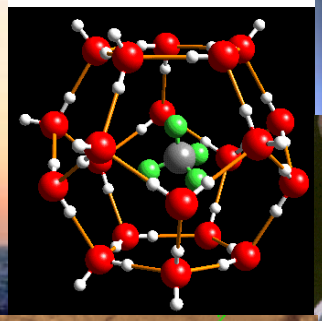
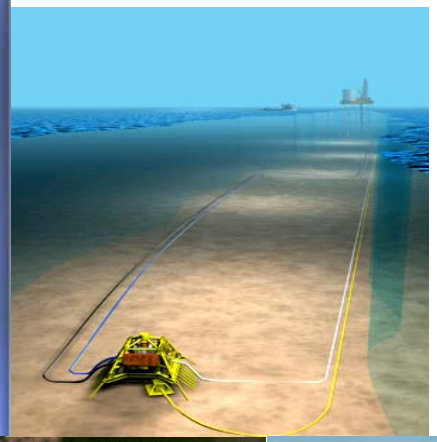
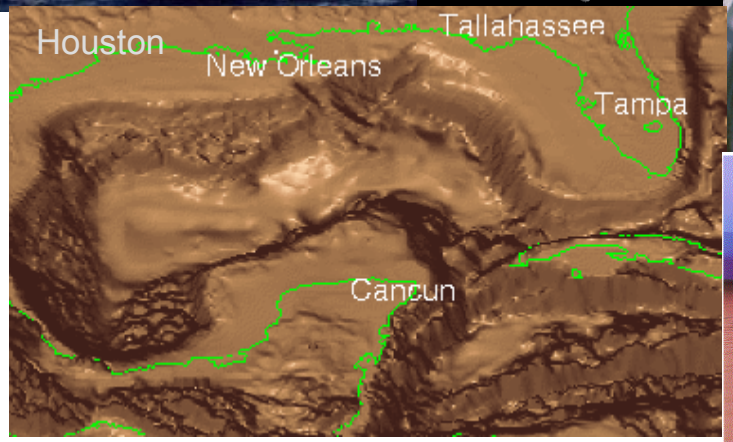
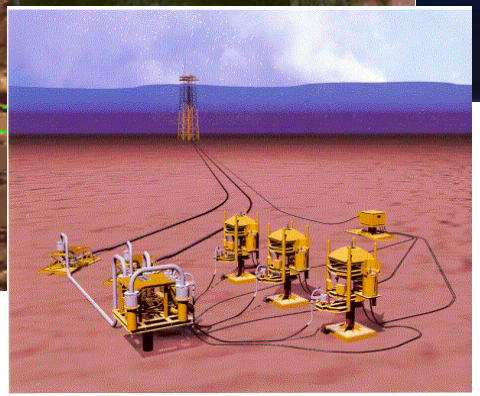
Characterizing Natural Gas Hydrates in the Deep Water Gulf of Mexico



