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Climate Change Impacts to KSC Launch Complex

Presented to:

2010 International Workshop on Environment and Energy

By:

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Kennedy Space Center

November 2010





Hurricane Season 2004

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KSC Dune Restoration Efforts

Hurricane Francis 2004





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KSC Dune Restoration Efforts

2005 Emergency Hurricane Recovery Funded Dune Restoration





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KSC Dune Restoration Efforts

◆ 2007 Nor'easter sits off coast for 2 weeks...



Dunes Breached
Again



2008 Restoration Shuttle Funds



Tropical Storm Fay 2008





Late Season (May 20 2009) Nor' Easter





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KSC Dune Vulnerability





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KSC Dune Restoration Efforts

◆ Why are Dunes so critical?

- Provide protection from storm surges, protect infrastructure
- Dunes also act as a reservoir of sand, to replenish and maintain the beach at times of erosion, however we are losing our dune therefore there is no source of sand to replenish.
- Dune habitats provide niches for highly specialized plants and animals, including numerous rare and endangered species



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KSC Dune Restoration Efforts

- ◆ Dune restoration started out as a wildlife issue
 - Breached dunes created light impacts to nesting sea turtles
 - Disorientations 4 times higher than our Biological Opinion (permit) allowed in 2007 due to light impacts at breached areas
 - 2008 continued dune erosion from non-Hurricane weather events.



Operation "Dark Dune"



2000



2002



Beaches are eroding at an alarming rate.
Efforts needed to ensure no additional
infrastructure damage.
and avoid a mission risk.
Need to identify root cause of this erosion.
Offshore shoaling? Bathymetric anomalies?

2007





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Dune Erosion

- ◆ Beach is narrow and dunes are being overwashed
- ◆ Beach/dune habitat is already being impacted
- ◆ NASA infrastructure will be at high risk for storm damage if breach occurs



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May 2009



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KSC Dune Restoration Efforts

