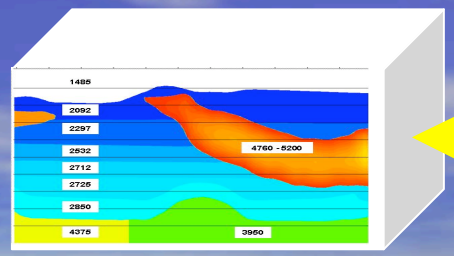
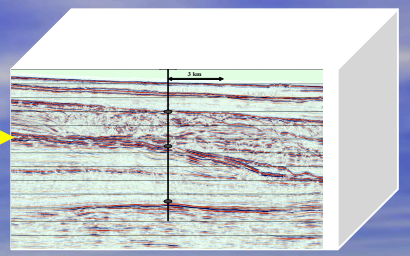
SEAM
SEG Advanced Modeling Consortium

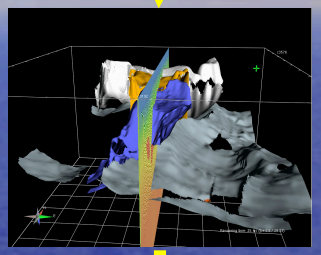
SEAM Plan

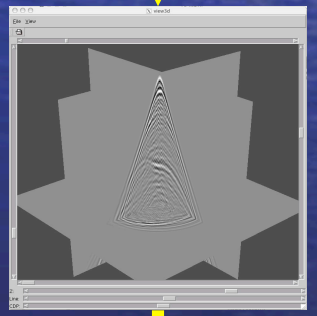
- Design
  - Model
  - Algorithms
- Data Generation
  - Realistic Deliverables
  - Execution
- Data Storage
  - Central site
  - Easily accessible





Realistic Model





Synthesis

Storage and Retrieval

Model design working group in progress

Amerada Hess, ChevronTexaco, CONOCO, EXXONMOBIL

Numerical modeling and software working group in progress

J. Blanch, Phil Bording, A. Cheng, W. W. Symes, D. Aldridge, …

Model execution issues

OS/Hardware/Software Guru

Domain Decomposition, Large number of CPUs,Large runtimes, Data Compression,

OS/Hardware/Software compatibility

Data distribution and archive

Data management guru

10-20 Terrabytes compressed (10:1), Software,

Model Design

- Model Design (Max) $
  - 40000X40000X10000 meters
  - 4000X4000X1000 cells
  - 64 Gigabytes
  - 60 GOM Blocks
- Algorithms $
  - Verification tests
    - Variety of code
  - (4,4)
    - Efficiency Dispersion

Air flow in a modern computer room

Algorithmic Impact

- At 15 m spacing:
  - 30,000 X 30,000 X 10,000 m model
  - 2000X2000X750 compute cells
    - 12 Gigs
  - 1 Gig per CPU
  - 48 CPU's per shot
- At 10 m spacing
  - 3000X3000X1000 compute cells
    - 36 Gigs
  - 1 Gig per CPU
  - 144 CPU's per shot

A pure memory hog

Domain decomposition

The EARTH Simulator
3 Megawatts
500 Million US $
It doesn't simulate global warming,
IT CAUSES IT!
But it would be nice to use

Execution - Hardware

Acoustic Finite Difference Problem Size Estimator (blue=user entry)

Earth Model Parameters		***Acquis & Proc Parameters***		***Algorithmic Parameters***		***Machine Parameters***	
Length (full model)	40000	***Max Freq***	**50**	***PseudoSpect?***	**yes**	Gflop/sec-cpu	1.50
Width (full model)	30000	Max Offset	8000	***O(Xspace)4,6?***	6	$ per cpu-hour	0.10
Height	10000	Desired drec	25	FDpts/minwavele	2.0		
Vmin	1500	***Nstreamers***	**10**	***O(T) 2,4,Hyb?***	Hyb		
Vmax	4500	xline/iline binsize	2	***Ops/cell/dt*** (depe	**80**		
Water Depth	1000	Max Rec Time	11				
Variable Density	**yes**	***Mig-Apert Radius***	**8000**				
				Dom VKdt (~ 2/(p	0.192		
				2nd Order T		**4th** Order T (!! Assuming locally constant vel & den)	
				VPhase Disp% at	0.15	VPhase Disp% at	-0.0002
				VGroup Disp% a	**0.47**	**VGroup Disp% a**	**-0.0010**
Max allowed dx	15.00	Ncells (millions)	3,596	inline dShot	50	dShot unaliased (	7.73
dx (=dy=dz)	15	active nx*ny*nz*nt	7.7E+12	xline dShot	250	alias angle in cmp	8
dRec	25	**Total Model Mem (G**	**53.58**			alias angle in cmp	17
nx earth model	2670	**Active Mem (Gb)**	**11.43**	Nshot iline	800		
ny earth model	2010			Nshot xline	120		
nz earth model	670			Total Nshots	96000		
nxactive	1070	Gflop/shot	5.7E+05	Total Gflop	5.5E+10		
nyactive	1070	1Shot cpu-hour	105.8	Total cpu-hour	10,160,373		
Sugg Tmax	10.04					#clstrs,6mos	Cost Sensitivities
dT(msec)	0.0011			**x000 cpu-days**	**424**	2.3	d$/d(km) 101,600
nt	10000	**1Shot $Cost**	**10.58**	**Total $Cost**	**1,016,000**		d$/d(Hz) 121,920