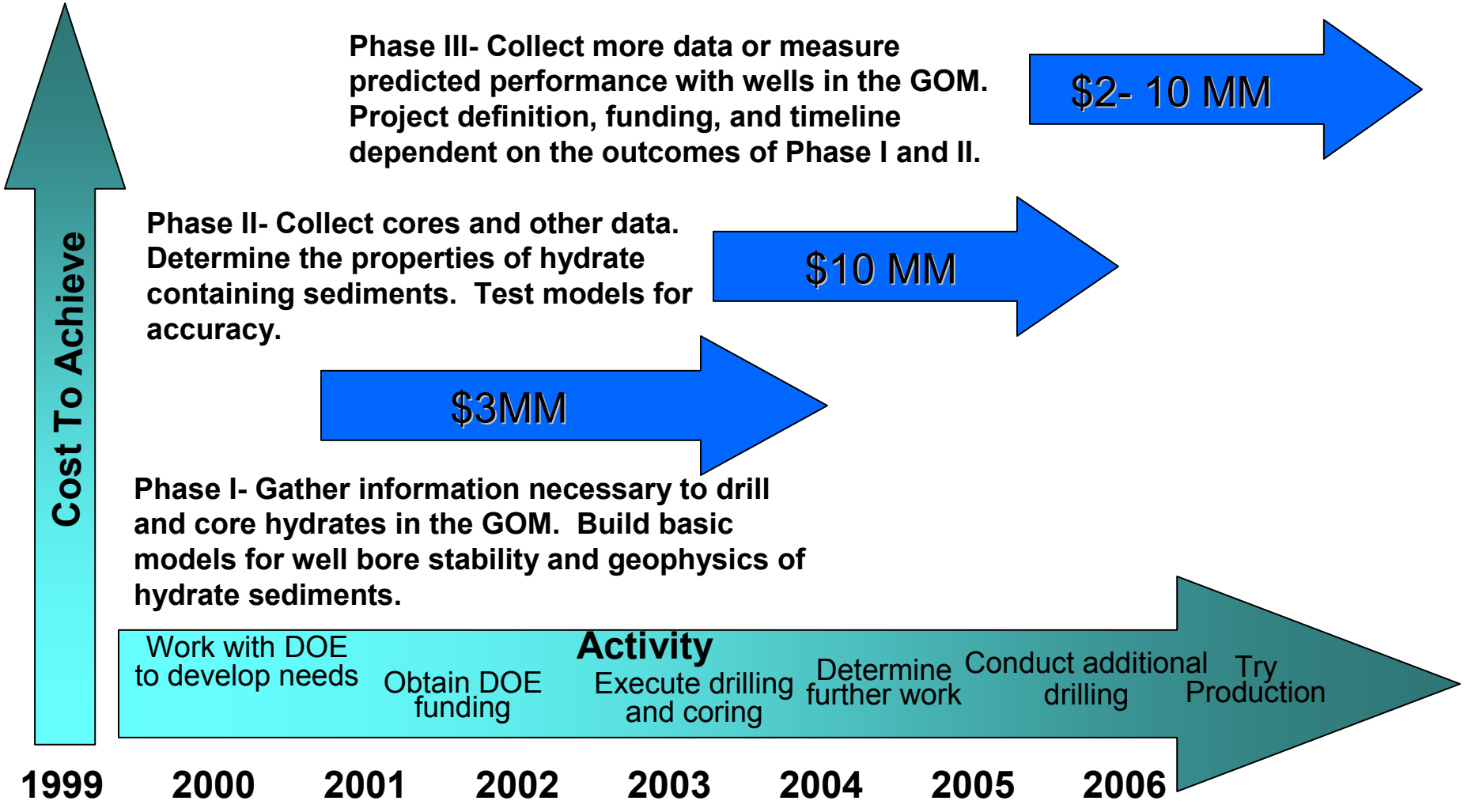




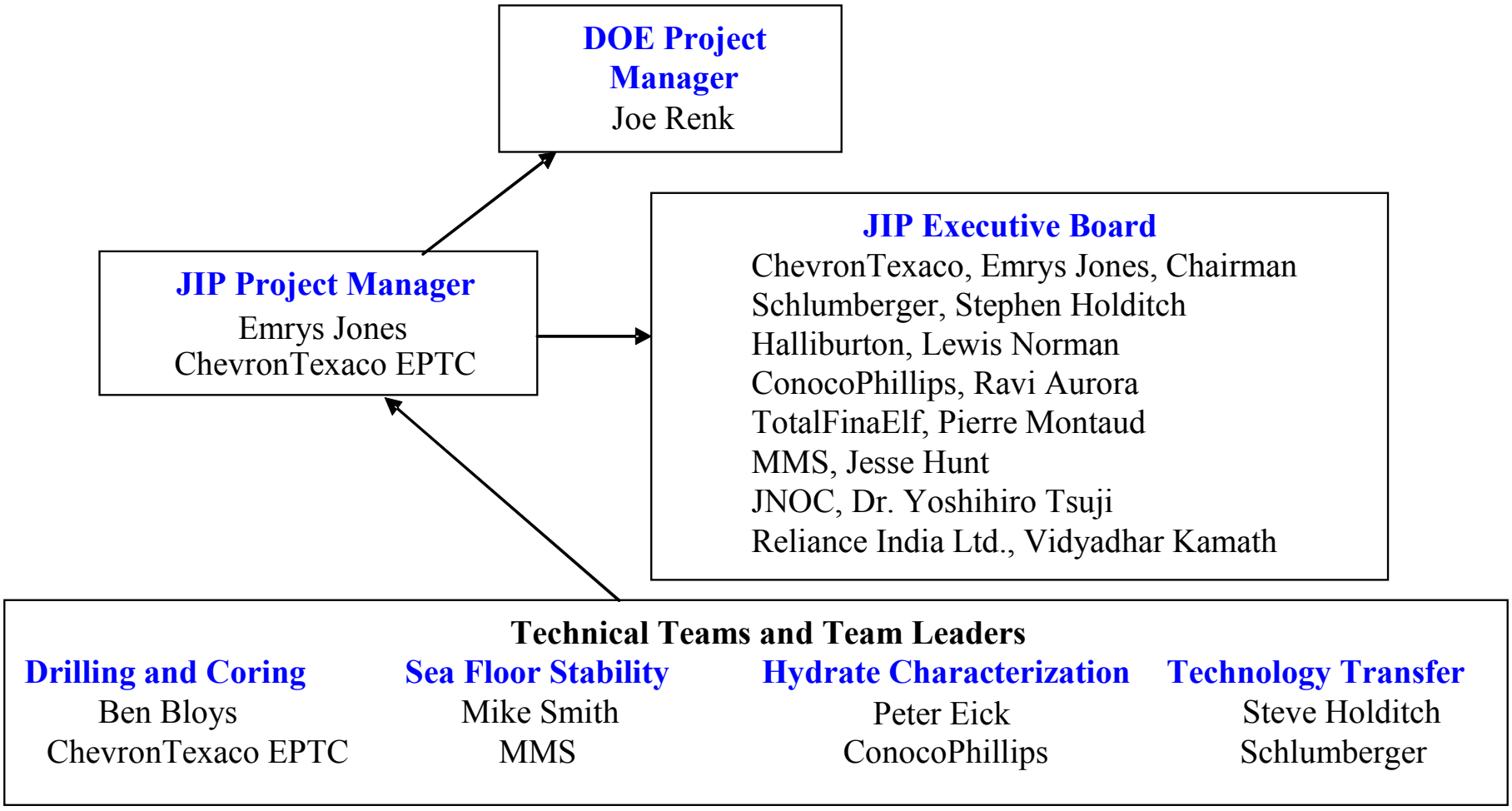


GOM Hydrate JIP Project Plan

DOE Cost Share ~ 80%



Project Organization



Phase I Activities and Linkages

Lab

Georgia Tech

JNOC

USGS

Modeling

WesternGeco

Schlumberger

Georgia Tech

USGS

NRL

Cruise Planning

JOI/TA&M

SIO

JIP companies

Fugro

Remote Data

WesternGeco

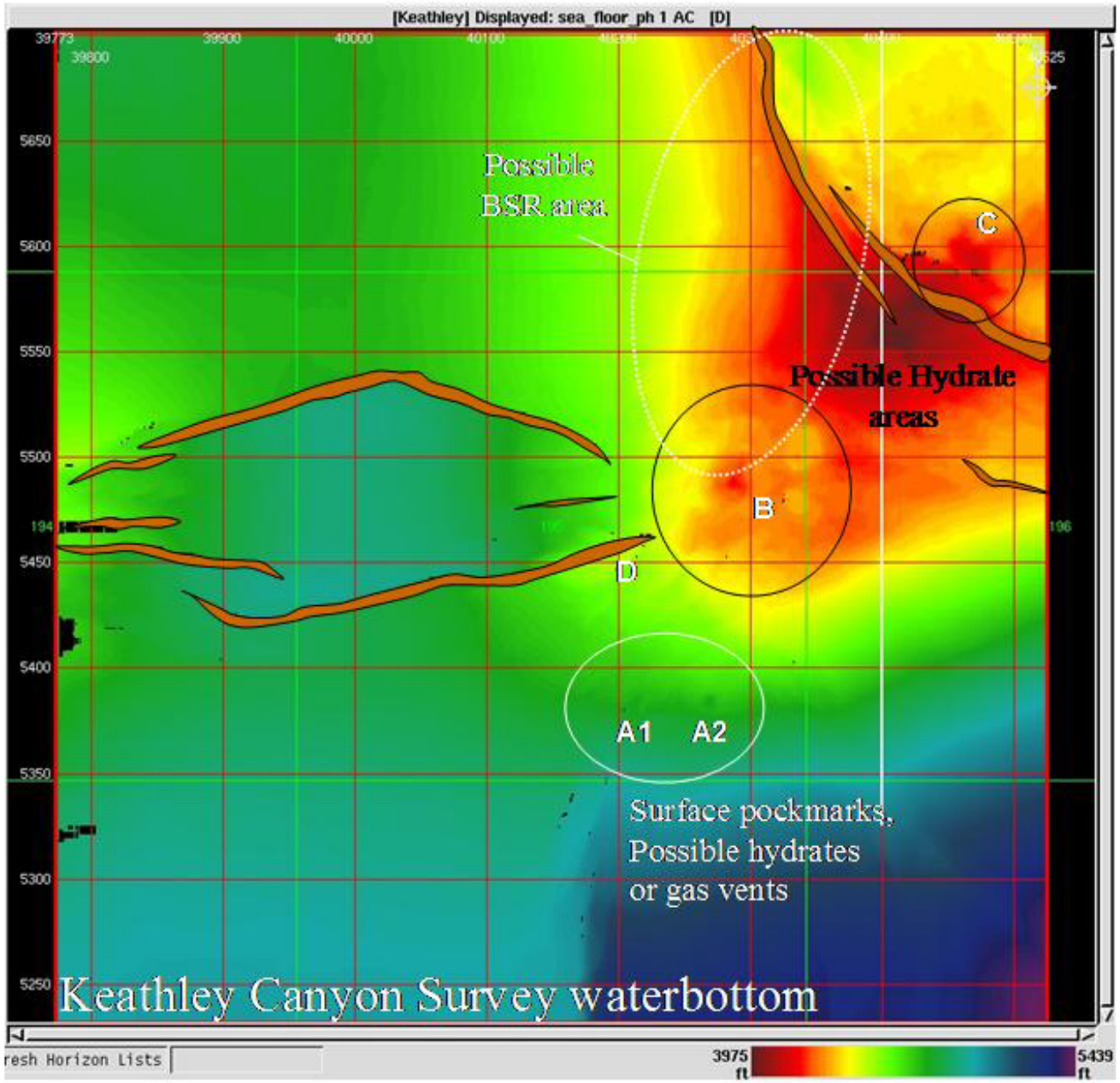
Georgia Tech

USGS

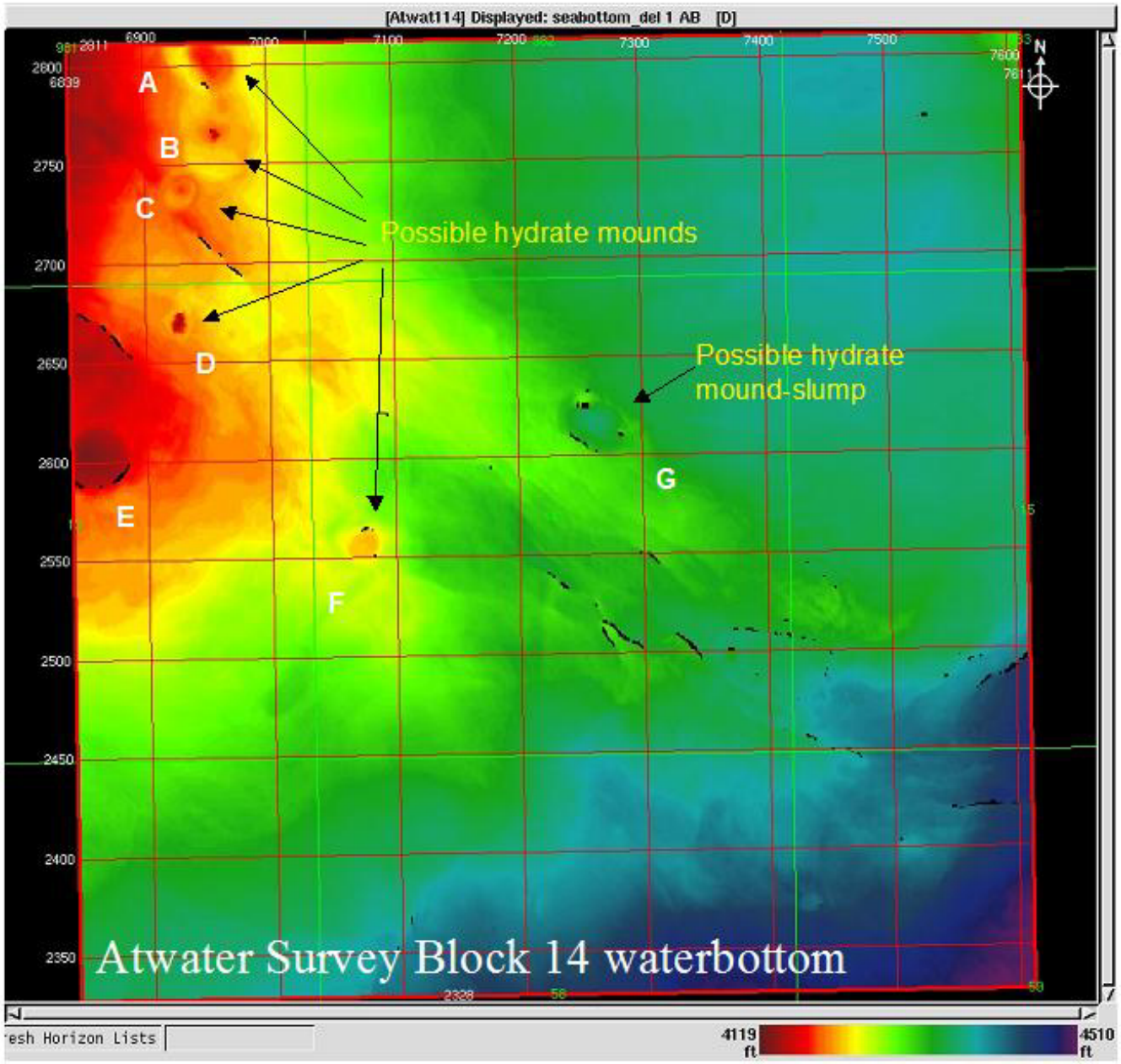
NRL

MMRI

Keathely Canyon Has An Indication of a BSR

