JPL Spring 2011 Gulf of Mexico DEVELOP Project Video Transcript

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The spring 2011 project by the Jet Propulsion Laboratory DEVELOP Team is titled *Gulf of Mexico Oil Spill Monitoring: Oil Spill and Wetlands Impact Assessment using Polarimetric Synthetic Aperture Radar Data*.

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The authors are Katrina Laygo, Briton Voorhees, and Stephen LaPointe. Our science advisors are Ben Holt and Dr. Cathleen Jones of the Jet Propulsion Laboratory.

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Our project falls under three societal benefit areas: Natural Disasters, Public Health, and Ecological Forecasting. The community concern is that oil from the Gulf of Mexico Spill is likely to become distributed widely in the waters of the Gulf of Mexico and along adjoining coastlines and wetland regions. A number of sensitive ecosystems along the Gulf Coast could be threatened if oil reaches them. Thus, mitigation of the impact will be most effective if assets can be targeted to areas with known oil contamination as quickly as possible following exposure. The United States Department of Homeland Security and United States Coast Guard are the two project partners for this research. Both organizations may benefit from this research as it provides a method of rapid oil detection that can be used in response to future oil spills, as well as provide an investigation into the effects of oil in Barataria Bay.

This spring term 2011, DEVELOP JPL's students sought to use NASA UAVSAR data, in conjunction with NASA AVIRIS imagery and additional ancillary and hyperspectral data in order to locate oil along coastal ocean water and in the wetlands.

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The Gulf Oil Spill released an unprecedented volume of oil into the Gulf of Mexico, which is causing major environmental impacts. The scientific goal is to develop methods to better characterize and quickly identify both oil slicks on water and their ecological impact on vegetation from L-band radar returns in Barataria Bay. Remote sensing radar, which can see below cloud cover, will be instrumental in reaching this goal. This study will provide an analysis through a combination of satellite, airborne sensors, and *in-situ* field surveys to validate oil detection. The research results will be utilized for disaster management, monitoring, and mitigation.

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This research uses UAVSAR data, AVIRIS data, hyperspectral data from the Galileo Group, *in-situ* field surveys by the Department of Homeland Security's Science Mission Directorate and USGS observation sites to validate NASA's UAVSAR L-band data in the assessment of the impact of the oil spill on these coastal areas.

A five-class unsupervised classification was performed on each of the flight lines color composite images. The UAVSAR data was validated with optical sensor data and compared with the USGS Field Report from June 22 to July 10, 2010. The results include DHS *in-situ* data overlaid on Google Earth, with the processed UAVSAR and AVIRIS imagery.

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The oil spill entered the Barataria Bay location on May 23, 2010. June 21, 2010, shows a closer image of the extent of entry into our study area.

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AVIRIS flight line data is displayed in Google's open source and freely available Fusion Tables platform, which can be exported to Google Earth.

Slide 8
UAVSAR data from 2009 was compared to 2010, after the oil spill. The 2 images on the right show the 5 types of unsupervised land classifications from flight line 32017.

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The 2 main areas of impact are seen in a mosaic from fight lines 22202 and 32017, from June 23, 2010. These classifications were compared to the AVIRIS, Galileo Group data, DHS field surveys, and the USGS field report.

Slide 10
Ground truth photo points from DHS and USGS were plotted and also included EPA water sampling points to study the relationship between *in-situ* data and potential oil coverage extent.

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DHS field photographs were plotted in the Barataria Bay location and compared to the land and oil spill classifications from the UAVSAR data. The NDVI results from the Galileo group image processing show areas of stressed vegetation along the same areas as these photos.

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With reference to the unsupervised Wishart classification conducted by Dr. Elijah Ramsey of USGS, our NDVI results display the stressed and dead vegetation along the southernmost portion of one of the Barataria Bay Islands and were matched with DHS field report surveys.

Slide 13
End-user products include AVIRIS flight line data and Google Earth layered products of our processed flight lines.

Slide 14
The unsupervised classification of potential oil spill area within our study location from UAVSAR data is overlaid here in Google Earth. The yellow circles with black crosses depict DHS ground truth points.

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This study shows the method and applicability by which UAVSAR can be utilized to track, characterize, and classify the Gulf Oil Spill as a part of the efforts to work with the Department of Homeland Security and the United States Coast Guard in identifying the impact and location of the oil spill on the coastal waters of Louisiana. This study shows that synthetic aperture radar and hyperspectral satellite and airborne imagery prove to be more effective for oil spill disaster response in small bodies of water. The best method for oil spill tracking on coastal waters is through a combination of *in-situ* surveying, ground validation, radar, UAVSAR tracking, and hyperspectral earth observations. The findings from this study can be used by our end users as well as by local groups to assist in oil spill recovery efforts.

This concludes DEVELOP JPL's spring 2011 Project.