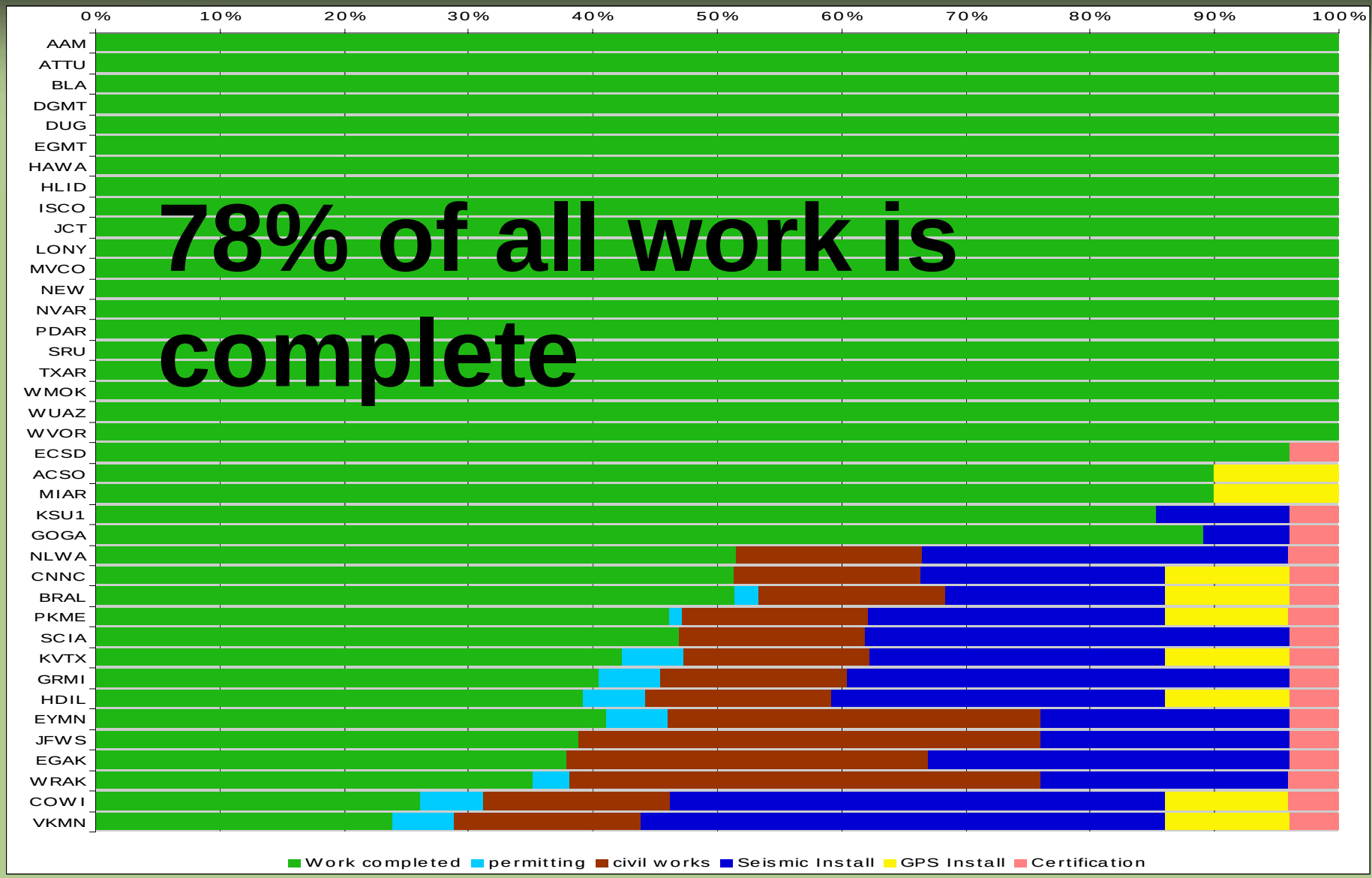
Power Spectral Density





Co-located GPS

Permanent Array - Remaining Tasks



Remaining Schedule

- **May**
  - ECSD - Install from 8-19 May
  - KSU1 - Install from 22-31 May
  - SCIA - Install from 20-31 May
- **June**
  - BRAL - Installation 5-15 June
  - CNNC - Installation 19-31 June
  - NLWA - Installation 5-14 June
  - KVTX - Installation 16-26 June
- **July**
  - EYMN - Installation 5- 17 July
  - JFWS - Installation 7-19 July
  - PKME - Installation 17-28 July
- **August**
  - EGAK - Installation 1-15 Aug
  - WRAK- Installation 17-31 Aug
  - COWI - Installation 1 - 15 Aug
  - GRMI - Installation 1 -15 Aug
  - HDIL - Installation 16 - 29 Aug
- **September**
  - AGMN - Installation 5-20 Sept

Permanent Array Personnel

- IRIS
  - Rob Woolley
  - Rhett Butler
  - Kent Anderson
- USGS
  - Lind Gee
  - John Derr
  - Bob Hutt
- Honeywell
  - Doug Ford
  - Kyle Persefield
  - Jared Anderson
  - Steve Roberts
  - Leo Sandoval

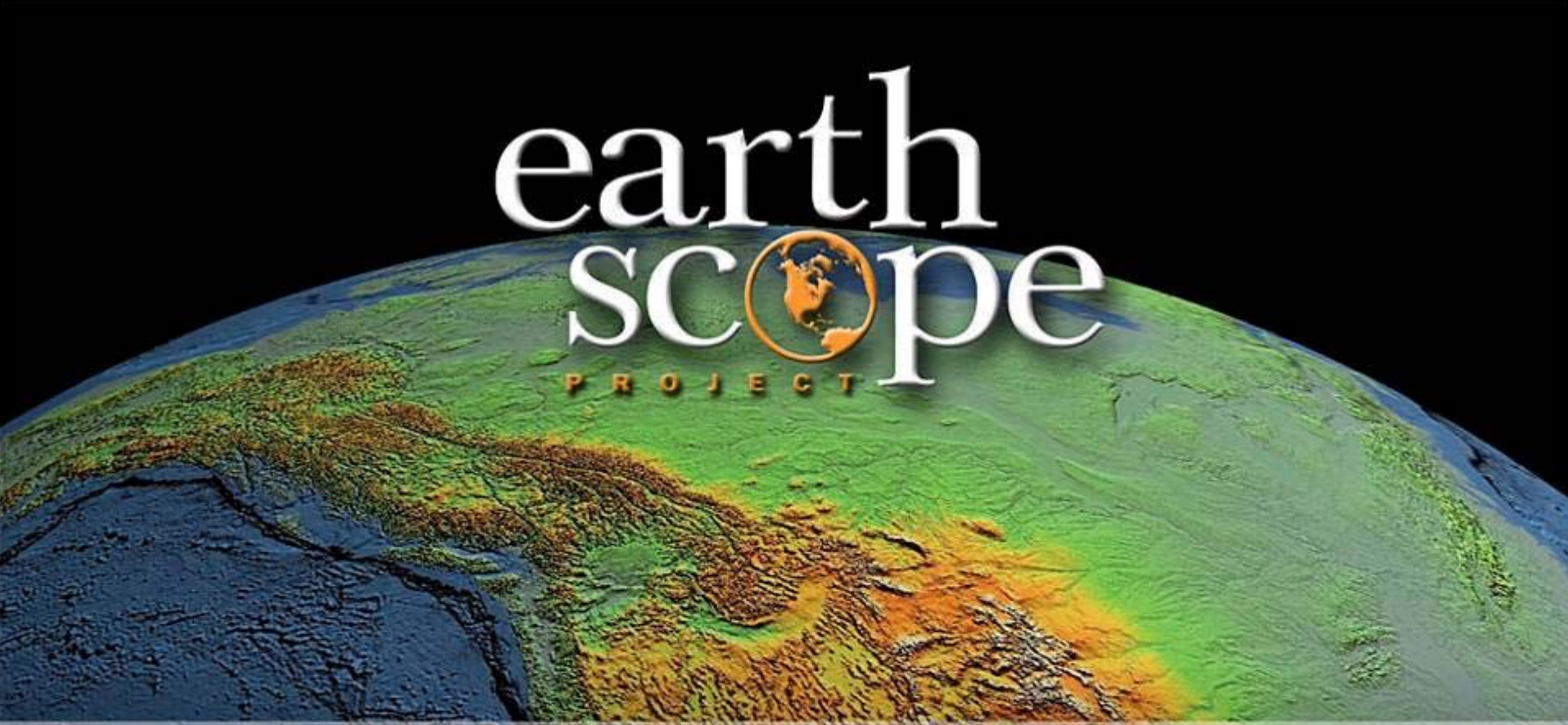
- Not Pictured
  - USGS

  Alena Leeds, Mark Meremonte, Jim Allen, John McMillan
  - Temporary hires

  Mike Bolz, Mike Busby, Ryan Davis, Jeff Fox

Outline

- USArray Overview
  - Agenda/Logistics
- USArray Facility Construction Update
  - Transportable Array – Bob Busby
  - Flexible Array – Marcos Alvarez
  - Permanent Array – Kent Anderson
  - Magnetotellurics – Shane Ingate
  - Data Management – Tim Ahern
- Conclusion – David Simpson



EarthScope MT Facility Status

Shane Ingate
EarthScope USArray MT Manager

EFEC Site Review
May 17, 2006

MT Status Report - By Task

- Management Activities
  - EMWoG
  - Change Order #15
- MREFC Status
  - Procurement
  - Backbone construction
  - Co-location test
- O&M Status
  - Mobile (Transportable)
- Other Activities, Planning and Opportunities

MT Re-structure

- A USArray Magnetotelluric Manager will be responsible for coordination of MT activities and oversight of the portable MT program. The MT Manager will report to the IRIS President as PI for USArray.

- A *Magnetotelluric Working Group* will be established to provide advice to the MT Manager. This working group will be constituted under and report to the IRIS Coordinating Committee. EMWoG has been established as a joint working group of IRIS and EMSOC, the electromagnetic consortium.

After USArray Site Review, May 2005

ElectroMagnetic Working Group (EMWoG)

EMSOC
ElectroMagneticStudiesOfTheContinents

IRIS

Members

- Gary Egbert (OSU)
- Rob Evans (WHOI)
- Shane Ingate (IRIS) - Liason
- Dean Livelybrooks (UO)
- Kevin Mickus (Miss State)
- Stephen Park (UCR)
- Adam Schultz (OSU)
- Martyn Unsworth (U. Alberta)
- Phil Wannamaker (UU) - Chair

Observers

- Tim Ahern (IRIS)
- Kent Anderson (IRIS)
- Bob Busby (IRIS)
- Jim Fowler (IRIS)

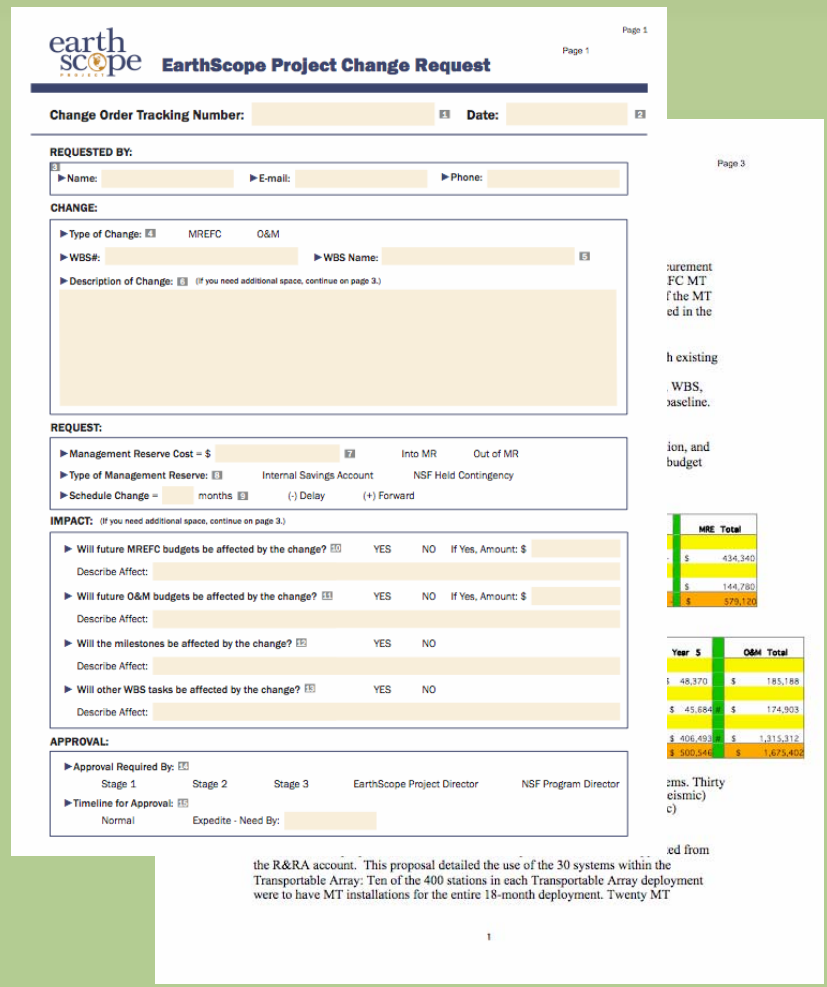
Meetings

- Nov 22, 2005
- Dec 20, 2005
- Jan 17, 2006
- Feb 2, 2006
- Feb 21, 2006
- Mar 9, 2006
- Mar 23, 2006
- Apr 11, 2006
- Apr 25, 2006

•All Minutes at http://www.emscope.org

USArray Change Order #15

- Affected MREFC budget allocation only
- Submitted 1/25/06, approved by ESO 2/8/06, approved by NSF 2/24/06
- Solved the oversight in funds for MT equipment procurement absent from the 2003 Baseline by using $144K from USArray-held contingency.
- Descoped from 10 Backbone purchase/installation to 7
- Descoped purchase of 30 systems for transportable use to 20
- Reiterated 2003 request (no change) for O&M funds, including out-years



earth scope

EarthScope Project Change Request

Page 1

Change Order Tracking Number: 1 **Date:** 2

REQUESTED BY:

3 ▶Name: ▶E-mail: ▶Phone:

CHANGE:

▶Type of Change: 4 MREFC O&M

▶WBS#: ▶WBS Name: 5

▶Description of Change: 6 (If you need additional space, continue on page 3.)