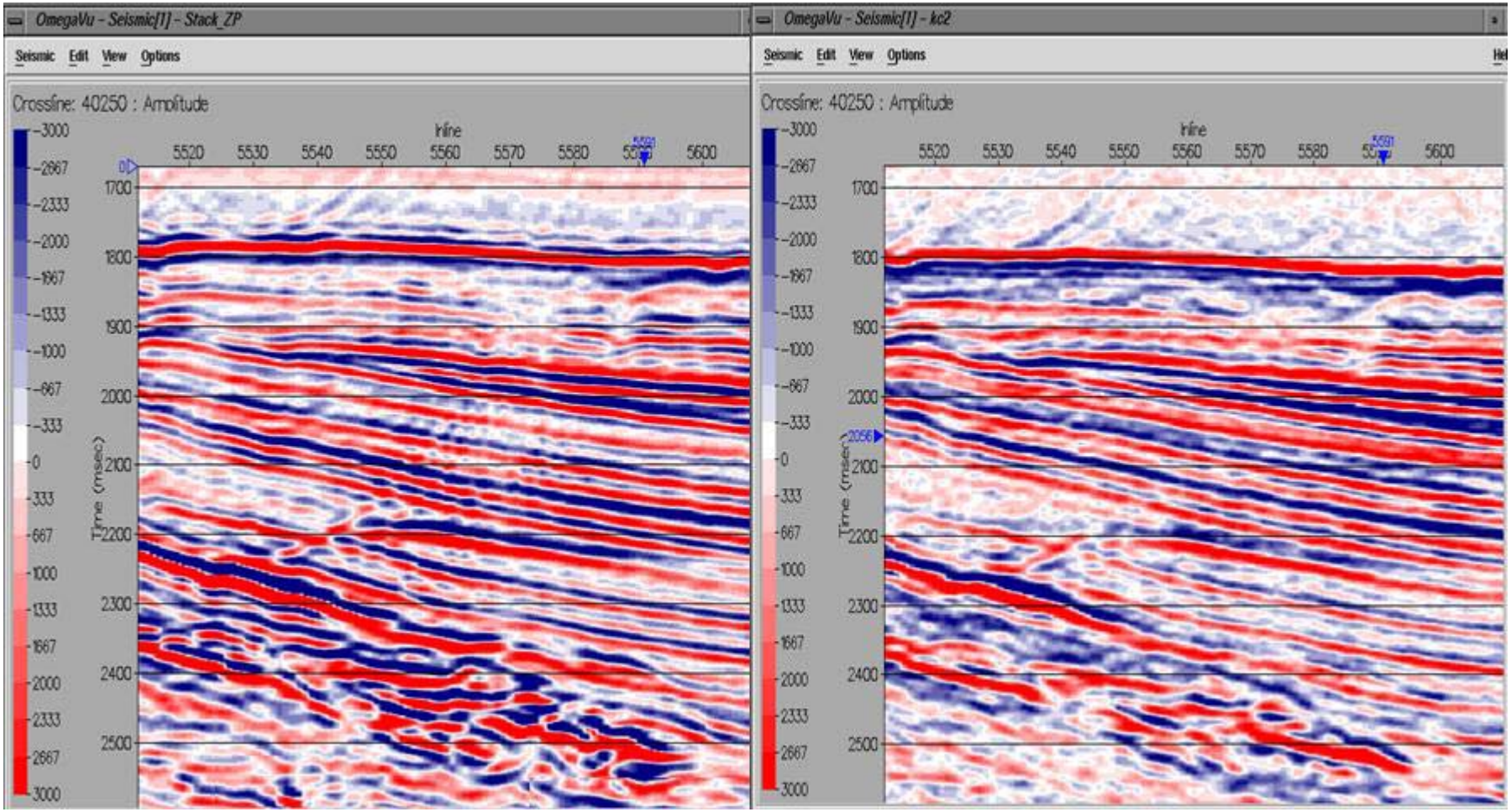


Atwater Valley Has Several Mounds and Vents



Keathley Canyon 195 Reprocessing

Xline 40250 Reprocessing Original



Properties Being Measured by Georgia Tech

Mechanical	Longitudinal and lateral (lower precision) stress-strain
	Elastic-Plastic Transition
	Tensile strengths (indirect from Mohr-Coulomb intercept)
	Shear strength
	Compressive strength
	Failure/stability envelopes (Mohr-Coulomb)
	Bulk moduli static (poor resolution) = Hydrostatic compaction coefficient