So ~ $2,000,000 is not unrealistic

Deliverables

- Initially
  - Compute model wide swaths (10-20)
    - 30,000 X 30,000 aperture
  - Surface and OBC
- Ultimately
  - Sufficient shots for an 8 streamer Acquisition
  - Surface and OBC
- 2.5 D data sets from selected models

Execution - Management

Guru to load code, test, train and execute

- Not a full time job
- Consultant

Data Storage and Retrieval

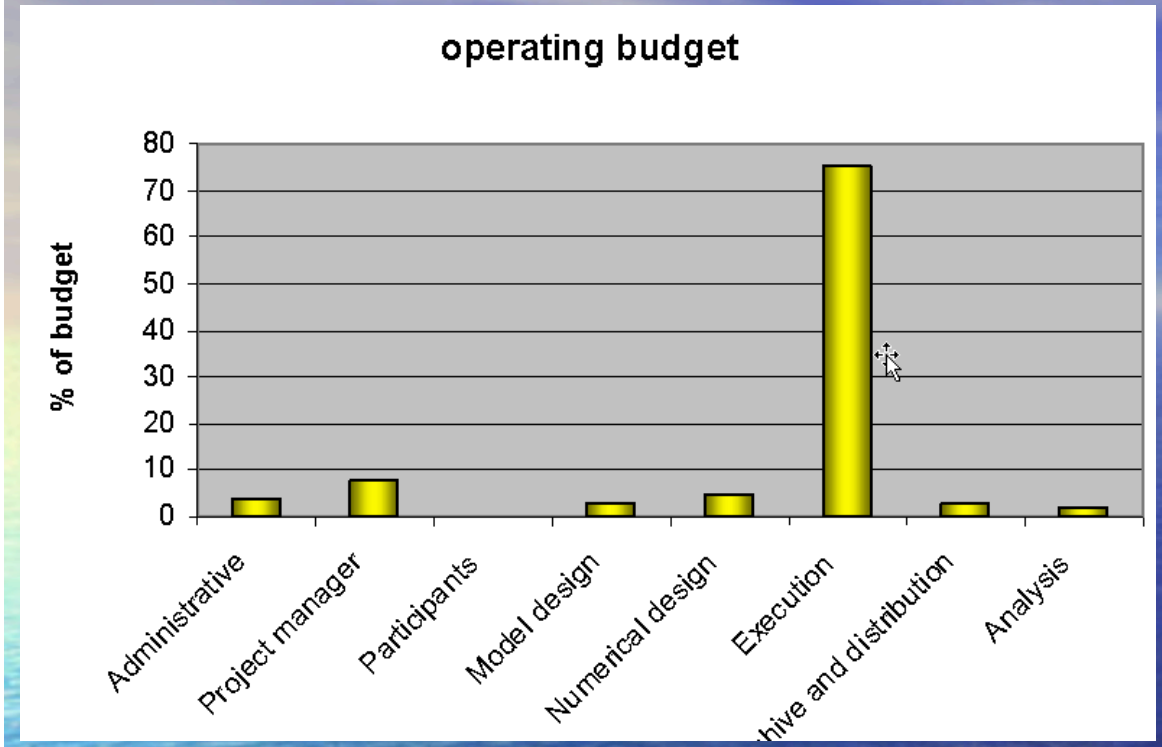
50 Terrabyte:

250 Gig Disk ~ $100

400 for RAID 5 ~ $40,000

Frequently asked organizational questions:

- Budget assumptions
- Expected time duration of consortium
- Number of participants
- Contribution schedule
- How will consortium function
- Legal items
- Data ownership rights and privileges
- Intellectual property
- In-kind contributions



20 participants @ $50,000 annual

2 year initial activity, renewable

	% Expenditures	$
Administrative	4	$ 40,000
Project manager	8	$ 80,000
Participants	0	$ 0
Model design	3	$ 30,000
Numerical design	5	$ 30,000
Execution	75	$750,000
Archive/Distr.	3	$ 40,000
Analysis	2	$ 20,000
		$990,000

Operator
(Administrator)

Executive Committee
(Participants)

PROJECT MANAGER

CPU contractors

Model design group

Numerical group

University projects

Legal and Financial Structures

- Umbrella contract adapted from long standing “DeepStar” consortium
- Published business and operating plan
- Specific work proposals (e.g. key model executions) voted on as budget items by participants only, with advice from SEG and EAGE research chairs.
- SEG provides fiscal and legal controls, collects and distributes funds
- Work contributions from participants or interested parties gratefully accepted
- Delivered data to be protected intellectual property for 2 years prior to access by public
- Universities encouraged to work on data early on in trade for data license

Key Contractual Milestones

- Nov 1, '05- Verbal pledges from key participants
- November 10 – SEG workshop
- December 1 - distribution of legal contract
- December 15 - EXCOM ratification
- January 3, '06 – collection of funds
- February 1 – consortium vote on proposed model
- June 30 - Initial hardware contracts
  - Execution and data storage
- July 1 – consortium closed to early participation
- July 1 - Initial execution runs
- December 31 - Initial swaths completed and available