REQUEST:

▶Management Reserve Cost = $ 7 Into MR Out of MR

▶Type of Management Reserve: 8 Internal Savings Account NSF Held Contingency

▶Schedule Change = months 9 (-) Delay (+) Forward

IMPACT: (If you need additional space, continue on page 3.)

▶ Will future MREFC budgets be affected by the change? 10 YES NO If Yes, Amount: $

Describe Affect:

▶ Will future O&M budgets be affected by the change? 11 YES NO If Yes, Amount: $

Describe Affect:

▶ Will the milestones be affected by the change? 12 YES NO

Describe Affect:

▶ Will other WBS tasks be affected by the change? 13 YES NO

Describe Affect:

APPROVAL:

▶Approval Required By: 14

Stage 1 Stage 2 Stage 3 EarthScope Project Director NSF Program Director

▶Timeline for Approval: 15

Normal Expedite - Need By:

Page 3

	MRE Total
	$ 434,340
	$ 144,780
	$ 579,120

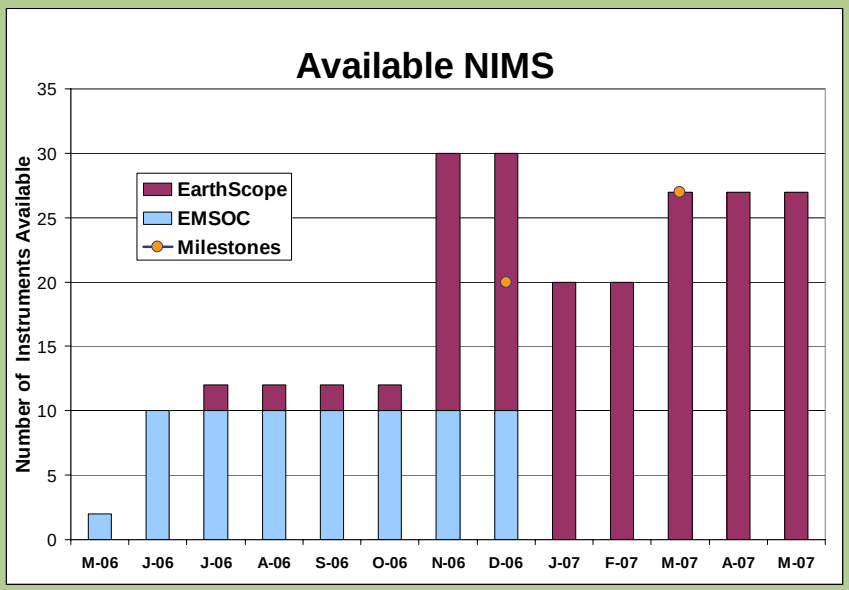
Year $	O&M Total
$ 48,370	$ 185,188
$ 45,684	$ 174,903
$ 406,49	$ 1,315,312
$ 500,54	$ 1,675,402

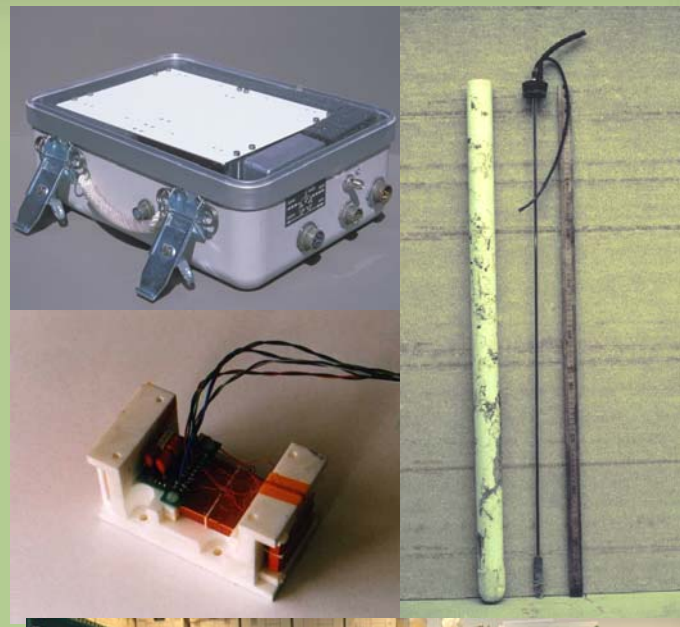
the R&RA account. This proposal detailed the use of the 30 systems within the Transportable Array: Ten of the 400 stations in each Transportable Array deployment were to have MT installations for the entire 18-month deployment. Twenty MT

1

Procurement

- Order for 20 NIMS systems placed Nov 2005
  - Order revised Apr 2006
  - ETA Autumn, 2006
- Order for 7 NIMS systems placed Apr 2006
  - ETA Spring, 2007
- Order total CAD$412,793 (~$363K) Concern:
- Availability of suitable ring core material (5/12/06 run failed)





Backbone MT (BBMT)

Backbone Schedule

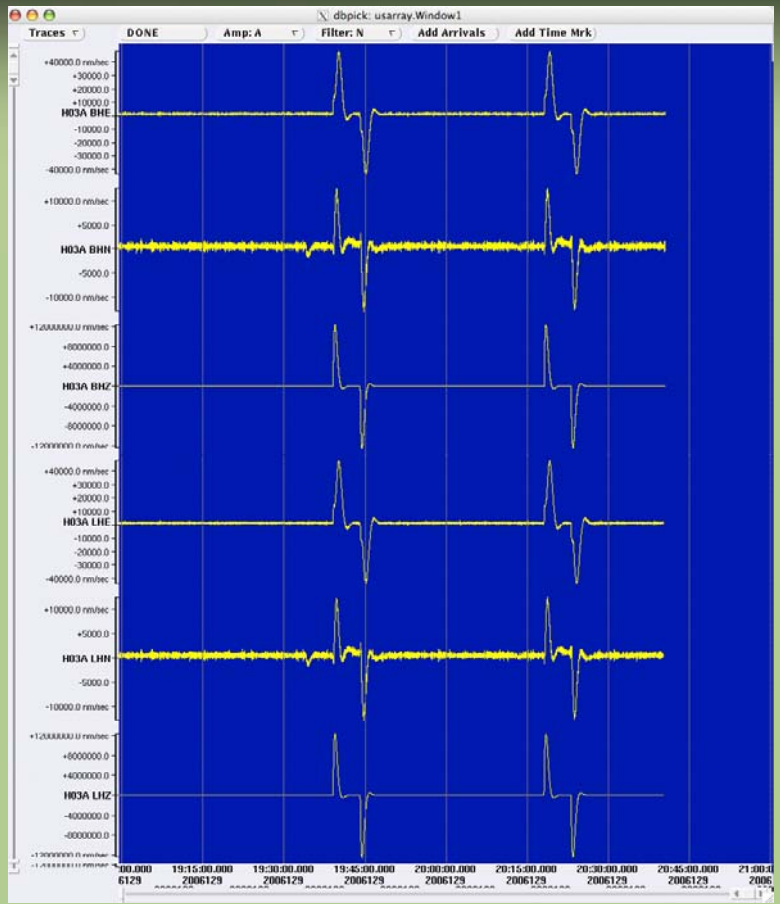
- 4/30-5/5 ANMO, NM (now Hilton Ranch)
- 5/19-5/23 Parkfield, CA
- 6/5-6/9 Bull Shoals, MO
- 6/22 -6/25 Wild Horse Valley, OR (now Soap Creek Ranch)
- 7/9-7/14 Conover (COWI), WI
- 8/27-9/1 Alum Ck State Park (ACSO), OH
- 9/17-9/22 Dagmar (DGMT), MT
- 10/15-10/27 Visit any alternative Backbone sites required
- 11/12-11/25 Acceptance testing newly delivered Backbone NIMS

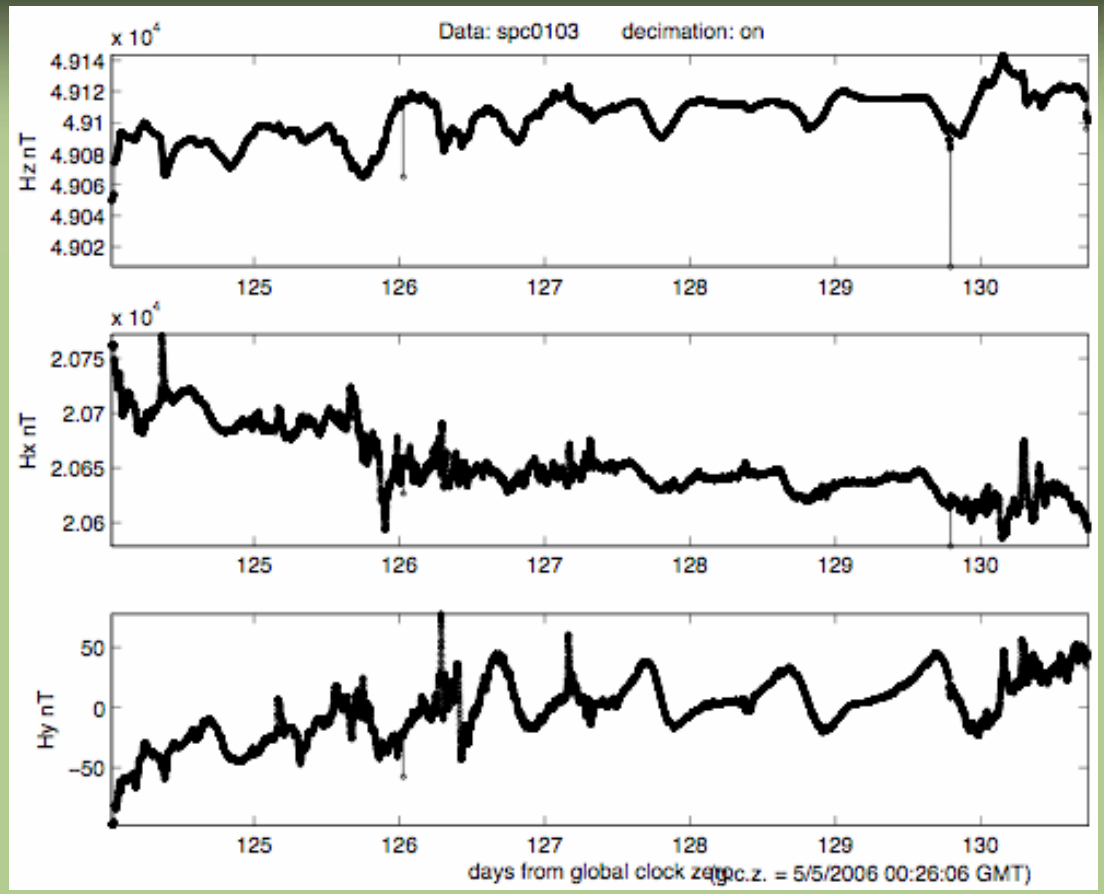
(Note: 2 systems for Backbone testing on loan from EMSOC)

TA Co-location MT.SPC02 and TA.H03A

- Tests conducted at TA.H03A (May 8-12) to determine influence of passive MT recording systems on TA equipment, and impact of TA telemetry and large mass/coil movements on MT.