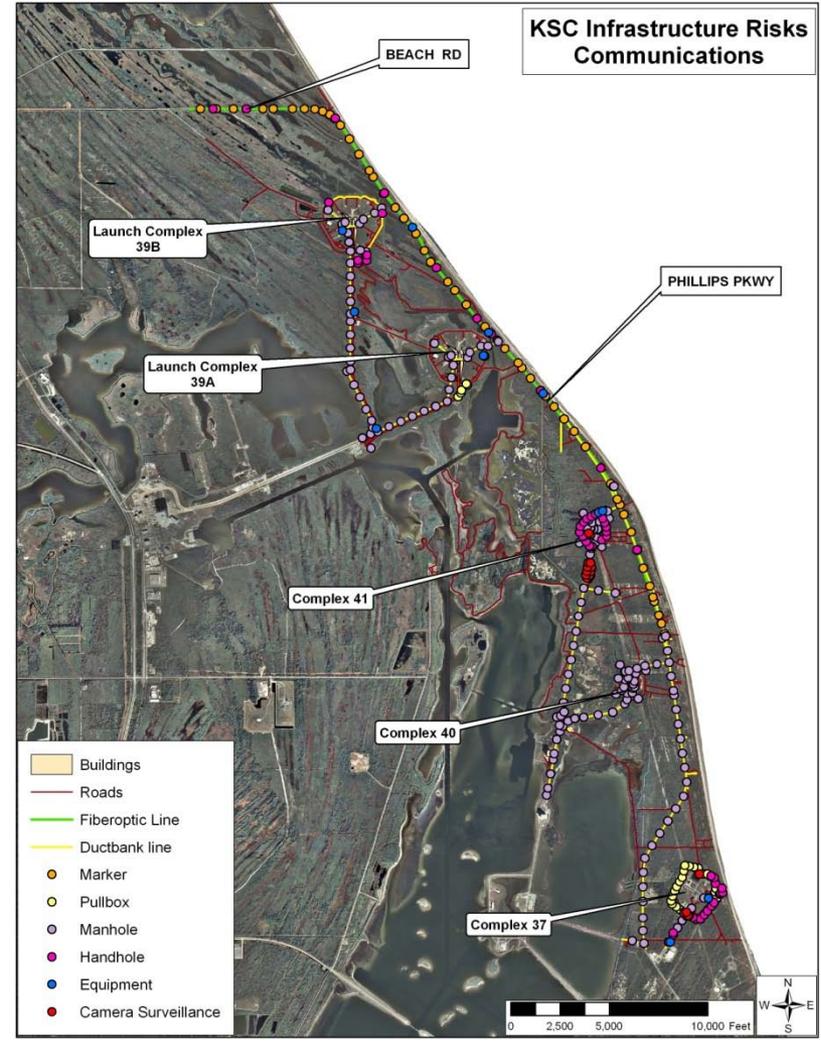
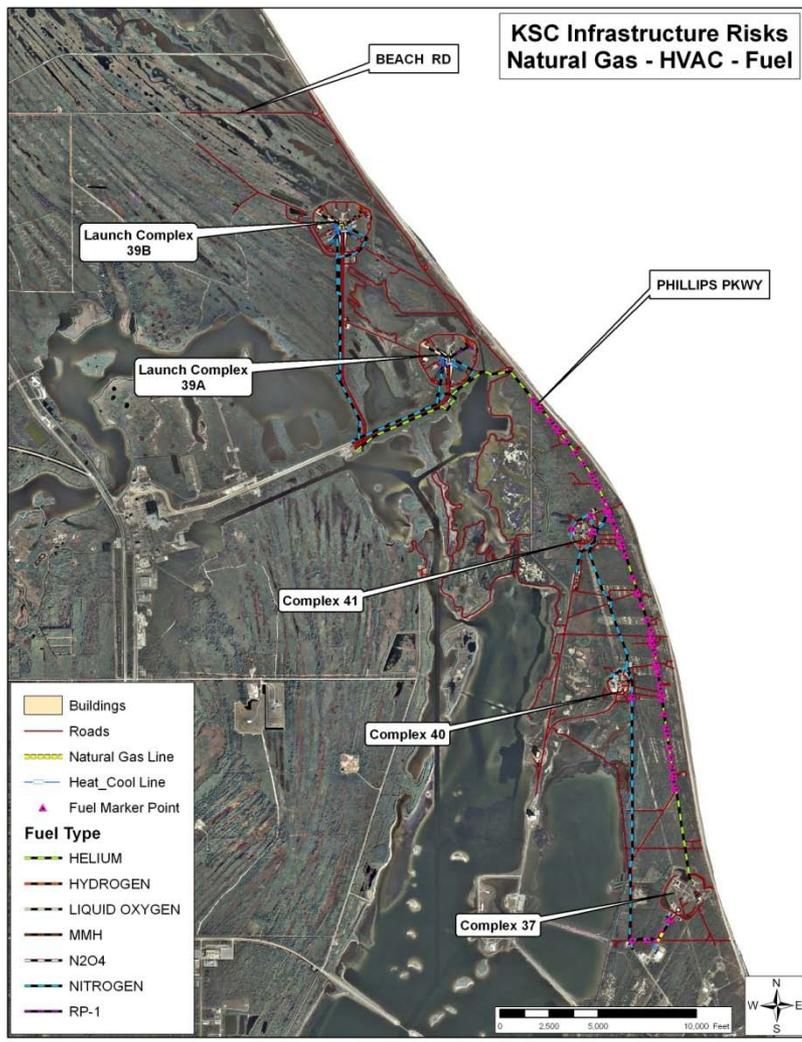
- ◆ Dune restoration now becomes an infrastructure issue
 - Need expertise to study just what is happening along our coast
 - Joint effort with FWS/NPS leads to USGS and University of Florida contracts
 - KSC Environmental been the driver
 - Need support from Programs





