



# Microturbine Experience in the Gulf of Mexico

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6<sup>th</sup> Annual Microturbine Applications Workshop

U.S. DOE/Canada NRC

January 18, 2006



# Why a Microturbine Offshore?

- **Electricity as a Necessary Evil**
  - Oil Won't Flow w/o Power
  - Really Dark at Night w/o Power
  - Not in the Power Business
- **What We Need**
  - High Reliability - 99% vs. 95%
  - Small Footprint
  - Low Maintenance
- **What We Like**
  - High Efficiency
  - Low Emissions





# BP Installation Overviews -

- Capstone Experience

- GI-41A Offshore Platform
- C60 unit, 55 site kW
- High Pressure NG as fuel
- Prime Power/Island Mode
- No heat recovery



- Ingersoll-Rand Experience

- Grand Isle Tank Battery
- (2) MT250 units, 404 site kW
- Low Pressure Flare Gas as fuel
- Onboard Fuel Booster
- Prime Power/Island Mode
- No heat recovery



# BP's First Offshore Application - GI 41A



GI 41A



20 kW Recip



- Increased Electrical Load
- Unmanned Operation
- Limited Space
- Test Unit Installed 1/02
- Permanent Unit 11/02
- Over 3 Years Running

60 kW MTG

# BP's Grand Isle Tank Battery



Flaring

~~Purchased Power and Natural Gas~~

- Units Operational 6/04
- 9600 Tons/Yr CO<sub>2</sub>E Reductions
- Over \$500,000/Yr Ops Savings

Oil Sold to Pipelines



Oil from Offshore



# Project Cost Tables in US\$

## Grand Isle 41A

Item	Actual
Capstone C60 Offshore Pkg	65,000
Offshore Installation (Two Day Hook-Up)	3,000
Electrical	4,000
Offshore Logistics	2,000
Engineering & PM	2,000
<b>TOTAL</b>	<b>\$76,000</b>

## Grand Isle Tank Battery

Item	Actual	100% Hindsight
I-R MT250 (2)	735,000	735,000
Mechanical	500,000	250,000
Electrical	250,000	150,000
Engineering	400,000	150,000
Project Management	75,000	25,000
<b>TOTAL</b>	<b>\$1,960,000</b>	<b>\$1,310,000</b>



# Package Performance

## Grand Isle 41A

- Hours of operation to 12/31/05
  - Test Unit Ran for 6500 Hrs
  - Permanent Unit Ran for 25,000+ Hrs
- Availability
  - 99.9% Availability and Runtime for Both Units
- Current estimate of annual O&M costs excluding major hot end replacement
  - US\$1000/yr and <\$0.01/kWh
  - Only maintenance was air filter replacements, performed by BP field maintenance staff

## Grand Isle Tank Battery

- Hours of operation to 12/31/05
  - Units Ran for 2825 & 2737 Hrs, respectively
- Availability
  - 73% for One Unit
  - 83% for Other
- Current estimate of annual O&M costs excluding major hot end replacement
  - US\$4000/yr
  - \$0.01/kWh