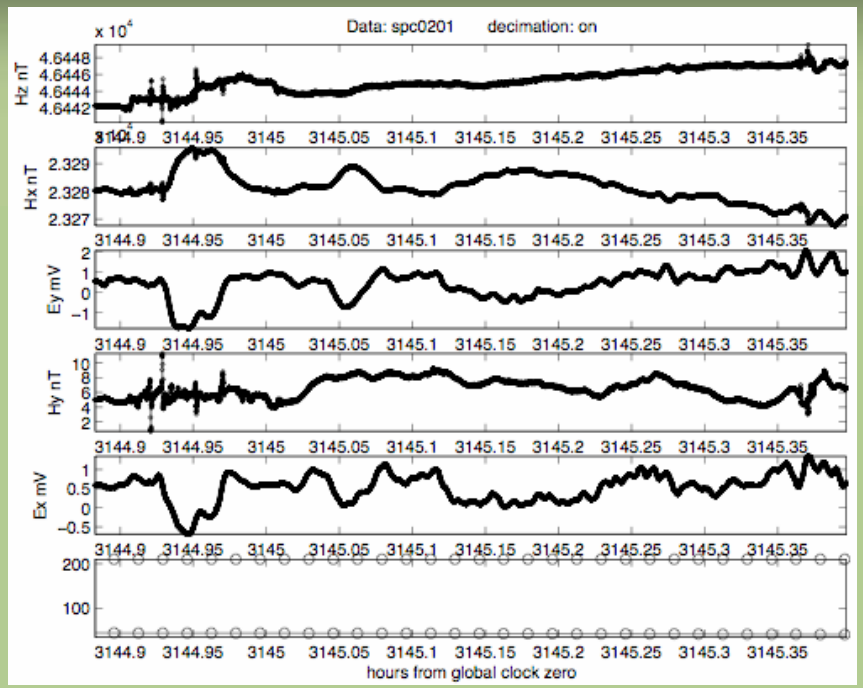
SPC02/H03A - Interactions





- Effect of large-scale seismic sensor calibration

SPC02/03 - Electrode Test



- Site SPC02 uses Pb-PbCl2 electrodes with kaolin/KCl buffer in a Russian bucket filled with kaolin/NaCl
- SPC03, separated by 2 m, uses same electrodes with kaolin/NaCl buffer
- Will run for 1 more week

O&M: Transportable MT - OR Pilot

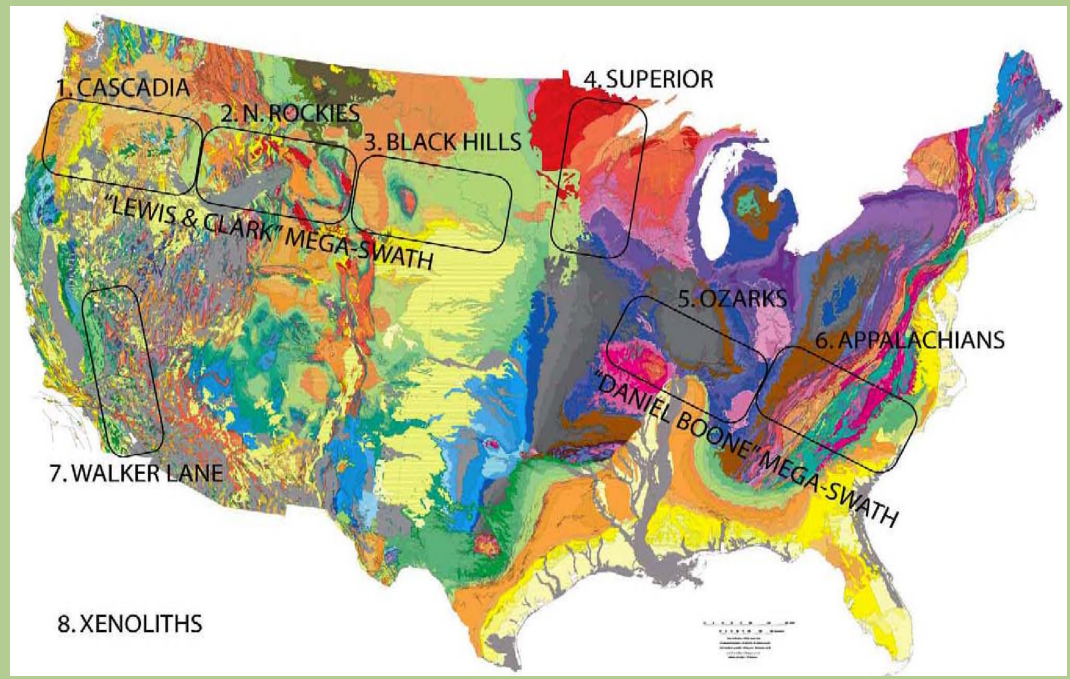
- Pilot Project provides temporary support and cost experience
- Select, permit, install, operate up to 50 MT sites in OR
- ~70 km station spacing
- Two RFPs released April, bidding closed 5/5/06
  - Site selection & permitting(PSP)
  - Installation, operations and maintenance (POM)
- 6 proposals received from for-profit organizations
- 5 months of field work, June-November, 2006
- 10 NIMS on loan from EMSOC
- Oversight conducted via subaward
- Evaluation at end of contract will be conducted
- Why Oregon? Fluids in the Cascade subduction system and tectonic accretion

Transportable MT Planning

GeoFrame community listed priority areas for Flex Array studies

- Cascadia/Idaho bath/Yellowstone/maybe Black Hills
- Salton Sea/Walker Lane
- Mid Continent Rift/Superior area
- S. Appalachians/New Madrid/Reelfoot Rift

These areas will have to get broader community support through the proposal process but they may be tentative choices for us to put our groups of 70 km sites

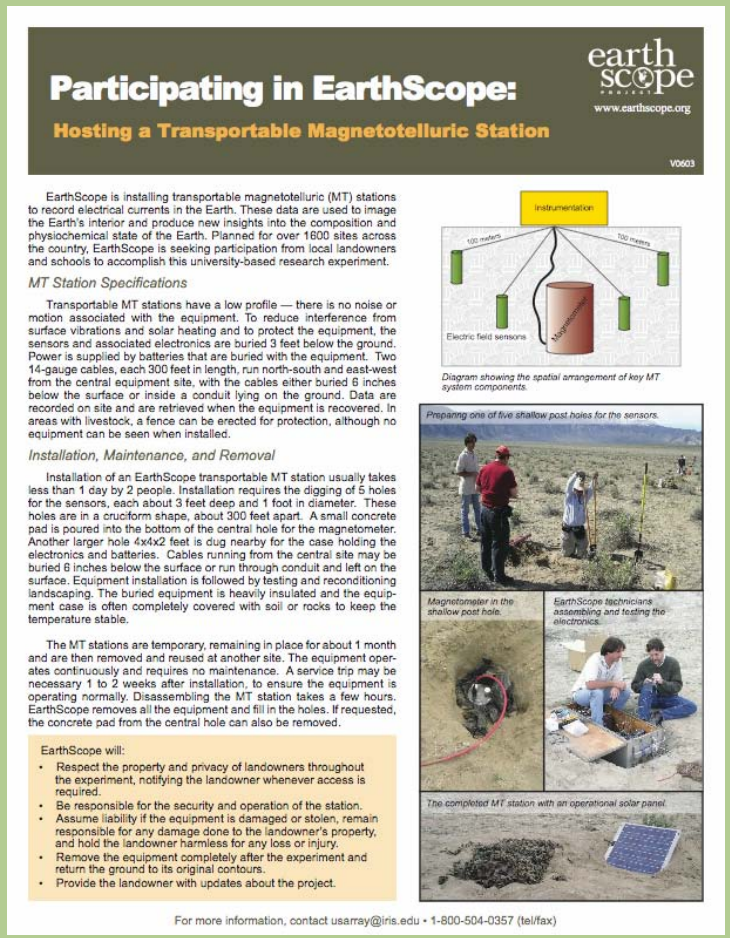


Other Activities & Opportunities

ESMT pre-IRIS Workshop short course
6/7/06

IRIS annual workshop 2006
Westward Look Resort, Tucson AZ, June 8-10, 2006

Siting Outreach



Participating in EarthScope:

Hosting a Transportable Magnetotelluric Station

earthscope PROJECT www.earthscope.org

V0603

EarthScope is installing transportable magnetotelluric (MT) stations to record electrical currents in the Earth. These data are used to image the Earth's interior and produce new insights into the composition and physiochemical state of the Earth. Planned for over 1600 sites across the country, EarthScope is seeking participation from local landowners and schools to accomplish this university-based research experiment.

MT Station Specifications

Transportable MT stations have a low profile — there is no noise or motion associated with the equipment. To reduce interference from surface vibrations and solar heating and to protect the equipment, the sensors and associated electronics are buried 3 feet below the ground. Power is supplied by batteries that are buried with the equipment. Two 14-gauge cables, each 300 feet in length, run north-south and east-west from the central equipment site, with the cables either buried 6 inches below the surface or inside a conduit lying on the ground. Data are recorded on site and are retrieved when the equipment is recovered. In areas with livestock, a fence can be erected for protection, although no equipment can be seen when installed.

Installation, Maintenance, and Removal

Installation of an EarthScope transportable MT station usually takes less than 1 day by 2 people. Installation requires the digging of 5 holes for the sensors, each about 3 feet deep and 1 foot in diameter. These holes are in a cruciform shape, about 300 feet apart. A small concrete pad is poured into the bottom of the central hole for the magnetometer. Another larger hole 4x4x2 feet is dug nearby for the case holding the electronics and batteries. Cables running from the central site may be buried 6 inches below the surface or run through conduit and left on the surface. Equipment installation is followed by testing and reconditioning landscaping. The buried equipment is heavily insulated and the equipment case is often completely covered with soil or rocks to keep the temperature stable.

The MT stations are temporary, remaining in place for about 1 month and are then removed and reused at another site. The equipment operates continuously and requires no maintenance. A service trip may be necessary 1 to 2 weeks after installation, to ensure the equipment is operating normally. Disassembling the MT station takes a few hours. EarthScope removes all the equipment and fill in the holes. If requested, the concrete pad from the central hole can also be removed.

EarthScope will:

- Respect the property and privacy of landowners throughout the experiment, notifying the landowner whenever access is required.
- Be responsible for the security and operation of the station.
- Assume liability if the equipment is damaged or stolen, remain responsible for any damage done to the landowner's property, and hold the landowner harmless for any loss or injury.
- Remove the equipment completely after the experiment and return the ground to its original contours.
- Provide the landowner with updates about the project.

Diagram showing the spatial arrangement of key MT system components.

Preparing one of five shallow post holes for the sensors.

Magnetometer in the shallow post hole.

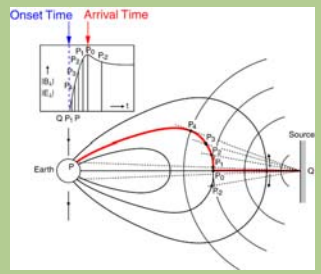
EarthScope technicians assembling and testing the electronics.

The completed MT station with an operational solar panel.

For more information, contact usarray@iris.edu • 1-800-504-0357 (tel/fax)

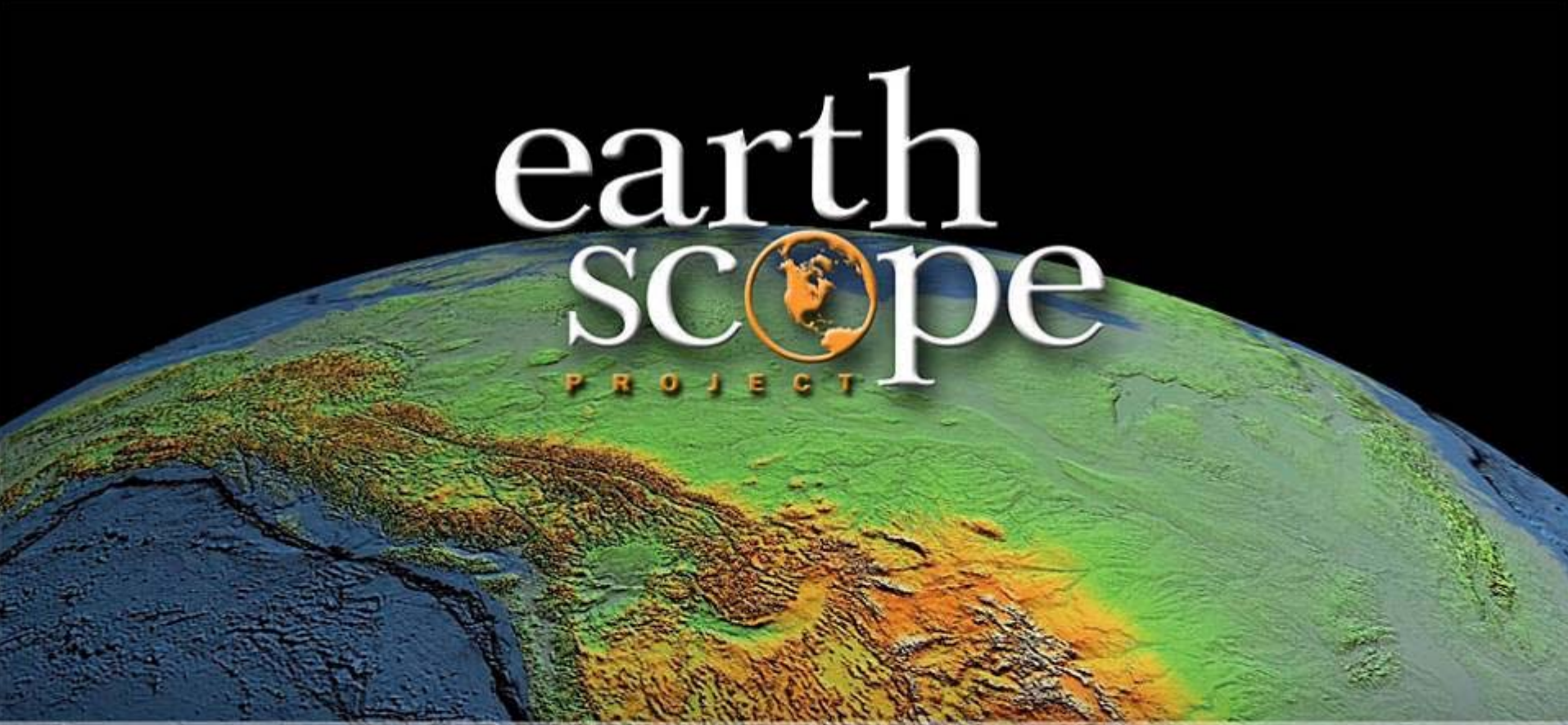
EOS paper (EMWoG)