	Triaxial compaction coefficient (drained - from longitudinal and lateral stress-strain)
	Young's modulus static (strain level affects)
	Volume-Pressure compaction curves (zero lateral strain) = Uniaxial volume compaction
Thermal Acoustic	Thermal Conductivity
	Thermal Diffusivity (low probability)
	Heat Capacity (indirect; low probability)
	Volume change during phase transformation
	P-wave velocities - Constrained Modulus M - Longitudinal mechanial impedance
	S-wave velocities - Shear modulus G - Mechanical Shear impedance
	Bulk moduli dynamic (indirect through Vs and Vp)
	Electrical Resistivity
	Real permittivity 200 MHz - 1.3 GHz (oedometer at low confinement)
	Hydrate distribution (optical/visual--destructive of sample)
	Pore filling vs. grain boundaries

Georgia Tech is Conducting a Few Experiments

Grain size	100												45												1												18 (CaCO3)				0.01 (illite)				GOM sed			
concentration	0				10				20				0				10				20				0				10				20				0		20		0		20		0		20	
Confining pressure	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	0.50	1.00	2.00	0.01	1.00	0.01	1.00	0.01	1.00	0.01	1.00	0.01	1.00	0.01	1.00
Mechanical	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
	T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T		T	T	T	T	T	T	T	T	T	T	T	T
Thermal acoustic	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
per	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
dis	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
pore	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in

