Delivered Data Summary for *ROV Jason* Cruise <cruiseID>

Chief Scientist: Dr. Jane Doe

Data Processor Name: John Doe

NDSF cruise: D00-00_Doe20

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[JASON DATA PROCESSOR: At the end of your cruise customize this document with appropriate content, including removal of this instructional section. Rename the file so that it has form *<NDSFcruiseID>_DataPkgSummary.doc*. Look for **bolded selectable content** and grayed-out provisional content that you should change to match your cruise. Make the change and normalize it. Once satisfied that it is complete, save the final version in PDF format. Include the PDF in the Documentation section of the data package. If possible, email the PDF to the chief scientist, smccue@whoi.edu, and mheintz@whoi.edu. If you have questions about how to accomplish what's described in here, contact Scotty.]

Overview

Introduction

The data package you received at the conclusion of your *Jason* cruise is a collection of real-time logs and post-processed products from the variety of measurement systems that are carried by the vehicle. This document is intended to help you understand the content and organization of the package so that you and your group can process it more efficiently after your cruise.

This document started as a form letter. The *Jason* data processor on your cruise has completed it, adding information such as cruise metadata, data volumes, media count, and descriptions of nascent or other non-standard data products.

Data Deliverables

General organization of the data package

The standard media for the cruise data package is DVD optical disc. The majority of media in your package consists of directly recorded video. Digital data from, e.g., vehicle sensor records was also burned onto DVDs and added to the package. These media were labeled to indicate date or dive number, and data type.

If you the chief scientist provided one, the *Jason* data processor also copied the digital data to an external USB hard drive for your convenience. Data organization is typically by type, and the top level of the drive filesystem will present a directory structure that resembles the following:

Documentation/ DSCPics/ HDStills/ Multibeam/ Nav/ Procdata/ Rawdata/ Virtualvan/

Data Specifics

1. DVD video recordings

Total # of DVD discs _____

Three cameras (**brow camera, pilot camera, science camera**) were recorded to DVD in real time. We refer to your set as the "working" copies, and they are denoted by a "-W" in their label. They were overlain with annotation specified by you, usually dive number, time, and position in local coordinates [the archive set (–A) of recordings was not annotated in order to preserve a less tampered version of the recording.]. These can be viewed using a DVD drive-equipped computer with media playback software, or a home theater player.

A watchstander from your party was responsible for labeling the discs and for logging the start and stop times of the recording. The *Jason* data processor proofread the labels for content and spot-checked the recordings for proper function of the recording system. A copy of the log was placed in the Documentation section of your data package.

2. High Definition video highlights

_____ clips comprising _____ TB

Your group made direct-to-hard disk recordings of important moments from high definition video. The *Jason* data processor copied them to hard drives that you brought with you. **He/she** also renamed the clips so that they indicate lowering ID, start time, and stop time. A summary listing of the clips is in the Documentation section.

The recordings were compressed in real time using the *ProRes422* family of codecs. They can be played back on your computer using video player software: examples include *QuickTime* player and appropriately compiled versions of the open source software *VLCplayer*. They can be edited using *Final Cut* from Apple. The recording includes time code that is synchronized to the same time reference as the other logging computers in the *Jason* system. Post-processing guidance is offered in a white paper (Morin, 2010) that is available on the NDSF web site.

> "HD Stills and Video Enhancement Techniques for the NDSF HD Camera Using Photoshop and Final Cut", M. Morin, http://www.whoi.edu/page.do?pid=51119

3. Vehicle data:

Total size of Rawdata _____ and Procdata _____

Total count of digital data (non-video) discs _____

DVD discs were labeled to indicate appropriate information such as date, lowering, and data type. If you had a copy placed on hard drive logged vehicle data was collected in two top-level directories: 'Rawdata' and 'Procdata'. We expect that most users will use the material from the 'Procdata' hierarchy. The 'Rawdata' hierarchy was provided for completeness.

