Alvin Video Mosaicking

DESSC Meeting
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WHOI Co-PI’s

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Lava contact (EPR, Nov. 2006)
Main objective:

Software to create image mosaics from video and navigation data collected during Alvin dives
How do we get from these…

+ navigation data

…to these??

Panorama of vent discovered on Alvin Dive 4271 (EPR, Nov. 2006)

Transect at Rosebud on Alvin Dive 4117 (May 2005)
Why video mosaic?

- Dive planning and reports during the cruise
- Science (during or post-cruise)
  
  **Geology:**
  
  Identification of features on larger scale than single images;
  Visual confirmation of features in side-scan sonar or bathymetric maps.

  **Biology:**

  Habitat mapping and density of benthic fauna.

  Capability already exists for IFREMER vehicles…
  first paper published earlier this year…
Example geological interpretation

Plot of slope draped over bathymetry on ridge flank at EPR

Visual confirmation of lava contact

Slide from Adam Soule, Yuri Rzhanov
Habitat map of a cold seep, using IFREMER’s ROV Victor 6000 and proprietary video mosaicking software

Olu-LeRoy et al. (2007)
Software development

Alvin Video Mosaicking Software Suite

- Manual processing
  Useful for transect mosaics when you have limited or no navigation data, or when you want to quickly make a mosaic for a targeted video segment;
  Required for panorama mosaics.

- Automated processing
  Produces transect mosaics for entire dive track, using video frames extracted from DVCAM tapes based on vehicle navigation and altitude data.
Automated Processing

Preferably renav’d data

Default 15m

1. Navigation data
2. DVCam tape
3. Calibration parameters
4. Segment length
5. Required overlap
6. Processing parameters

Stage 1
Segment description

Stage 2
Video sequences

Stage 3
Corrected video sequences
Registration records
Verified records

Stage 4
Geo-referenced mosaics

 avi files

GeoTIFF’s for direct import into GIS

Rzhanov et al. (2006)
Transect at Rosebud on Alvin Dive 4117 (May 2005)

Transect mosaic placement into GIS

Figure by Adam Soule
Alvin Video Mosaicking Software Suite

Tested during 3 Alvin cruises:

- **EPR, Feb. 2004**: Selected video segments (~1-min ea.)
- **Galapagos Rift, May 2005**: 1-hr “mow-the-lawn” survey to compare with still camera mosaic
- **EPR, Oct./Nov. 2006**: Automated mosaicking performed during cruise for 7 of 15 dives; 42 - 98% (median 68%) of the mosaics were good (did not require manual post-processing) *

* “Bad” mosaics generally due to switching cameras, altitude, or turbidity.
Notes for data management
from field trial (EPR, Oct./Nov. 2006)

Average no. mosaics per dive = 150
(~2250m total transit per dive)

Am’t of data storage necessary per dive = 30 - 40 GB *
* (including .avi files; order of magnitude less if store only .tif files)
Video mosaicking
Alvin Dive 4273
(EPR, Oct./Nov. 2006)

9-min of dive track along lava contact (total length 147m)

Figure from Adam Soule
Using the software with Alvin

For the best quality video mosaics...

Lights!
starboard lighting.

Camera!
starboard arm 3-chip:
- as normal to seafloor as possible,
- zoomed all the way out,
- port observer recording the video transect,
- (optional) turn off overlay.

Altitude!
vehicle or Doppler altimeter; approx. 2-3m above bottom.
How does the new software differ from other available mosaicking software?

<table>
<thead>
<tr>
<th>Video mosaicking software</th>
<th>DSL photo mosaic software</th>
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<tbody>
<tr>
<td>Uses video sequences from DVCAM tapes, plus navigation data</td>
<td>Uses still images from user-supplied camera</td>
</tr>
<tr>
<td>Produces strip transects (single swath)</td>
<td>Produces 2-D mosaics (multiple swaths)</td>
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<tr>
<td>Runs via executable files (command prompt or GUI)</td>
<td>Runs via Matlab</td>
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*Photomosaic capabilities*
- DSL Matlab-based software available (Pizarro, Femini, Singh)
  - Simple user interface
  - Color or B&W images
  - Prototype of geotiff creation functionality enabled.
Online description of ROV Victor 6000 promotes use of video mosaicking embedded in bathymetric swath.

http://www.ifremer.fr/flotte/equipements_sc/logiciels_embarques/caraibes/journeesutilisateurs/Brest_2004/Presentation/CARAIBES%202004%20MMR.pdf
Together, Alvin Video Mosaicking Software and Alvin Framegrabber provide similar capability to proprietary software.

Outputs of ADELIE software

- Video mosaic
- Proof sheet

Quote from IFREMER Sept. 2006:
“... the cost of an ADELIE license is 6000 euros (about $7600).”

http://www.ifremer.fr/fleet/systemes_sm/adelie/utilisateurs.htm
(accessed May 2007)
- Delivering software to the scientific community

Alvin Video Mosaicking Timeline

Technical challenges (e.g. extracting frames from DVCAM tapes) → Field trials on Alvin cruises (manual processing 2004-2005, automated processing 2006) → Delivering software at sea and online

Where we are now

- We are recruiting scientists to try the software.
- We would like to identify an online “home” for the software.
- By 2008, we expect to publish the User Manual as a WHOI Technical Report.
Testimonials from science users of the software

“I thought it would be this huge time commitment, but it only took a few minutes to set up, and then it ran itself.”
- Carly Strasser (WHOI graduate student)

“I thought it was easy to use. I like that you can start it going and then go do something else, and you don’t have to babysit it.”
- Kate Buckman (WHOI graduate student)
Future application to video from ROV Jason II

Technical challenge: Extraction of video frames from DVD’s

Figure from Yuri Rzhanov
Questions?
Contact stace@whoi.edu