



Evaluating Unmanned Aerial Systems (UAS) for use in Oil Spill Response and Damage Assessments

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Overview

- Why UAS?
- Evaluation Plan
- Set Up
- Analysis Results
- Conclusions

Response and NRDA Needs for UAS

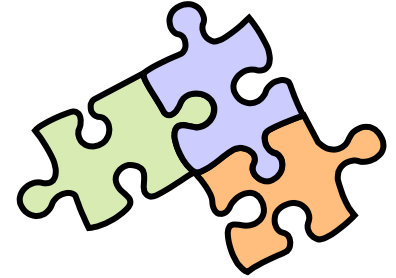
- Quick and Nimble
- Cover large areas but also focus on targets
- Access to the inaccessible
- Prevents disturbance of sensitive habitats
- Cost effective



Field Testing for Response and NRDA

- Response - Recoverable oil and oiled resources we can clean
- Damage Assessment – Finer resolution of data
 - Eg. Species affected, Number affected, Dead or Alive
- Developed both Offshore and Onshore scenarios for testing abilities of the PUMA aircraft, its EO and IR Sensors and processing software made by 2d3
 - Offshore - Oil Simulation - Fluorescein dye
 - Onshore - Beach Wrack, Simulated Wildlife, Simulated Oil and Recreational Human Use

What is being evaluated?



- Platform – Flight Time, Endurance, Stability
- Sensor – Resolution, Quality, Recognition, Spatial Accuracy
- Software – Georeferencing, Mosaicing, Image Enhancement
- Parts as a whole working together

Offshore Set Up



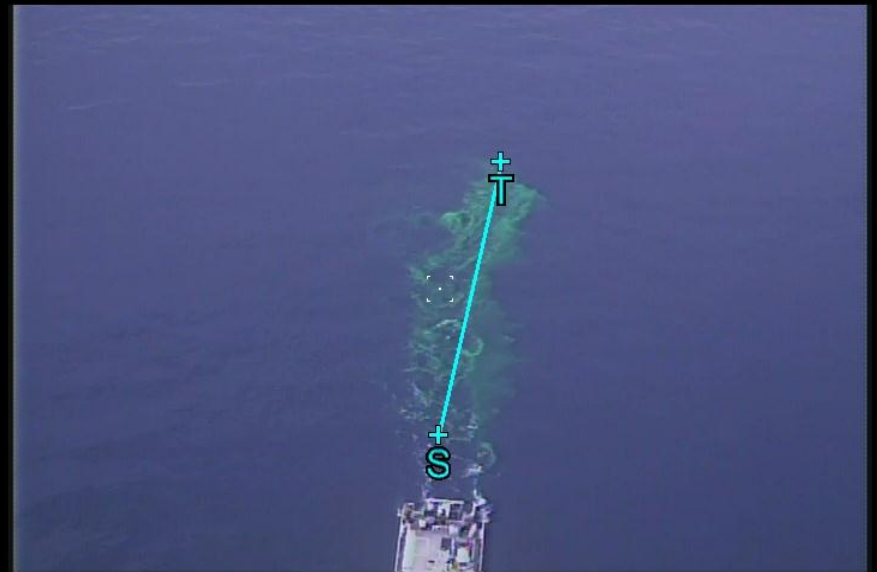
Oil Simulation



Distance Calculations



Lat/Lon: N 34° 08' 59.17" W 119° 25' 30.19"
Alt: 334 ft MSL
Mag: 42°



Gimbal

FOV Data:

Slant Rng: 171 m

CFOV Hdg: 313°

CFOV Lat/Lon: N 34° 09' 02.34" W 119° 25' 33.92"

Horiz. FOV: 29.6°

Targeting Data:

Target S Lat/Lon: N 34° 09' 01.63" W 119° 25' 33.34"

Target T Lat/Lon: N 34° 09' 02.97" W 119° 25' 34.76"