Magnetoseismology (McMAC, funded by NSF/ATM)



Outline

- USArray Overview
  - Agenda/Logistics
- USArray Facility Construction Update
  - Transportable Array – Bob Busby
  - Flexible Array – Marcos Alvarez
  - Permanent Array – Kent Anderson
  - Magnetotellurics – Shane Ingate
  - Data Management – Tim Ahern
- Conclusion – David Simpson



Data Management Center

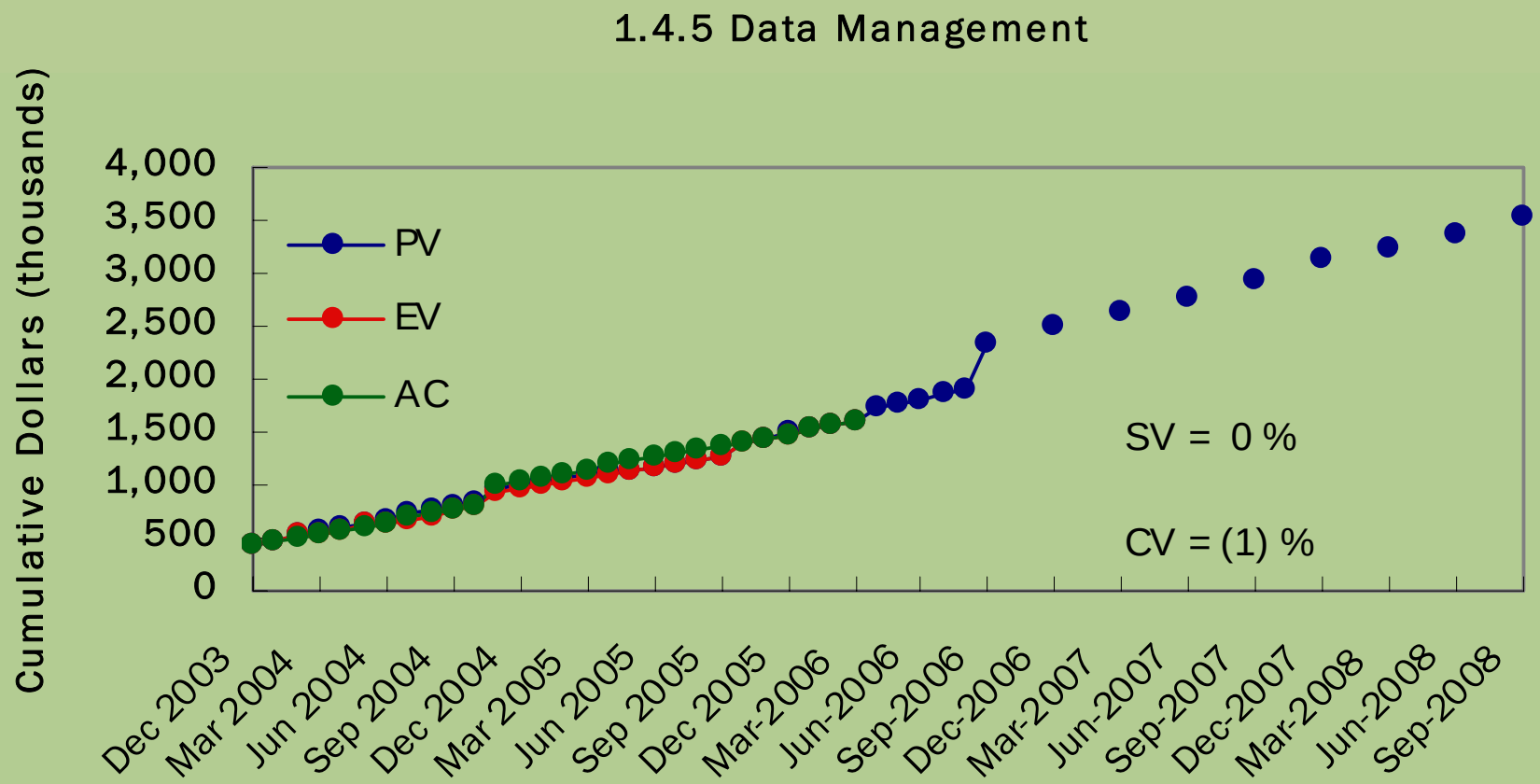
Tim Ahern
Data Management System Program Manager

EFEC Site Review
May 17, 2006

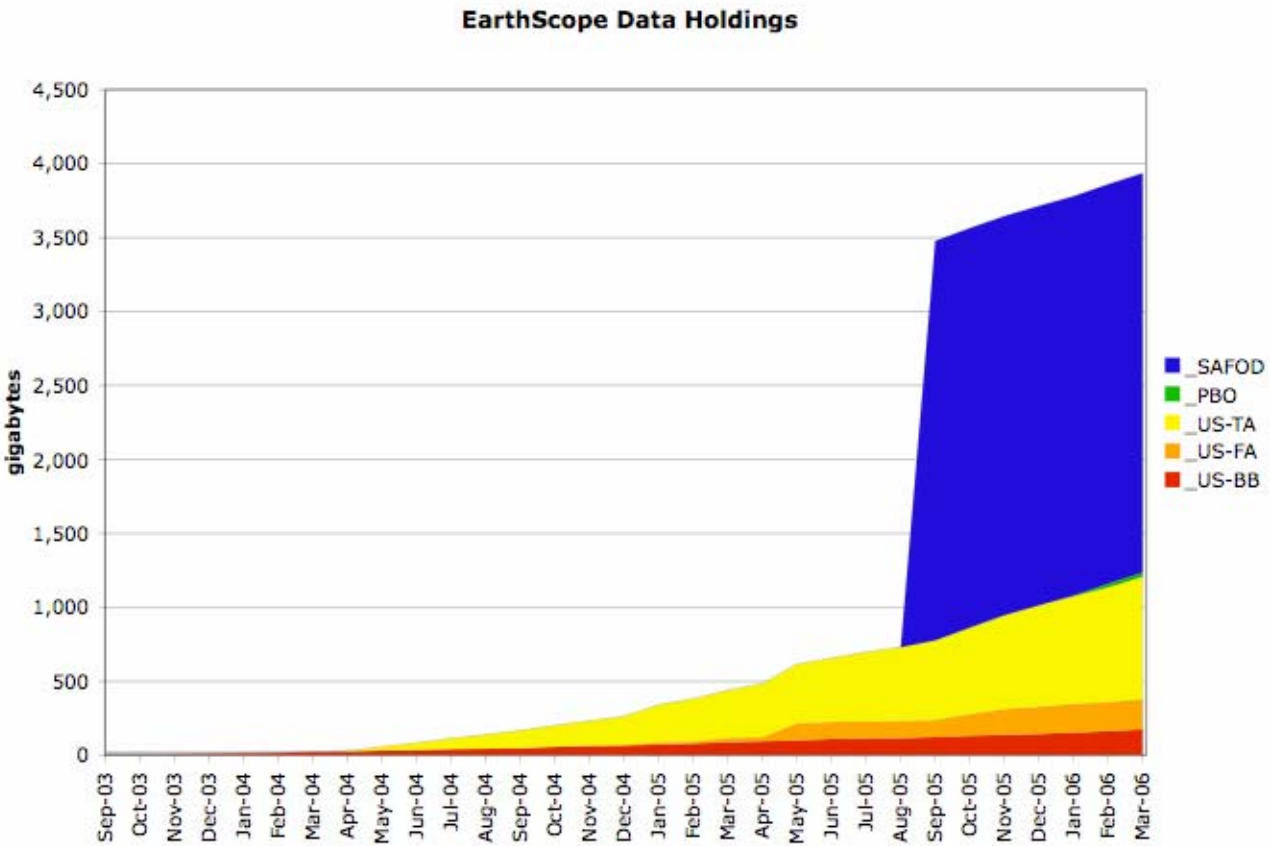
DMS Topics

- Earned Value Management
- EarthScope Data Volumes
- USArray Data Quality Issues
- Product Management System (SPADE)
- PBO and SAFOD Seismic Data
- EarthScope Data Usage

Data Management EVM



EarthScope Data Volumes

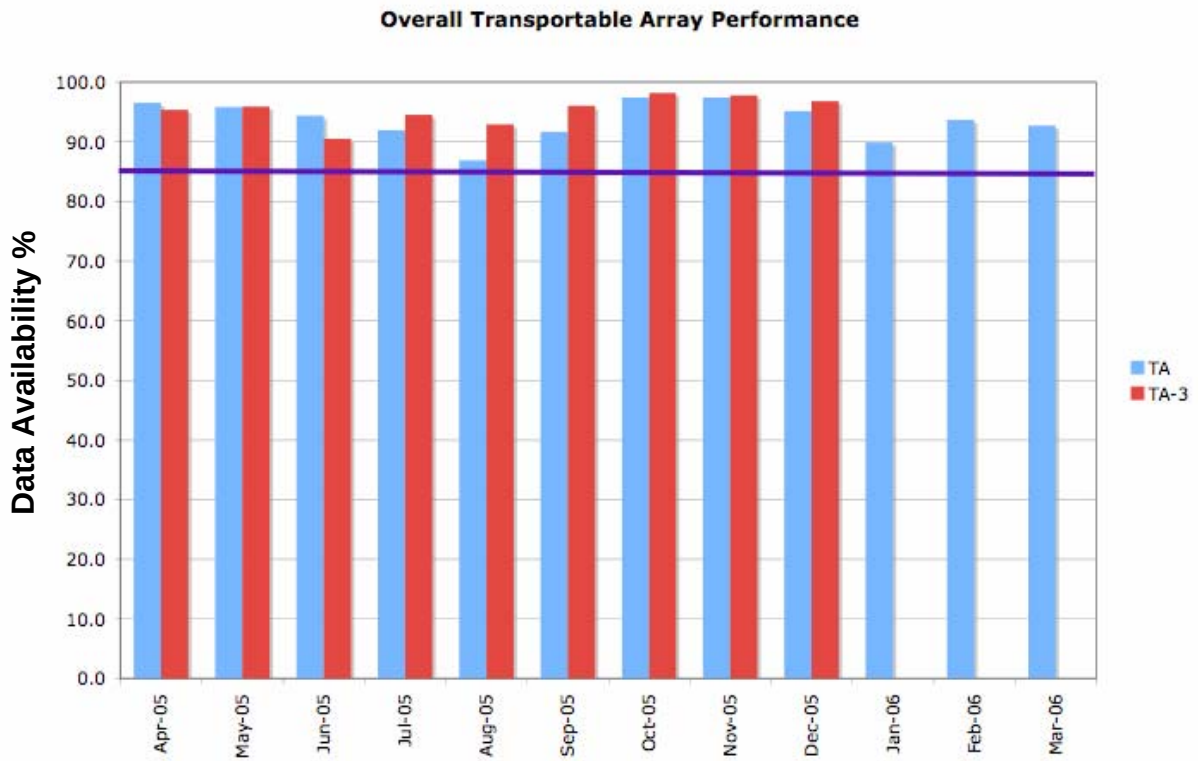


Data Quality

- Current emphasis
  - Data completeness
  - Correct Metadata
    - defined in the SEED format for scientific use of EarthScope data
      - Coordinated between DMC and ANF, USGS, AOF
- Near term
  - Features on Power Density Function Plots
  - Closer review of problems identified by the automated QA system