KSC Infrastructure Risks

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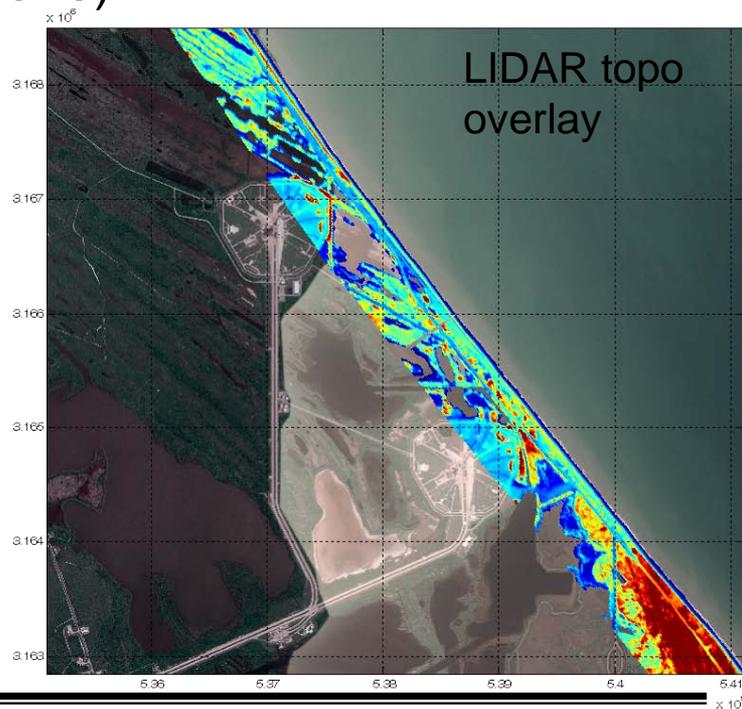




KSC Dune Vulnerability Team

◆ United States Geological Survey

- Light Detection and Ranging (LIDAR) topographic survey (2009)
- Historic dune location, current, and short term future (5-15 years)
- Areas of risk
- Shoreline Camera (KSC “Surf Cam” 2010)
- Bathymetric survey (Summer 2010)
- Prediction of operational impacts