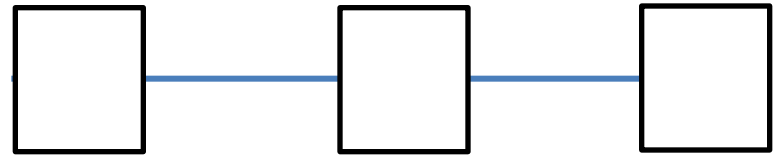
ADD 32 m LEFT 44 m

Range: 54 m Mag Bearing: 307°

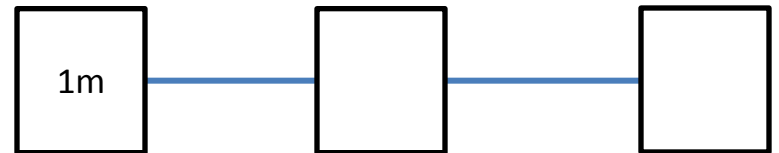
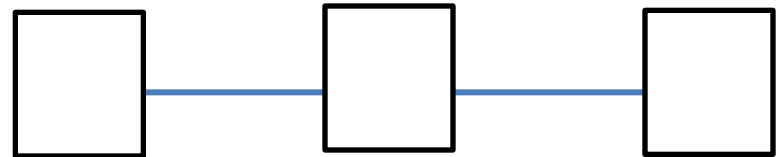
Beach Test Set-Up

- “Oil simulations” square Targets of 5 - 50 cm sides distributed at varying percent coverage across 30m x 1 m transect
- “Bird simulations” were distributed on and off transect for testing wildlife viewing
- PVC stakes are inserted into each quadrat to see if we can see height with imagery. Each stake has 10 cm increments marked.