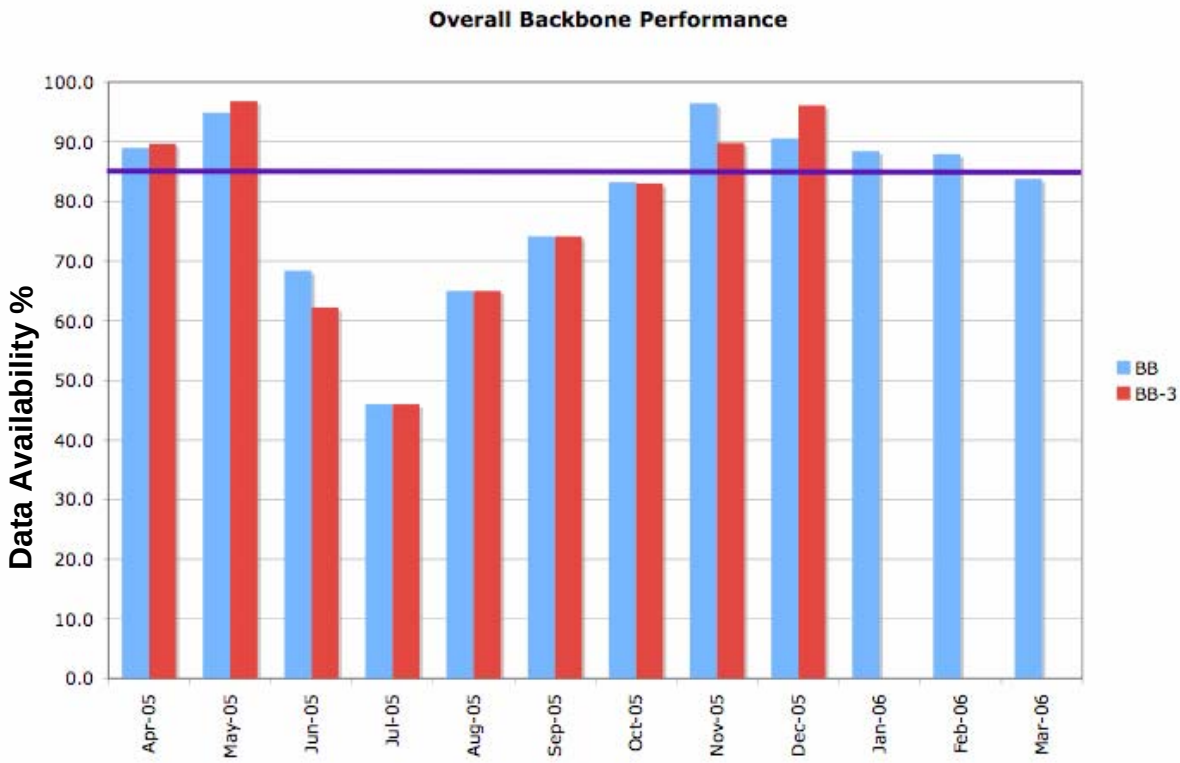
N2, N6

Transportable Array Performance



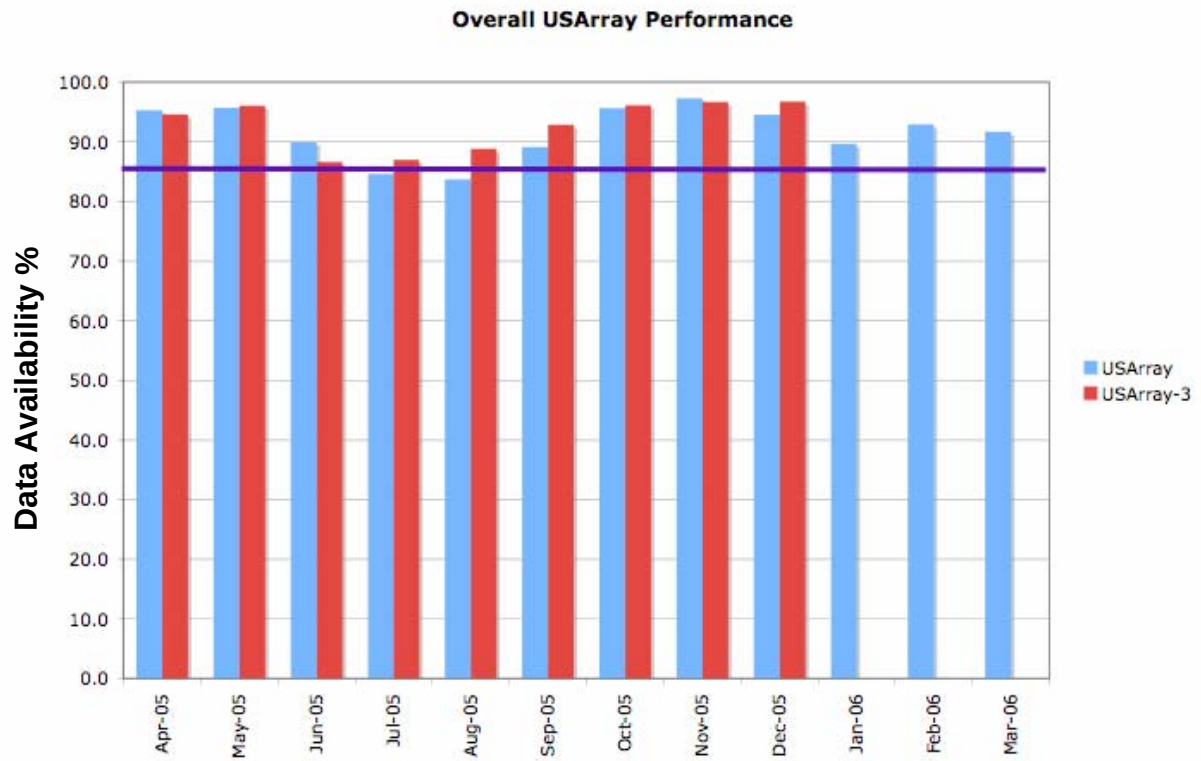
April 2005 March 2006

Backbone Performance



April 2005 March 2006

Overall USArray Performance



April 2005 March 2006

Product Management System

SPADE: Searchable Product Archive and Distribution Engine

USArray Data Management Plan

Uniform Product Distribution System

As part of the developments within the IRIS DMS we will develop the Uniform Product Distribution System (UPDS). This system will be a fairly complete web service implementation including leveraging technologies such as XML, SOAP, WSDL and we hope an instantiation of UDDI. The UDDI will act as a yellow page directory from which individuals or applications can discover resources such as USArray products on the Web, determine how to use them, and even manipulate them through other Web Services.

Year 3 Quarter 2

Beta Test

Year 3 Quarter 1

- Released submit and query client applications and a running archive server for the IRIS Data Management Center's Uniform Product Distribution System. This release is for system testing and evaluation purposes and exposes the entire planned query feature set. Queries to the archive are by product type and can contain filter constraints for any of the identified metadata fields. This is a testing- and evaluation-only release, and, as such, the user interface is not in its final form.

Year 2 Quarter 4

- Added support to the Uniformed Product Distribution System for optional metadata fields, optional client-side product validation, database extension, and name space-aware product processing.

Year 2 Quarter 3

- Continued development of Uniform Product Distribution System at the IRIS Data Management Center. Focused on the consideration of various design and implementation questions, particularly the structure of the document archive, general product XML schema questions, and issues relating to system and product definition and extension.

Year 2 Quarter 2

- Completed Uniform Product Distribution System requirements gathering. Submitted a preliminary WBS and schedule. Began detailed design and development on the web service-based submission component with an emphasis on handling generic data products.

Year 2 Quarter 1

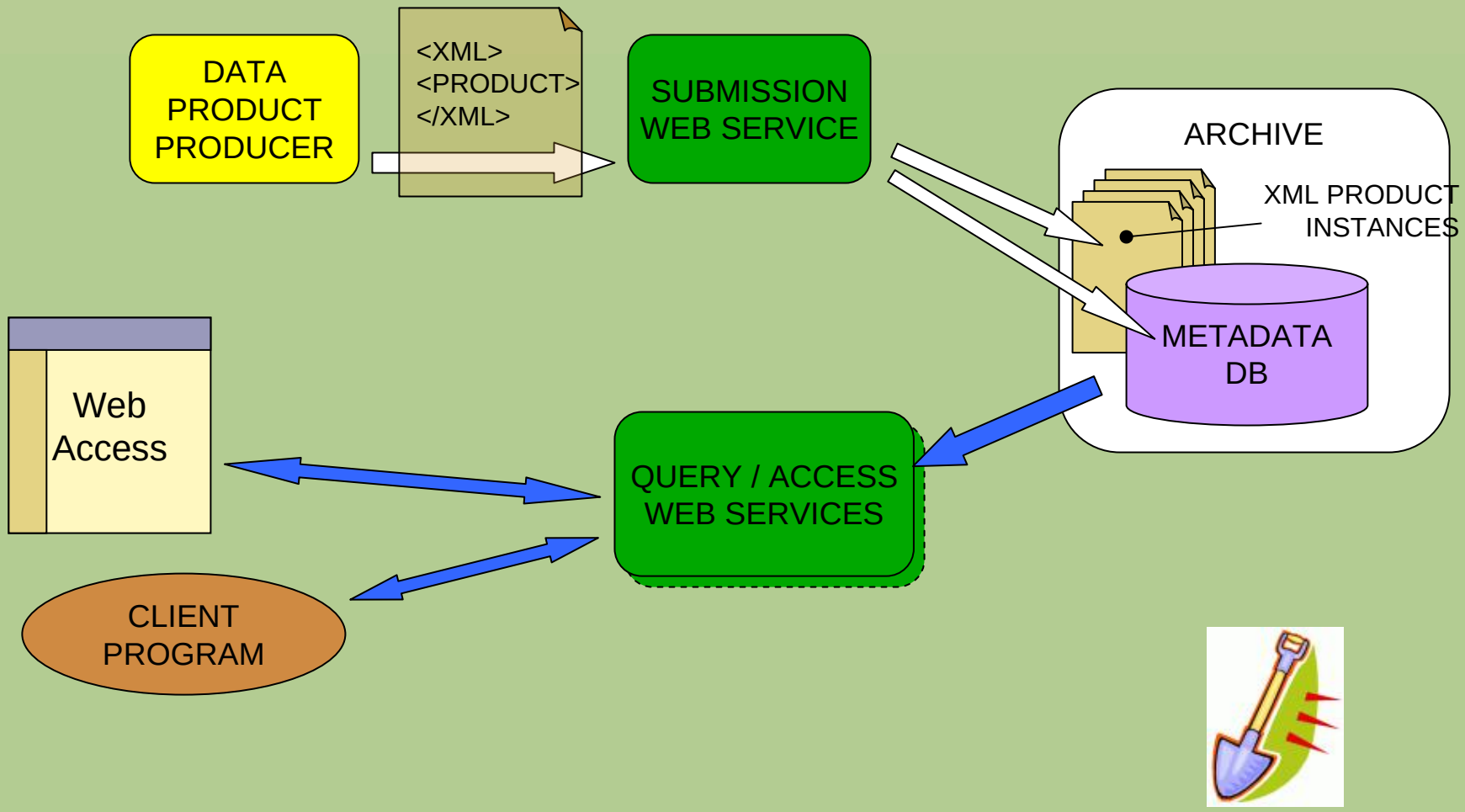
- Began design and development of the Uniform Product Delivery System at the IRIS Data Management Center. Feedback will be sought to insure compatibility with community needs.

Year 1 Quarter 4

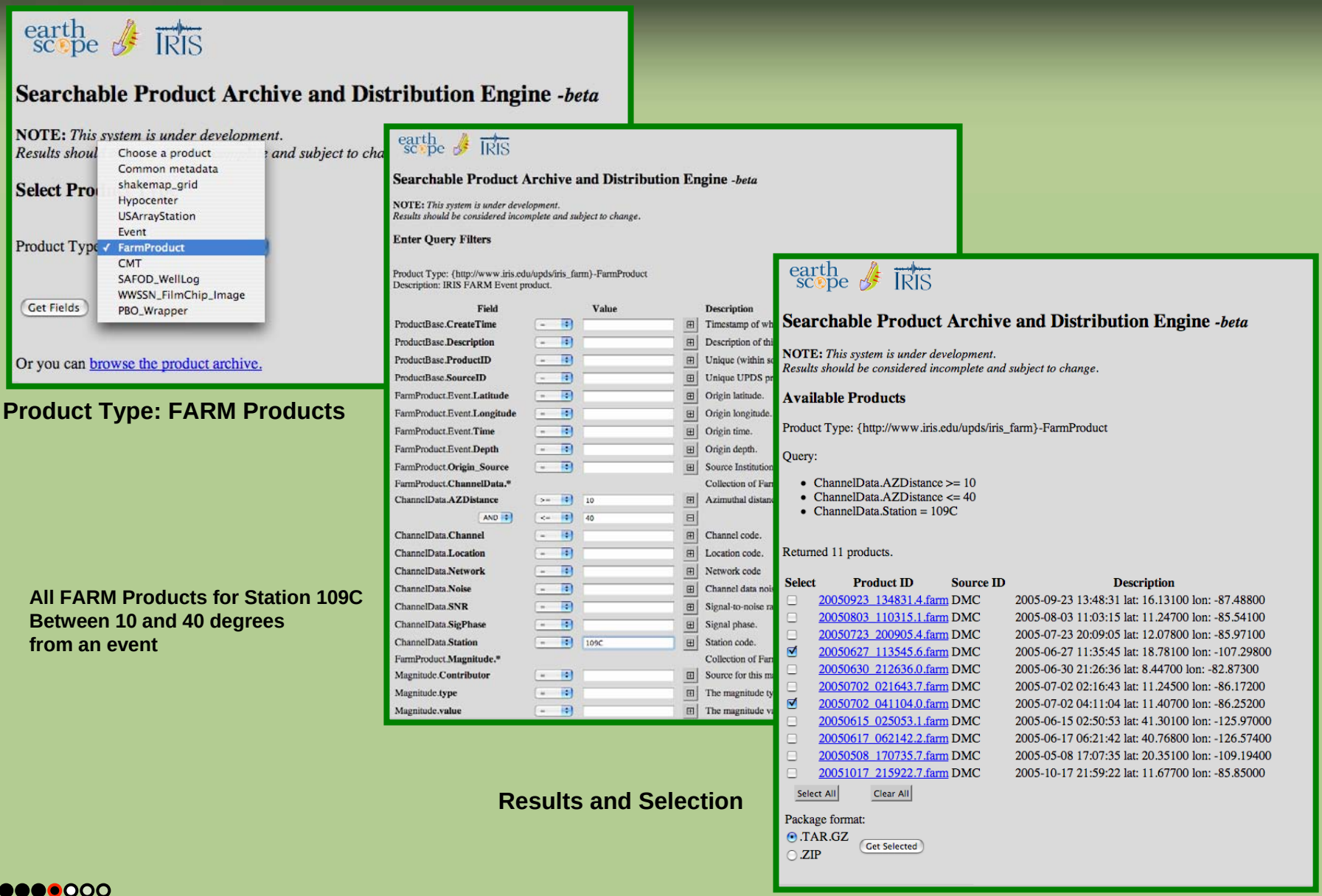
- Design has begun on the Uniform Product Distribution System for the distribution of EarthScope data products.