# BP's General Experience



## Grand Isle 41A

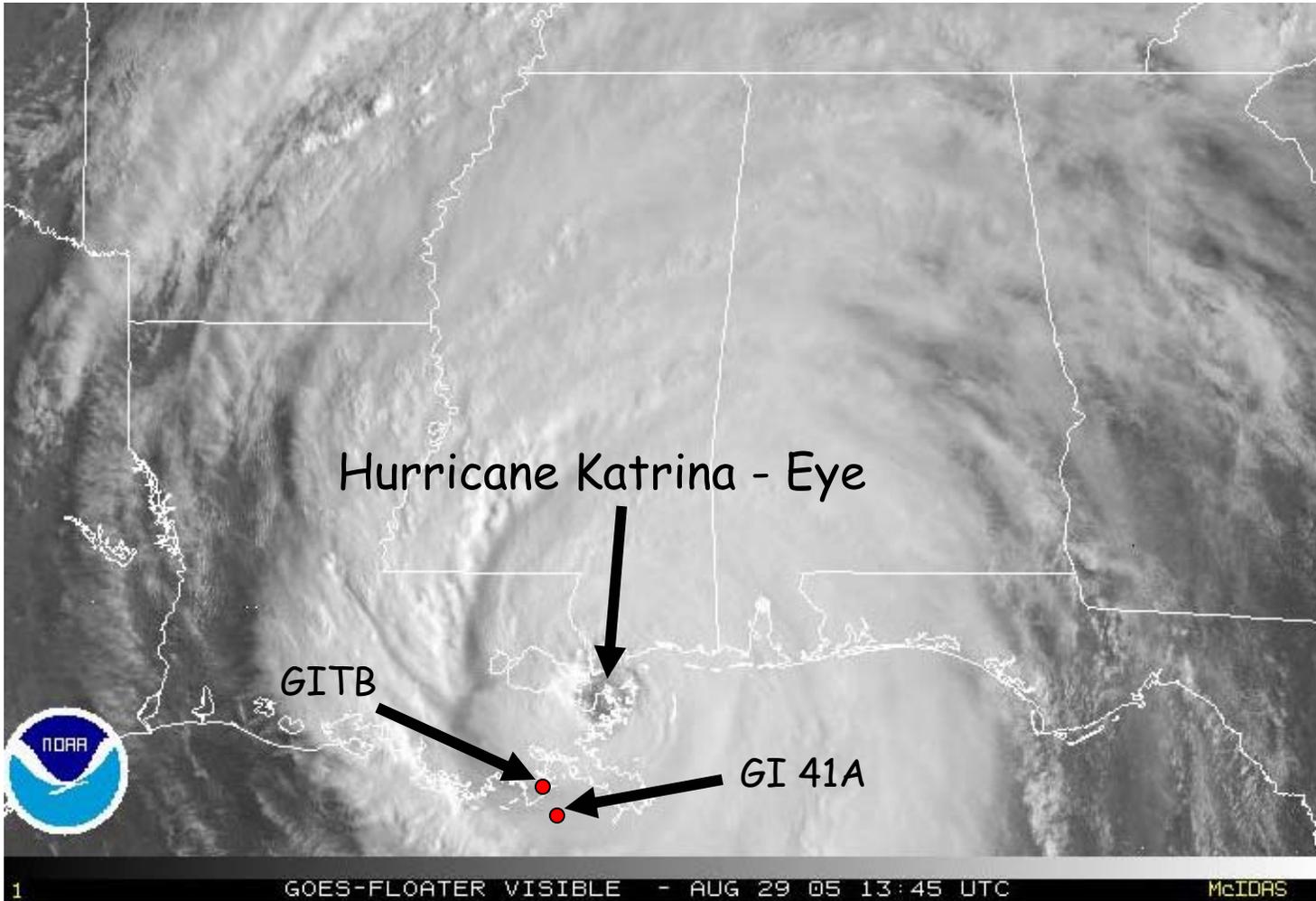
- Package design worked well in offshore environment
- Platform system required 208V vs. 480V generator
- Low emissions, no fluids, almost no maintenance
- Although not required for this project, Class I, Div II now available

## Grand Isle Tank Battery

- First MT 250 installation, grid-isolated, w/ multiple units
- Outstanding Service Support
- Very capable engineering technical support as well as field support
- Warranty issues very quickly resolved to BP's satisfaction



# Current Status - GOM Units



# Next Offshore Application - GI 41B



GI 41B

Opportunity  
Increase Turbine Efficiency  
Reduce Fuel Consumption  
Lower Emissions  
Improve Life-Cycle Cost  
Reduce Power Cost



Replace This



With These

# Conclusions - Lessons Learned/Future Opportunities



- **Power is a Necessary Evil - So Keep It Simple**
  - Simple Installation
  - Small Package Size and Weight
  - Low Maintenance
  - Consider Fired Hour Arrangements for Long Term
- **Vendor Support Critical**
  - Even though BP Knows Turbines, Still Need Specialized Help
  - BP Experience Should Be Incorporated into Future Designs
- **R&D Possibilities**
  - Continue to Increase Electrical Efficiency w/o Losing Reliability
- **Look for GHG Opportunities - Vents, Flares**