T= TRIAXIAL DEVICE

O = OEDOMETER

C = CONSOLIDATION TEST (OEDOMETER AT LOW CONFINEMENT)

S=selected

in = inferred

Additional Georgia Tech Experiments

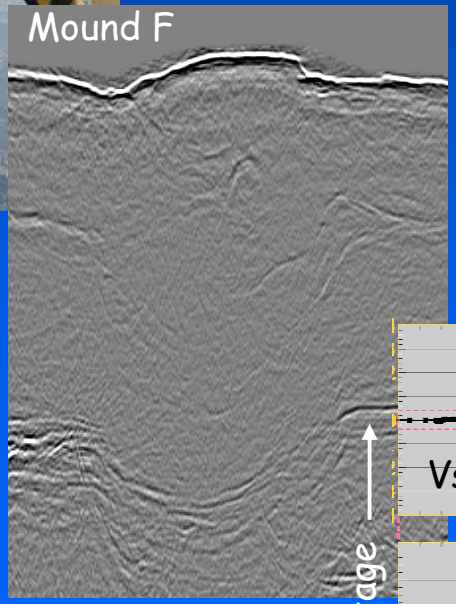
- Using typical GOM sediments Georgia Tech will.
  - Determine the effect of depressurization on the acoustic properties of a core.
  - Determine the effect of an estimated temperature cycle on the acoustic properties of a core.
- These experiments should allow us to estimate the error introduced in obtaining a conventional core as compared to a pressure and temperature compensated core.

Fugro Explorer

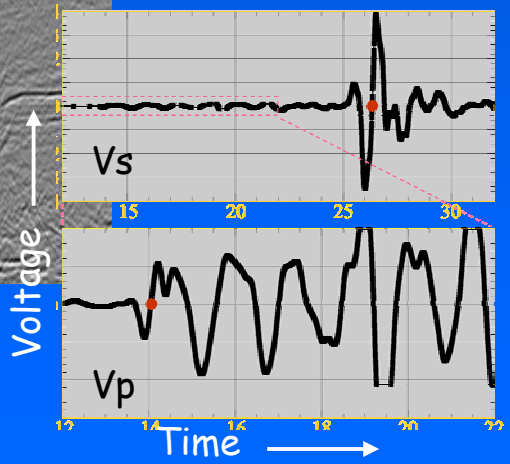
JOI/TA&M is developing the drilling and core handling guidelines

USGS Activites Related to the Gulf of Mexico Gas Hydrate JIP

Giant Piston Coring – to provide geochemical and geochemical information in 0-40 m subbottom depths.



High-Resolution MCS – to provide high-resolution information about mounds, BSRs, and geology



Lab Studies – to provide physical properties of hydrate-sediment mixes at silt sizes (methane and thf hydrate)