Product Archiving for USArray … and more

Architecture



FARM Products from TA Stations



Product Type: FARM Products

All FARM Products for Station 109C Between 10 and 40 degrees from an event

Results and Selection

Common Queries

Location, Time Metadata

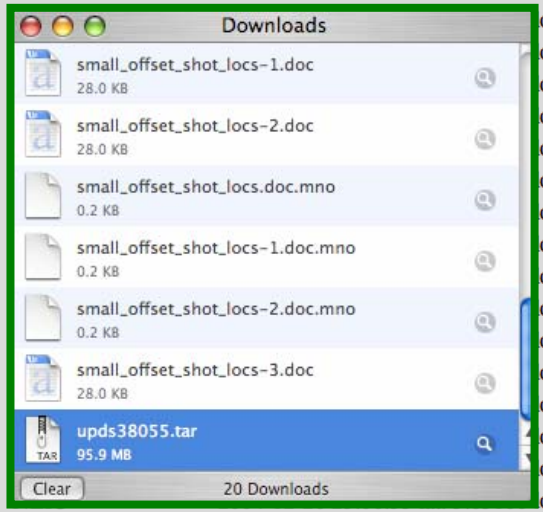
Enter Query Filters

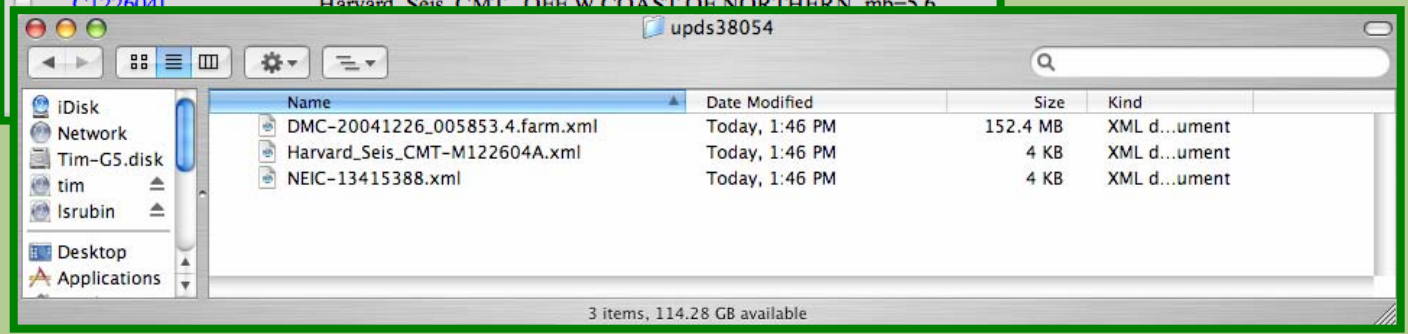
Product Type: {http://www.iris.edu/upds}-ProductCommon
Description: Query all products by common metadata fields.

Browse All ProductCommon products.

Field		Value
DublinCore.**contributor**	=	
DublinCore.**coverage**	=	
DublinCore.**creator**	=	
DublinCore.**date**	=	
DublinCore.**description**	=	
DublinCore.**format**	=	
DublinCore.**identifier**	=	
DublinCore.**language**	=	
DublinCore.**publisher**	=	
DublinCore.**relation**	=	
DublinCore.**rights**	=	
DublinCore.**source**	=	
DublinCore.**subject**	=	
DublinCore.**title**	=	
DublinCore.**type**	=	
ProductBase.**CreateTime**	=	
ProductBase.**Description**	=	
ProductBase.**ProductID**	=	
ProductBase.**SourceID**	=	
ProductCommon.Latitude.**Maximum**	<	4.0
ProductCommon.Latitude.**Minimum**	>	3.0
ProductCommon.Longitude.**Maximum**	<	96.0
ProductCommon.Longitude.**Minimum**	>	94.0
ProductCommon.Time.**Maximum**	LIKE	2004-12-26
ProductCommon.Time.**Minimum**	=	
ProductKeyword.**Keywords**	=	

Select	Product ID	Source ID	Description
☑	12985460	NEIC	2004-12-26 08:58:50 lat: 3.29700 lon: 95.77800
☐	12985475	NEIC	2004-12-26 10:59:12 lat: 3.17600 lon: 94.25900
☐	12992970	NEIC	2004-12-26 23:06:32 lat: 3.70300 lon: 94.02100
☐	13038865	NEIC	2004-12-26 08:58:53 lat: 3.31600 lon: 95.85400
☐	13038875	NEIC	2004-12-26 10:59:14 lat: 3.20700 lon: 94.32300
☐	12985460	NEIC	2004-12-26 08:58:50 lat: 3.29700 lon: 95.77800
☐	12985475	NEIC	2004-12-26 10:59:12 lat: 3.17600 lon: 94.25900
☐	12992970		on: 94.02100
☐	12985461		on: 95.78000
☐	12985477		on: 94.26000
☐	12992972		on: 94.02000
☐	13038865		on: 95.85400
☐	13038875		on: 94.32300
☐	13091384		on: 95.98200
☐	13091403		on: 94.13900
☐	13091413		on: 94.37700
☐	13091420		on: 94.28900
☐	13091563		on: 94.08600
☐	13415388		on: 95.98200
☐	13415407		on: 94.13900
☐	13415417		on: 94.37700
☐	13415424		on: 94.28900
☐	13415567		on: 94.08600
☐	20041226_150633.2.farm	DMC	2004-12-26 15:06:33 lat: 3.65100 lon: 94.08600
☑	20041226_005853.4.farm	DMC	2004-12-26 00:58:53 lat: 3.29500 lon: 95.98200
☐	C1226041	Harvard_Seis_CMT	OFF W COAST OF NORTHERN mb=5.6





This Example Returns
- **Hypocenters**
- **TA FARM Products**
- **Harvard CMT's**

All Products
- **within a lat-lon box**
- **on December 26, 2004**

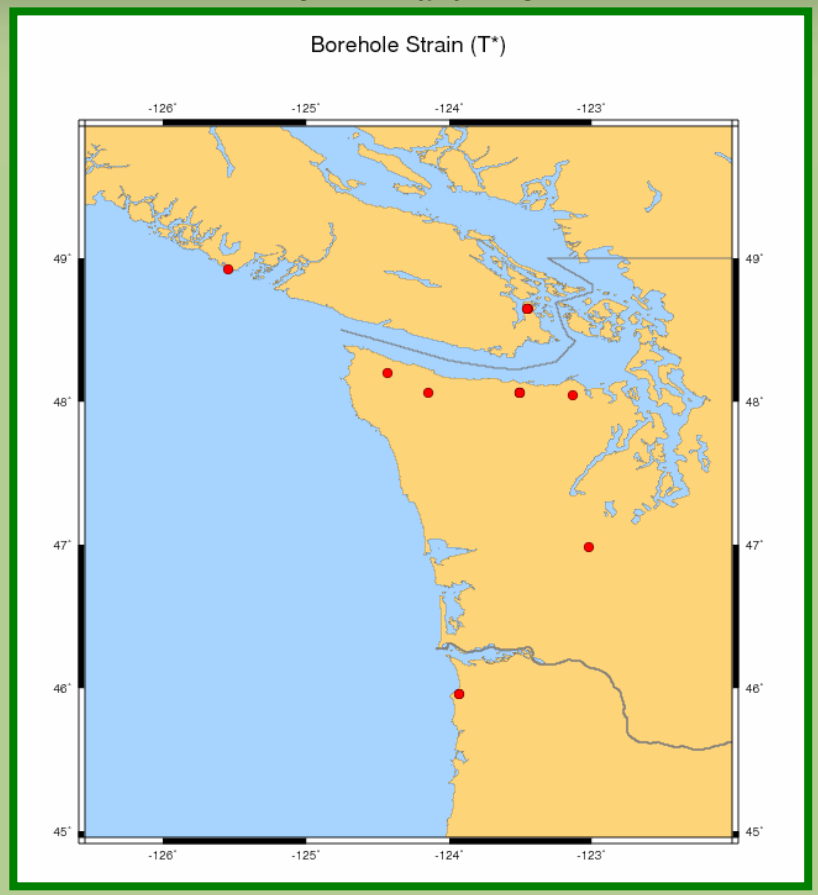
SPADE and EarthScope Components

- SPADE already has
  - Ingested PBO XML Products
  - Wrapped SAFOD Products and ingested them
- Designed as a distributed system
  - Instances of SPADE could be running at
    - EarthScope HQ
    - NSF
    - PBO
    - SAFOD
    - USArray

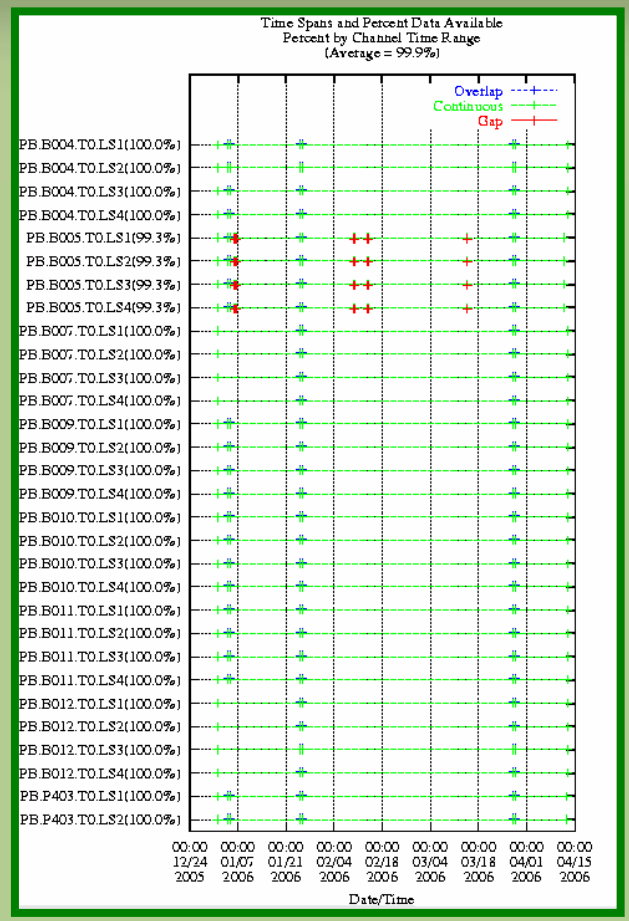
Current Status - PBO Strain

13 Borehole Strain Stations

From ANF and PBO



99.9% Data Return

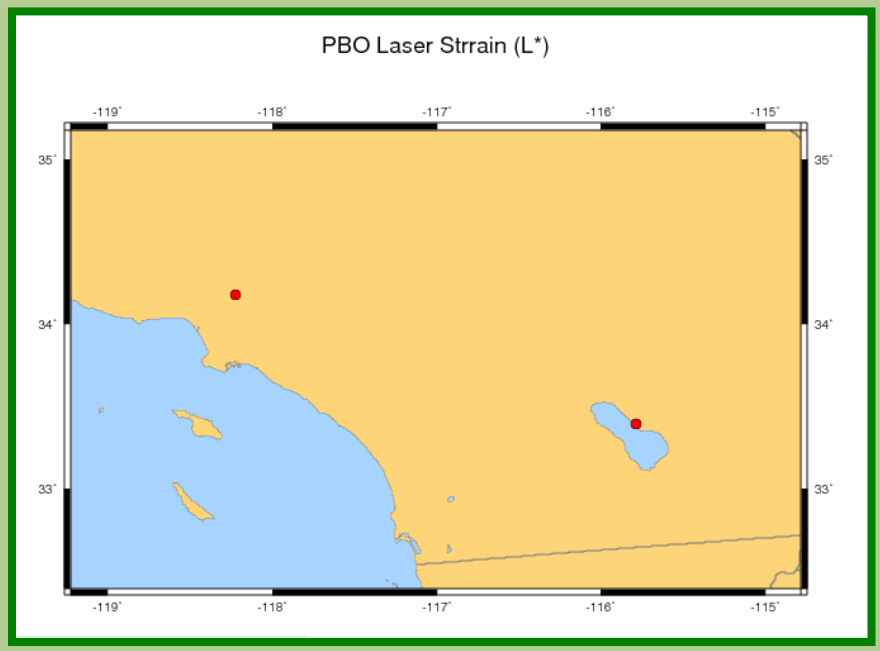


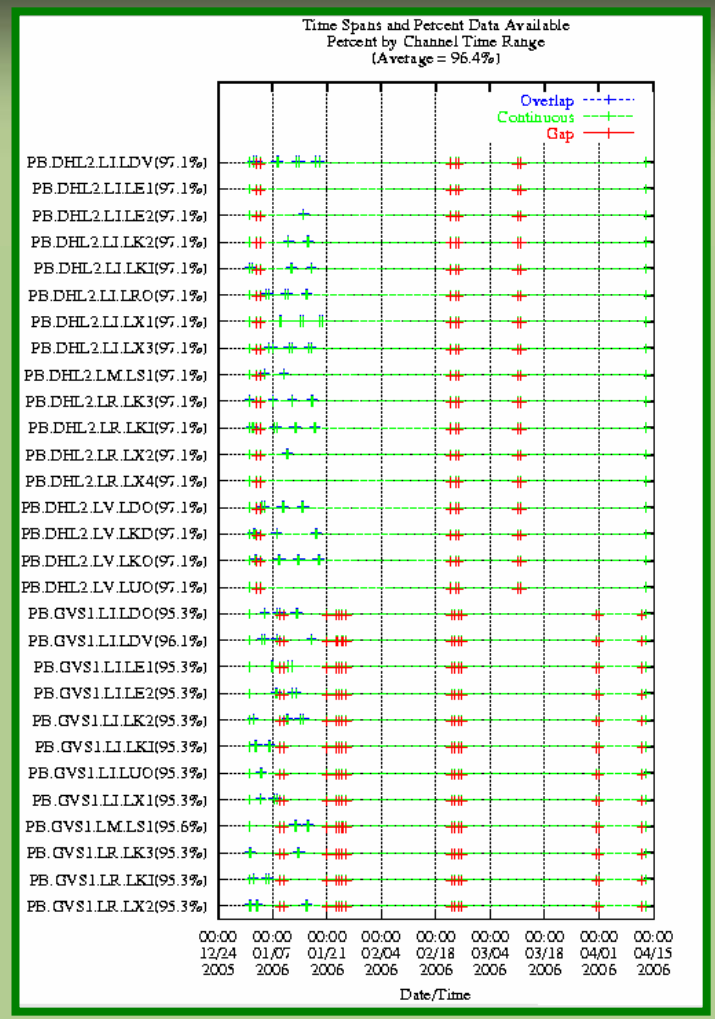
We also receive borehole strain data in native Bottle format via Unidata LDM