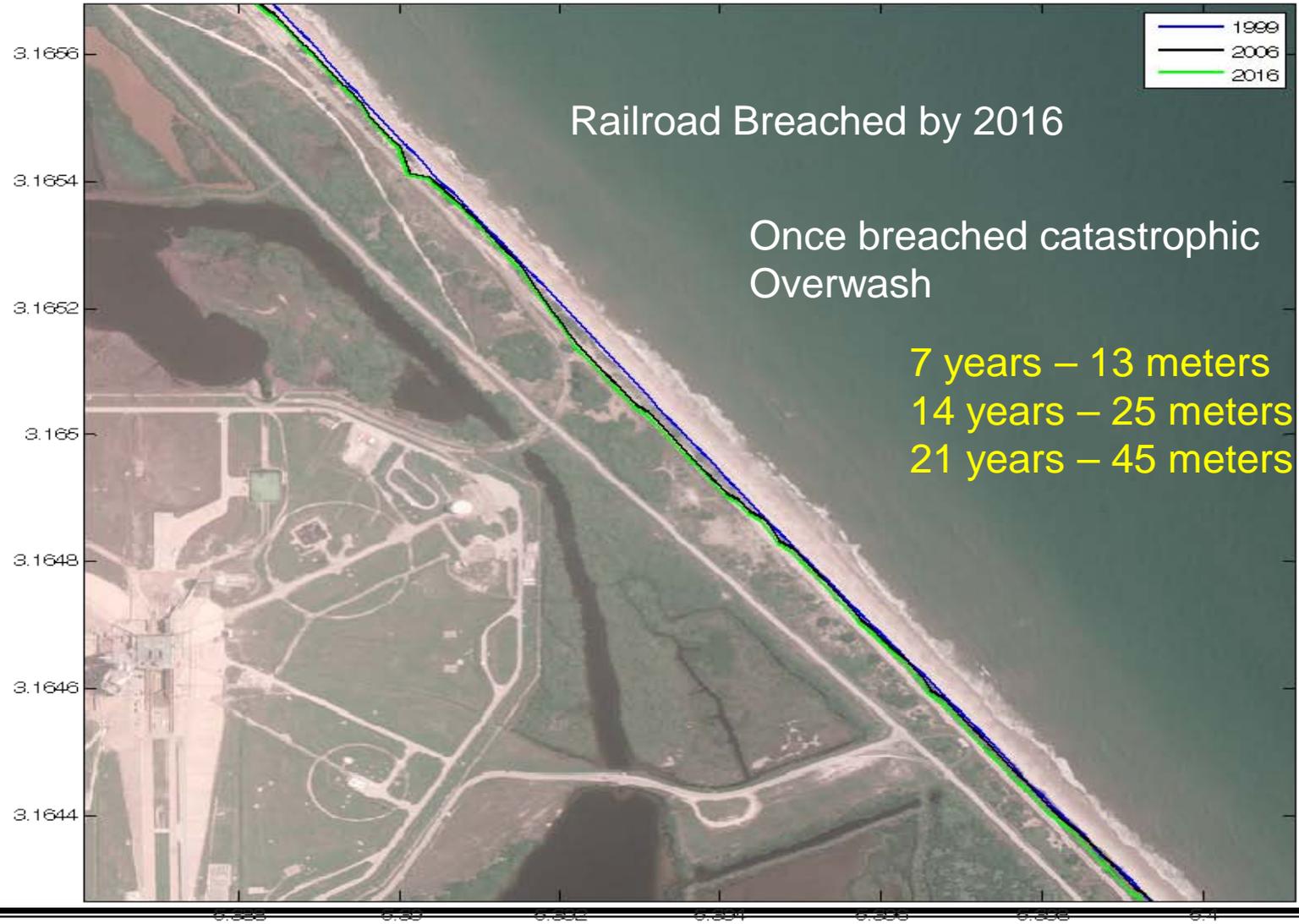




KSC Dune Vulnerability Team

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$\times 10^5$



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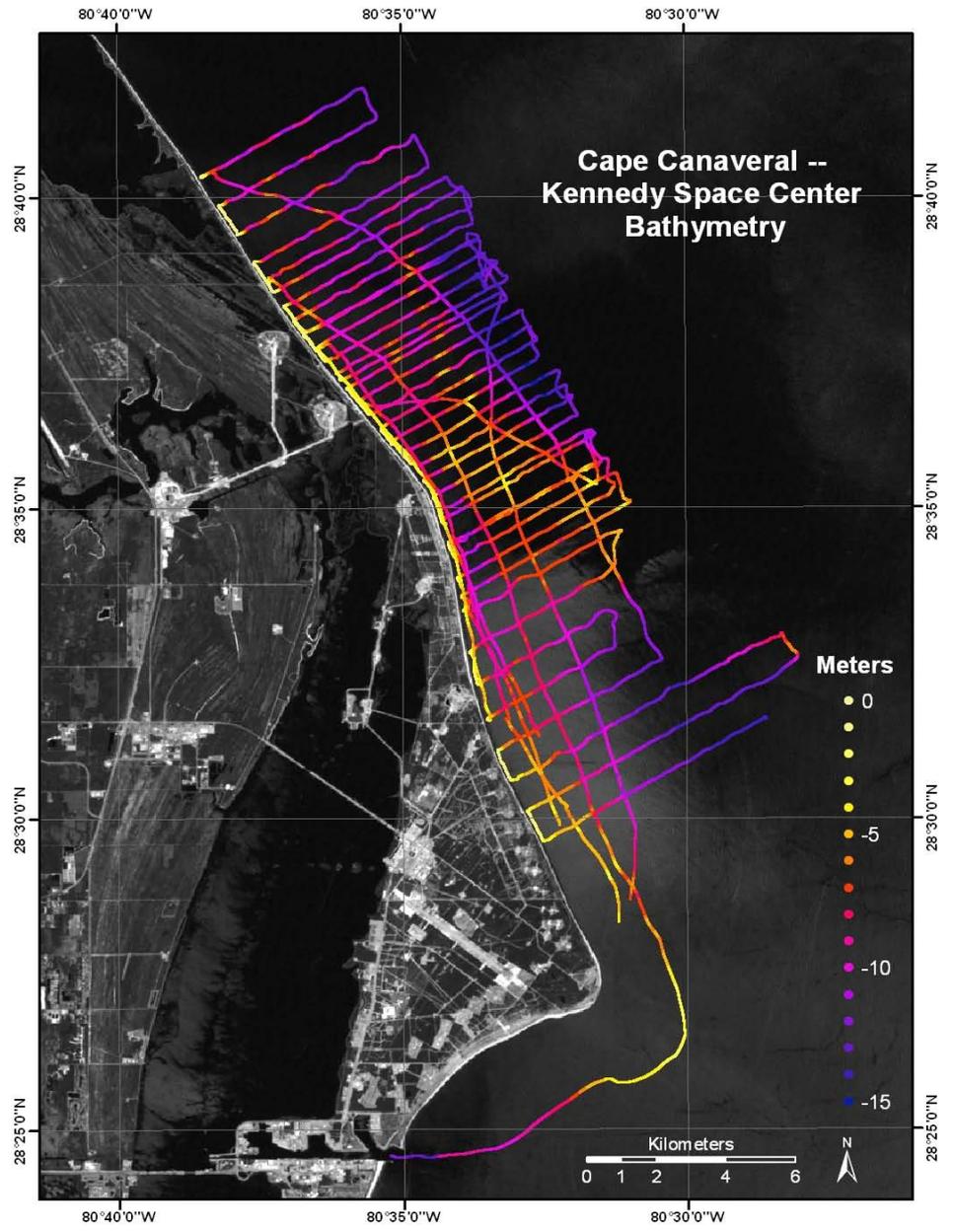
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Bathymetric Survey Offshore Cape Canaveral