USGS

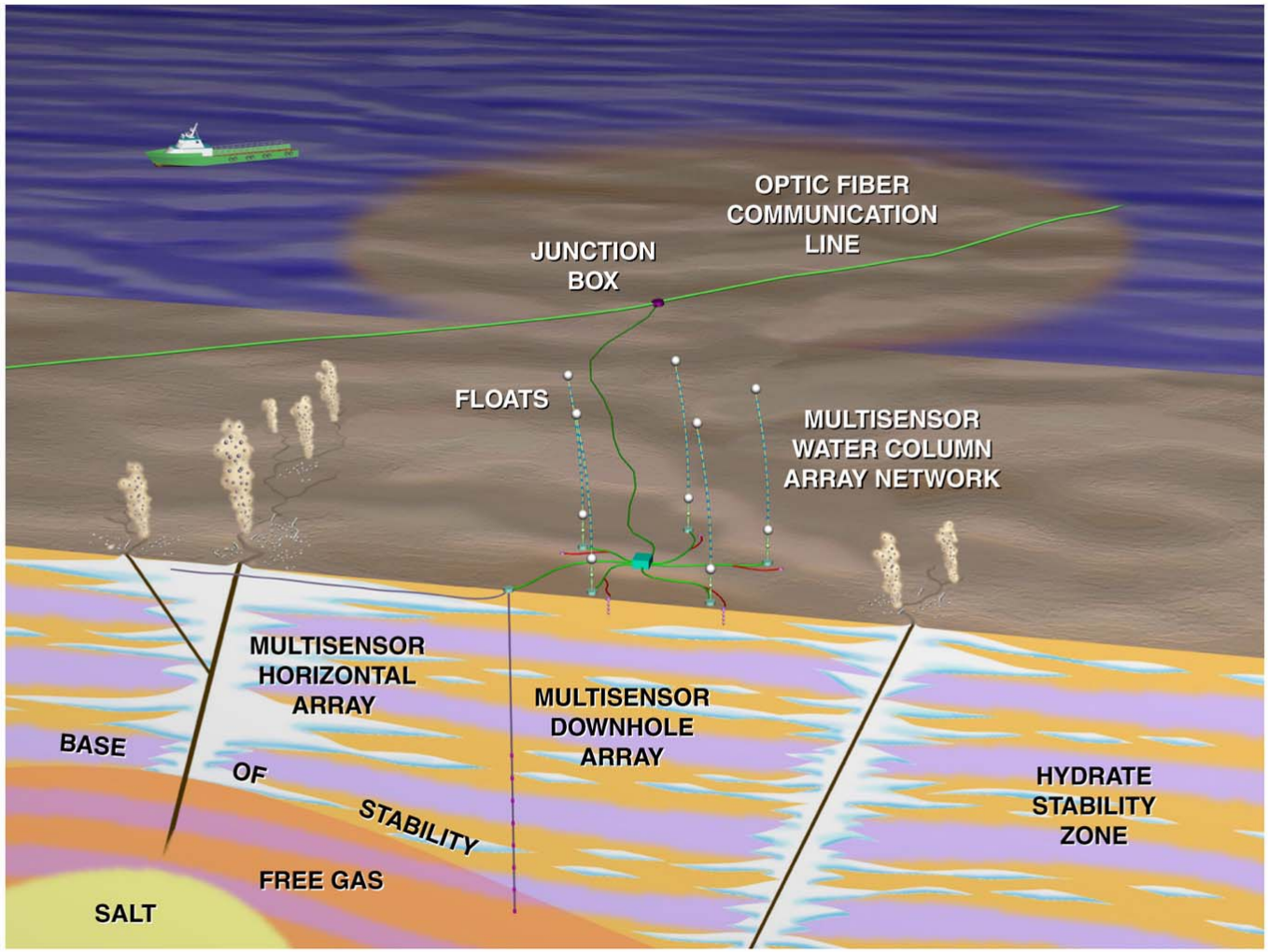
NOAA

NRL

NSF

MMS

MMRI Long Term Monitoring Work



Conceptual Drawing of Hydrate Monitoring Station Proposed for Atwater Valley Block 14
(Includes Array in DOE/JIP Borehole and Associated Horizontal Array)

Linkages Summary

- USGS- May 1-14, 2003 cruise. Collect high resolution seismic data over KC195 and AT14.
- NRL, Georgia Tech, and WHOI - August 5-19, 2003 cruise, deep tow and heat flow measurements.
- University of Mississippi- May 16-21 will conducted high resolution multichannel 500 m bsl, 500 m bml, seismic over AT14.
- University of Mississippi- Arranging to let them use one of our wells to monitor sea bed long term with geophones.

Drilling & Coring Plans for Phase II

- Leg 1 of Drilling and Coring will begin Q2 2004
  - Maybe total 16 holes drilled at 8 sites, likely riserless
  - twin holes at each site – one each for logging and coring
  - final # of holes is rig cost-budget dependent
- Leg 2 of Drilling and Coring may begin Q2 2005
  - will follow thorough analysis of Leg1 data
  - additional 10-12 holes at previous or new locations depending on information required
  - exploring opportunities to install long-term monitoring equipment in the holes

That’s All I have