Current Status - PBO Strain

96.4% Data Return

2 Laser Strain Stations



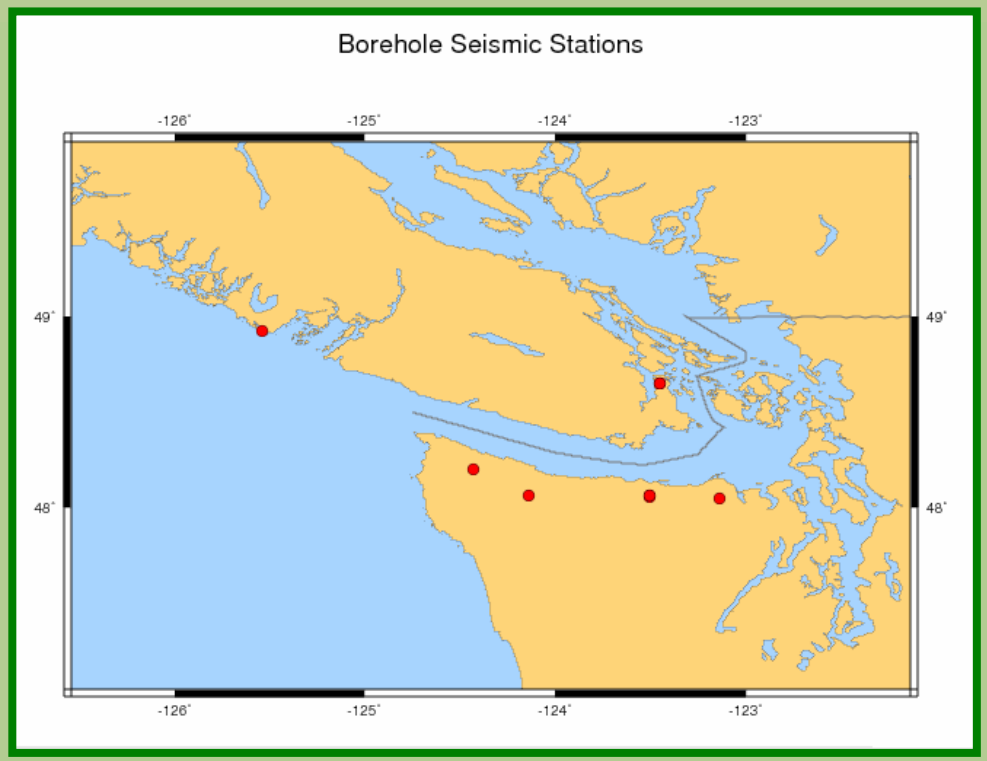


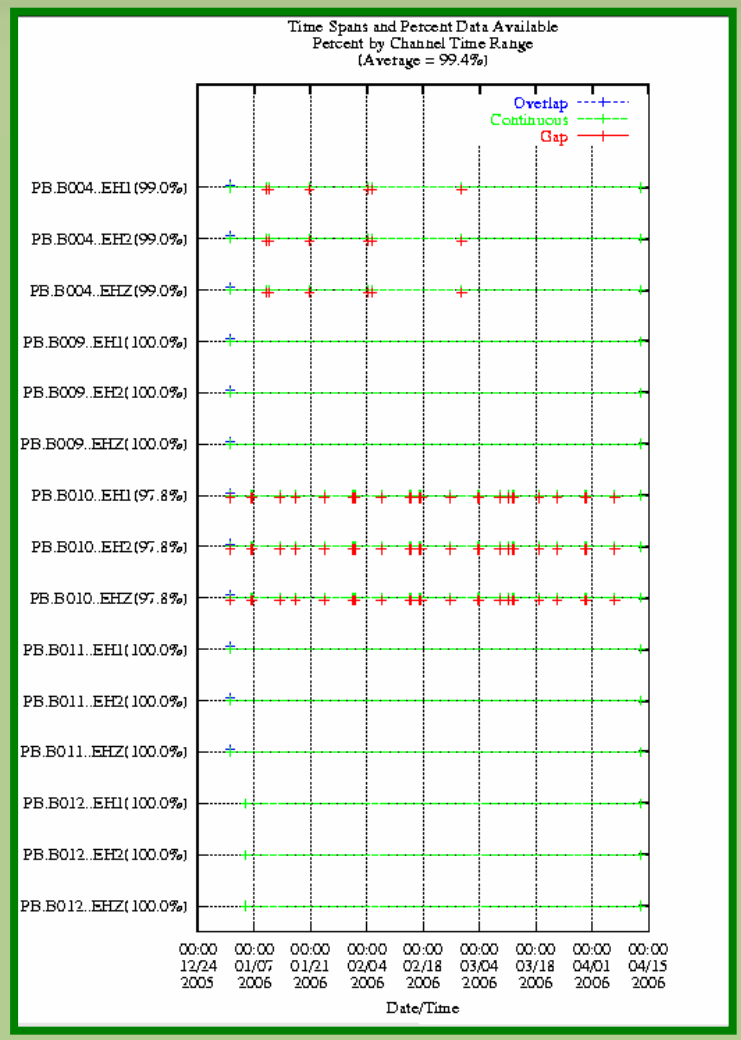
We also receive laser strain data in native ICE-9 format via Unidata LDM

Current Status - PBO Seismic

99.4% Data Return

13 Borehole Seismic Stations

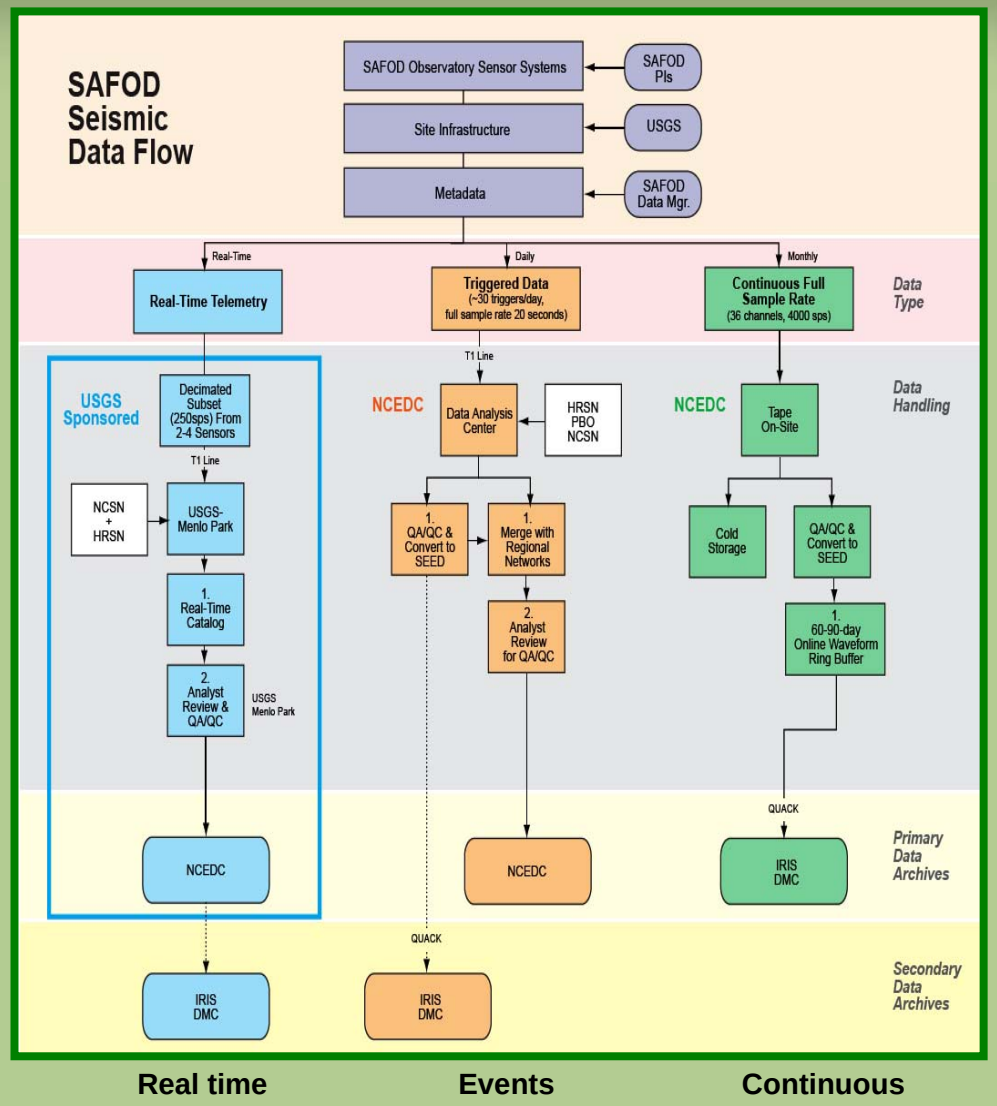




N10

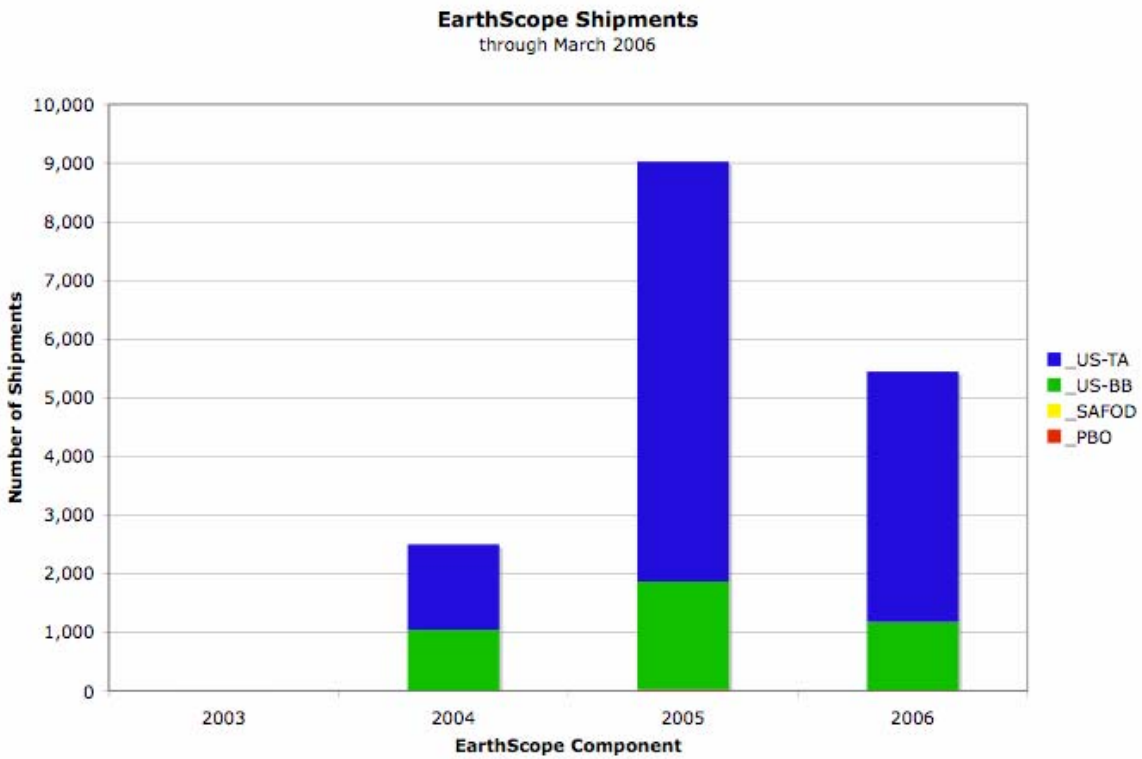
SAFOD Data

- All Data from NCEDC Electronically
  - All metadata will come from SAFOD
    - Data Manager & NCEDC
  - Real Time Telemetry
    - 90 gigabytes/year
    - Ingest into BUD and apply QUACK QA
  - Triggered Data
    - 85 gigabytes/year
    - Ingest into BUD and do not apply QUACK
    - Managed as Products?
  - Continuous High Sample Rate
    - 12 terabytes/year
    - Ingest electronically using method TBD
      - Data will be episodic
    - Develop appropriate QA (gaps, overlaps, SNR?)
    - Store as Tier-2 data