T1: 3% oil, with wrack



T2: 3% oil, no wrack, plus brown square



30 m

T3: 20% oil, with wrack

Beach Set Up



Beach Set Up



Bird Simulations

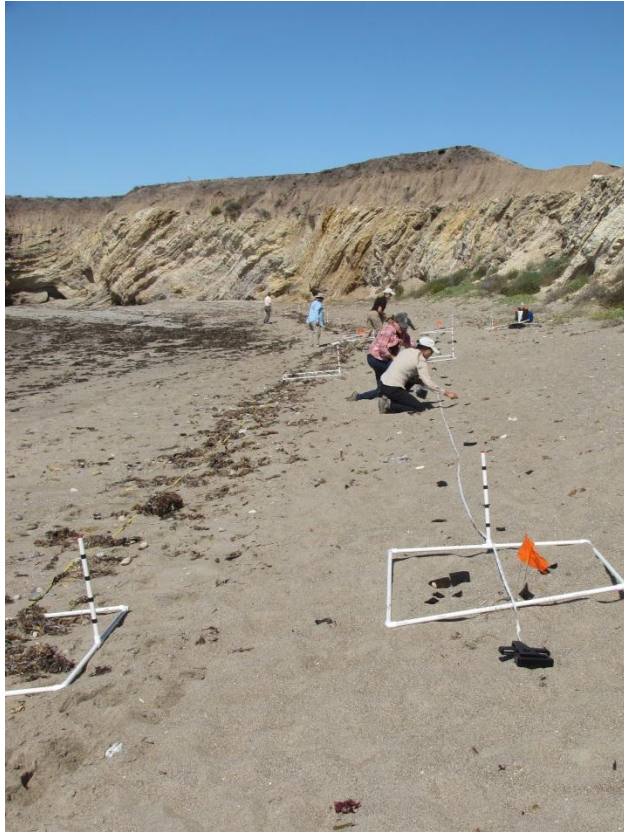
Oil Simulations

250 FT Altitude Mid Zoom - VAFB Beach



Quadrat Comparison

Field Oblique



Field Overhead



UAS 250 FT Altitude



IR



Wildlife Observations

Sunfish - Offshore



Bird Rookery - Nearshore



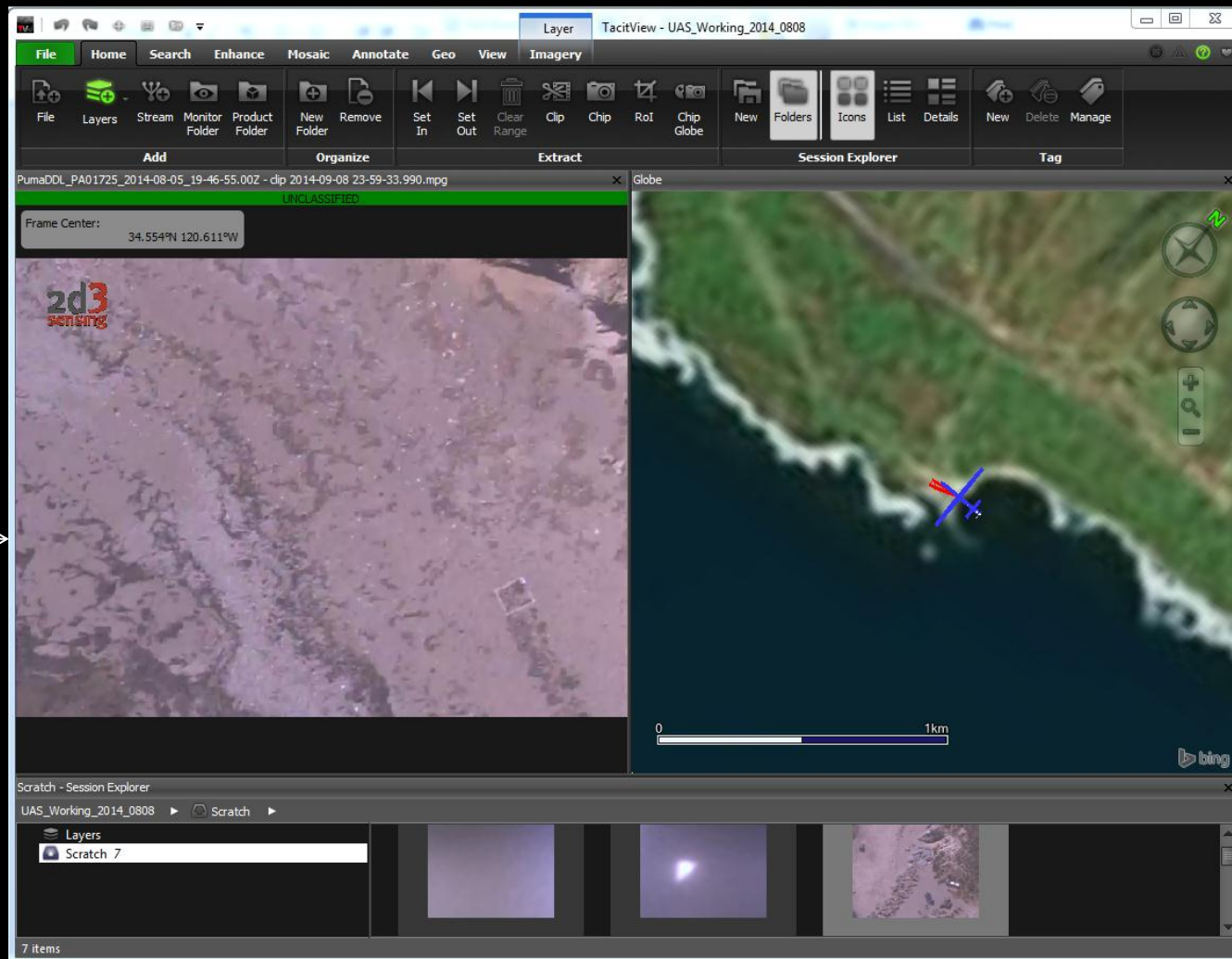
Kelp beds - Nearshore



Dolphin - Offshore



2d3 Video and Image Processing Software



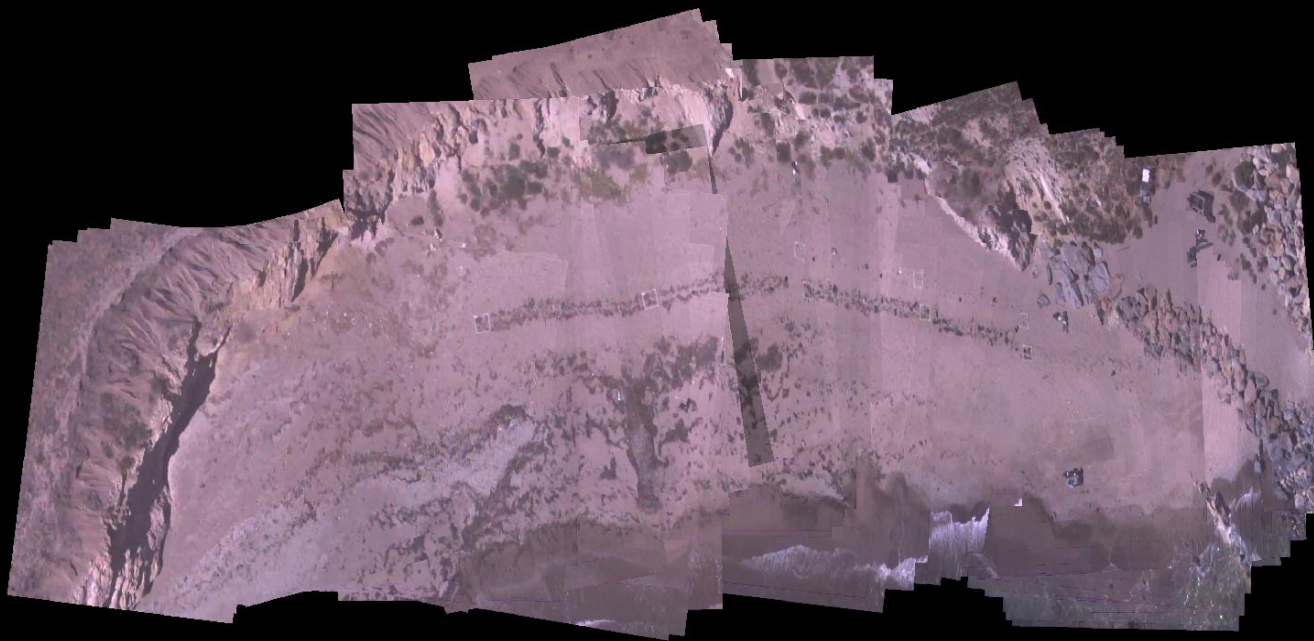
Live or Recorded
Video Feed Window

Map window
showing
location of UAS

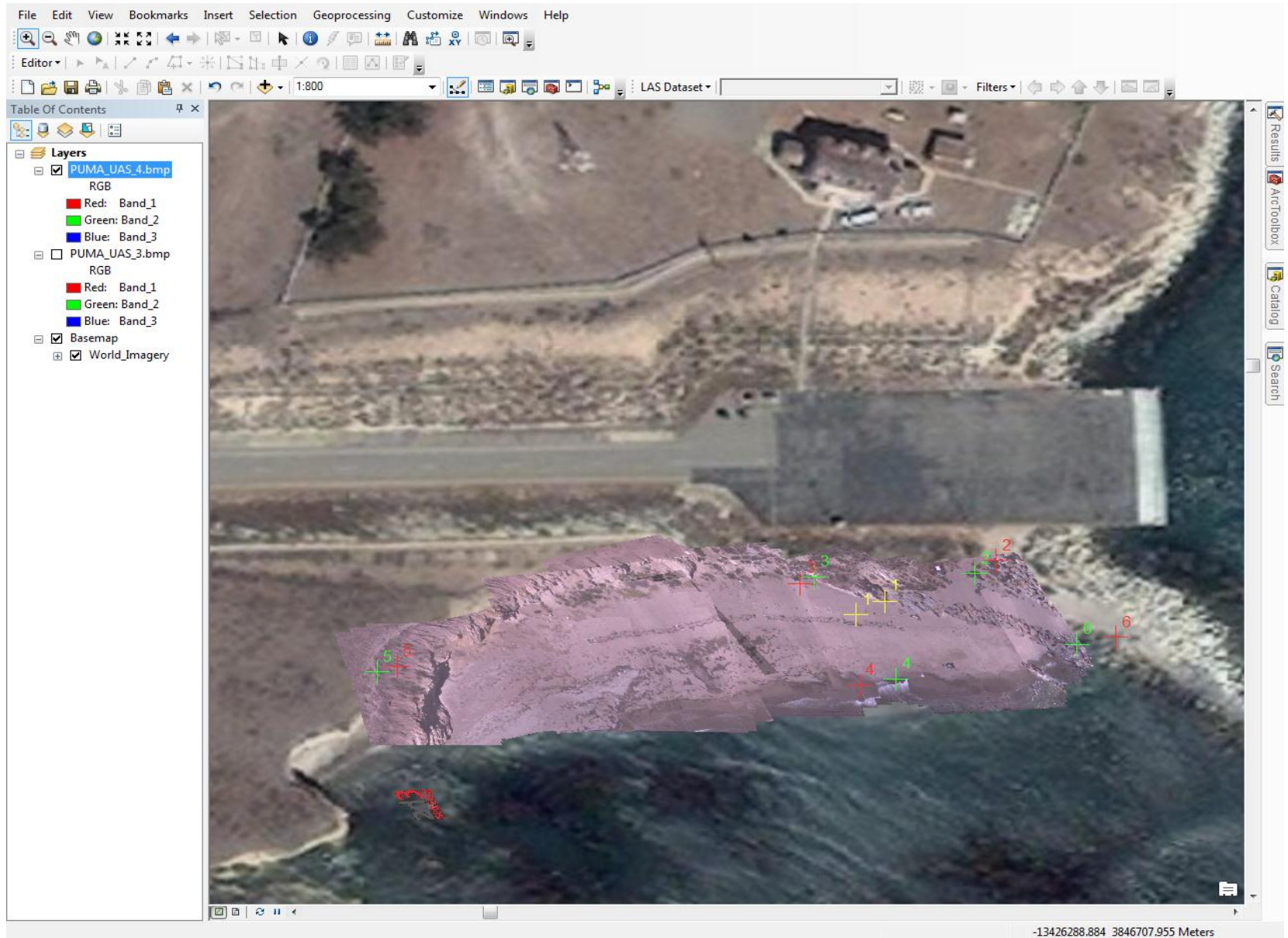
Filtering/Enhancement



Mosaicing



Geo-referencing



Upload to ERMA