What is offshore that could
be altering wave action
at LC-39 area?



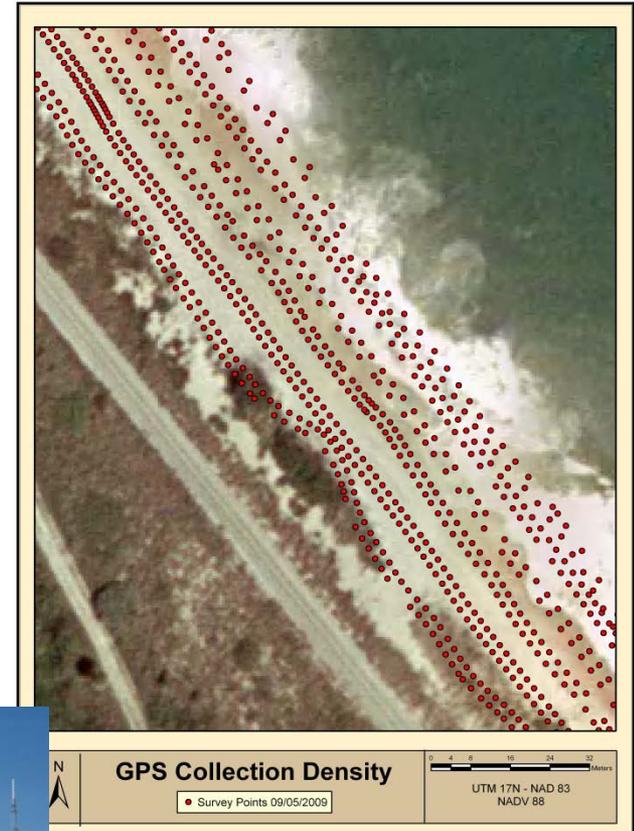


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Dune Vulnerability Team

◆ University of Florida

- Differential GPS record of shoreline documenting monthly changes in Shoreline and dune retreat.





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KSC Secondary Dune Project

- ◆ Cooperative effort between NASA and Air Force
 - 750 feet long
 - 70 feet wide
 - 15 feet high
 - 30,000 cubic yards of sand
- ◆ Cape Canaveral Air Force Station 45th Space Wing providing fill material
- ◆ Work currently underway.





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KSC Secondary Dune Project



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Engineering Perspective

- ◆ There are remediation measures that can be implemented
- ◆ Beach Nourishment, Dune Restoration, Coastal Structures





Engineering Perspective

- ◆ Surveys and geotechnical data already exists
- ◆ Ongoing NASA studies can be utilized
- ◆ Design & Permitting Needs:
 - Feasibility Study to identify Conceptual Design
 - Extensive Beach Survey Data (DVT Team in progress)
 - Environmental Studies
 - Sand Source Investigation
 - Permits & Approvals: FDEP, U.S. Army Corps, FWS, NMFS
 - Plans & Specifications for Construction
- ◆ Entire process will take 3 to 5 years
- ◆ Planning needs to start now to determine best course of action and identify funding



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Questions?