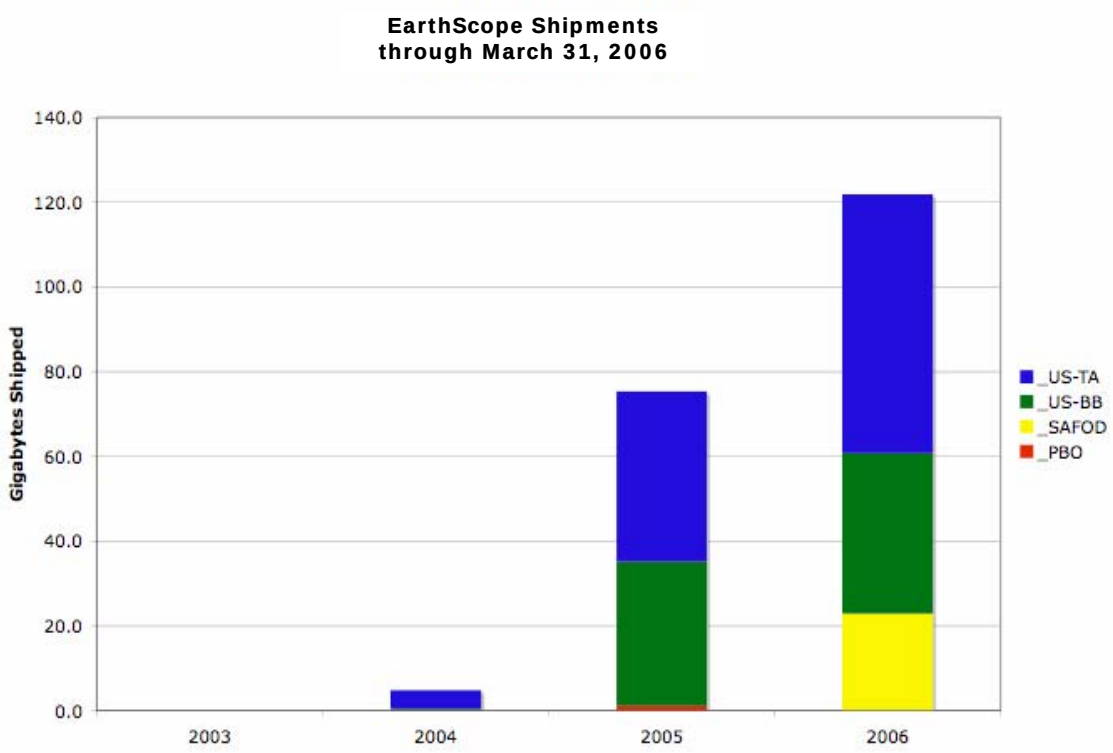
N10

EarthScope Data Usage:
Shipments - 2.5 times higher rate than last year



EarthScope Data Usage:
Data Volume Shipped

SAFOD and USArray Shipment Volume through March exceeds entire year of 2005



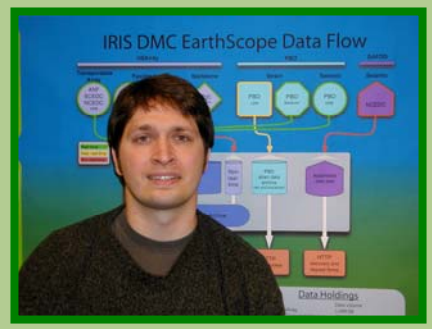
USArray Staff at the DMC

Peg Johnson

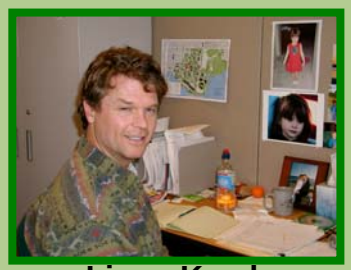
Mari Francissen

Lonny Jones

Tim Ahern



Chad Trabant



Linus Kamb

Thani Rojanaparpai

Mary Templeton

Stacy Fournier

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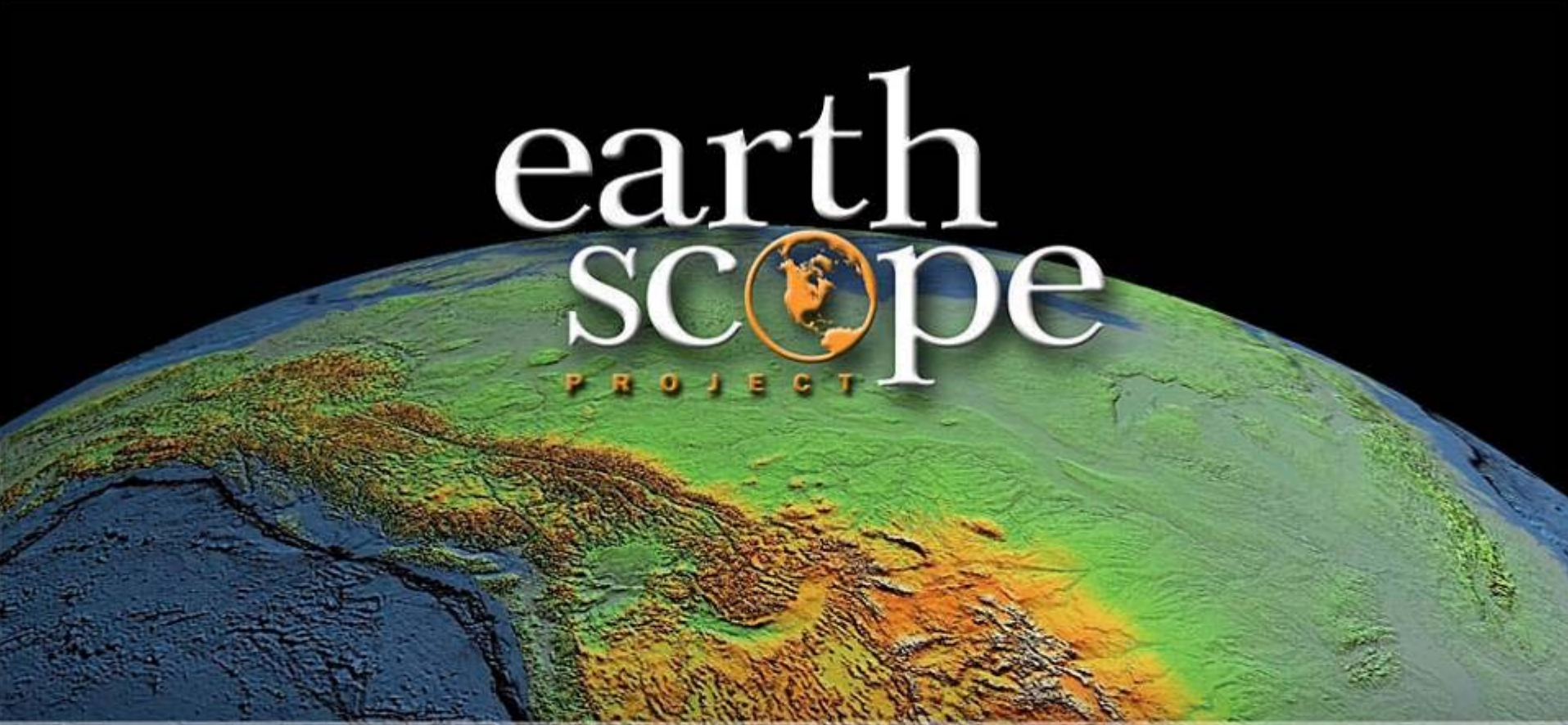


USArray EFEC Site Review
David Simpson

May 17, 2006

USArray Developments 2005-2006

USArray Team is in place and performing well

- USArray Manager appointed
- TA, MT Managers appointed
- TA, FA, MT, DMS, TACO staffing filled
- TA Operational Plan established
  - Permanent positions filled
  - Scalable contractor support (construct and install) established
  - Siting plan established
- FA operations and field support active at NMT
- PA activities strengthened at ASL
- Reporting and EVM practices improved

- April baseline revisions adopted
  - Transportable deployment efficiency
  - Revised costing, especially for Management, FA and PA

USArray Developments 2005-2006

- Community Involvement
  - USArray Advisory Committee
    - Meeting 12/05, 03/06, 05/06
  - TA Working Group
    - Meeting 12/05, 04/06, monthly conference calls
  - PA Working Group
    - Teleconferences as required
  - MT Working Group
    - Meeting 12/05, bi-weekly conference calls
  - Siting Workshops
    - Oregon (6/05), Arizona (11/05), Utah (5/06)
  - GeoFrame
    - St Louis 02/06
  - IRIS Workshop
    - June 7-10, 2006
    - “USArray Today,” June 8
    - MT and Data Access pre-Workshop short courses, June 7

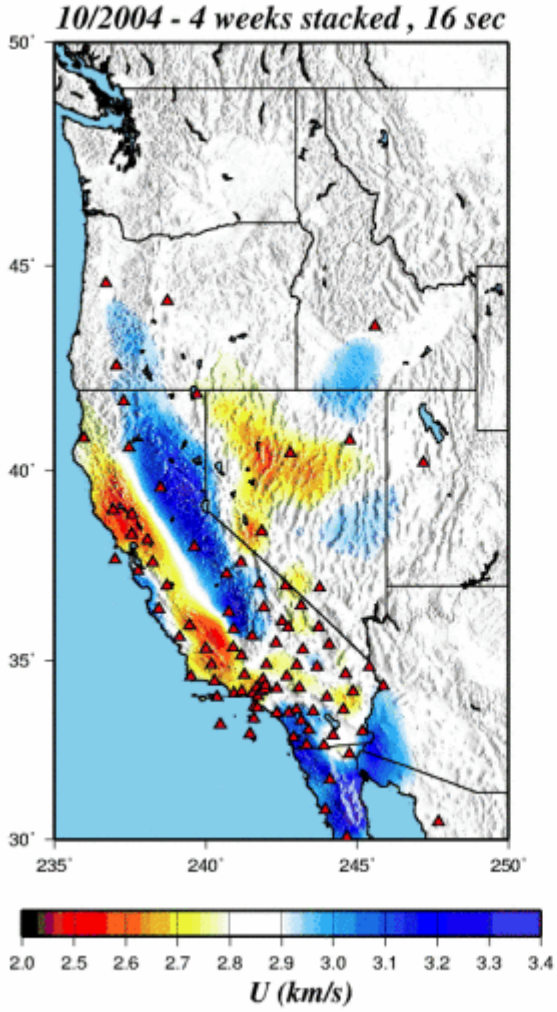
USArray Developments 2005-2006

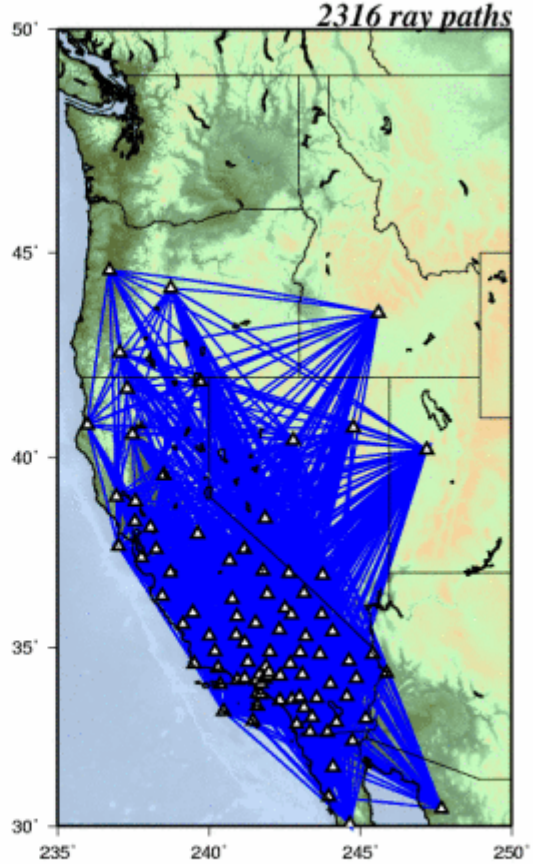
- Data Utilization and PI Interactions
  - Flexible Array
    - PI training and field support
  - Transportable Array
    - TA Working Group
    - Noise assessment and data quality
  - Permanent Array Network
    - Siting guidance and interactions with TA, MT and PBO
  - Magnetotelluric
    - EMWoG, EMSOC and Oregon Pilot Project
  - Regional Networks and NEIC
    - Access to current TA data
    - Future adoption of TA stations – especially with non-NSF funding
  - Data Management
    - Providing data to users and feedback on access tools and products

TRACKING THE PROGRESS OF THE USARRAY TRANSPORTABLE ARRAY: SURFACE WAVE TOMOGRAPHY FROM AMBIENT SEISMIC NOISE

Morgan P. Moschetti, Michael H. Ritzwoller, Nikolai M. Shapiro
Center for Imaging of the Earth's Interior
Department of Physics, University of Colorado at Boulder

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.


10/2004 - 4 weeks stacked , 16 sec
50˚
45˚
40˚
35˚
30˚
235˚
240˚
245˚
250˚
2.0 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4
U (km/s)


2316 ray paths
50˚
45˚
40˚
35˚
30˚
235˚
240˚
245˚
250˚