ERMA | Environmental Response Management Application
Southwest

Information | Help | Recent Data | Admin | Upload | Incident | Find

Layers | Legend | Query Tools | AOI | Labels | Zoom | Download | Print

Change Password | Logout

UAS Exercise Aug 4-8, 2014 (THIS IS A DRILL)
VAFB PUMA UAS Mosaic (NOAA/2d3)

Day 2 - Vandenberg Air Force Base Photos
Flight 2: PUMA Photos 08.05.2014 (NOAA)

Scale: 1: 846 | Zoom Level: 19 | Location: 34.55456°,-120.61194°

US DOC | NOAA | NOS | NOAA Office of Response & Restoration
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Coastal Response Research Center
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Analysis Conclusions

- Proof of concept has been achieved
- Platform
 - Good flight time ~ 3 hours, 15 – 20 knot winds started to push the plane around
 - Hover capabilities would be useful
 - Vertical Launch and Land would be useful
- Sensor
 - Need Higher Res
 - Better spatial accuracy
 - On the fly Orthorectification using LIDAR and the ability to provide fixed vertical downward viewing
 - Other sensors hyperspectral/multi-spectral/SAR
 - Use of a Gyro for stabilization
- Software Improvements – 2d3 very good for viewing and processing
 - What about transfer, storage and querying?

Other Platforms for Testing

- NOAA and SCRIPPS Quadcopters

- Hover capabilities
- Portable
- High definition
- Easy To Use



- Airphrame

- Consultant
- Low Cost
- Includes processing
- Preprogrammed flight routine
- Very high resolution
- Stills only