Directory 'Rawdata' contains sensor data as it was collected in real time, captured as hourly files over a calendar day (GMT). Also under 'Rawdata' are the logfiles collected by *DVLNav*, a core navigation display and collection software package used by *Jason*.

After a lowering the *Jason* data processor restructured the raw data logs and wrote the output to 'Procdata', and reorganized the data in the following ways:

1. Hourly files were copied so that type-by-day also exists as type-by-cruise.
2. Hourly files were copied so that type-by-day also exists as type-by-lowering.
3. Hourly files were concatenated so that type-by-hour also exists as type-by-lowering.
4. The processed .csv filetype is created by merging the raw .csv filetype, which contains solely real-time navigation information, with raw sensor types to yield a tabular presentation of real time vehicle navigation and sensor data.
5. *DVLNav* logs were copied so that they exist as by-lowering. All are hourly, and include the large native rate sensor logs, summary once/second tables in CSV format, screen captures of the real time *DVLNav* display, and the *DVLNav* configuration files. These are in the *Procdata/J2-XXX/dvl* directory.

Reference Documentation:

JASON2_ROV_DataFormats_v3.3.xls.
DVLNav Home Page: https://dscl.lcsr.jhu.edu/Research/DVLNAV

3. Documentation (directory)

This directory contains written and visual records from your cruise. These documents are:

1. This summary
2. Metadata spreadsheet, consisting of several worksheets
   - In/out water, on/off bottom times
   - Navigation local origin, on/off bottom position
   - Content of the data package
   - HD video clips metadata.
3. Daily status updates from the at-sea Expedition Leader
4. Data formats definitions
5. Event logger initialization files, which define the hot button vocabulary.
6. Pre-dive pictures of *Jason* and sometimes *Medea*.
7. DVD labels files
8. Video DVD log
9. Logs of multibeam survey events
10. **Jason DP: Add/remove to/from list as required**

HDstills

Frame captures from the high definition video camera were copied to this directory. You will find original and transformed versions of each capture. The original is Bayer-encoded, necessary for any single-chip camera, and is not viewable by your eyes. A non-linear transformation was applied to the original to yield a human-viewable color image. Image filenames include the capture time to support synchronization of the image to the timestamps in *Jason's* other logs.

The image is a single frame from a 1080p video stream. Its dimension is 1920x1080 pixels at an intensity quantization of 12 bits per pixel.

VirtualVan

During your cruise VirtualVan content was accessed by pointing a web browser at the acquisition system. After the cruise that content was extracted and placed in your data package as a stand-alone HTML hierarchy. This hierarchy can be copied to a personal computer and navigated using a web browser without having to be connected to a network. A copy of the hierarchy will be transferred to WHOI, where it will be loaded onto a web server and made available to the community at address *http://4dgeo.whoi.edu/jason*. Recently released guidelines from the National Science Foundation mandate that by default this data be made freely available to the community; however, access to the served VirtualVan data from your cruise can be password-protected with agreement from your NSF program manager. Discuss this with the NDSF data manager (Scott McCue, smccue@whoi.edu, 508-289-3462).

Commentary from the event logging station was inserted into the VirtualVan sampling history during the dive. The event logger software presented to its users customizable hot buttons that were perhaps based on a standard vocabulary that you provided. Use of these hot buttons made entry by users quicker, more reliable, and compatible with the vocabularies used in your research community. Look in the HTML hierarchy *(.../Export/CSV)* for files containing logged event records that can be examined by a spreadsheet program, or searched for, e.g., select hot-button entries. The parameter file, or files if they were modified over the course of the cruise, used to configure the event logger software were placed in the Documentation section of your data package (*dsEvent.ini*).

DSCpics

During your cruise the legacy Insite Scorpio digital camera (Nikon Coolpix 995) was employed. The resulting images were placed in this directory. The image filenames include the capture timestamp.

The images are 2048x1536 pixels x 8 bits and are in JPEG format.

Nav

This content was produced by the *Jason* navigators and contains configuration materials for *DVLNav* such as underlay maps and initialization files. Also in this section are configuration materials for the **USBL system or the long baseline (LBL) navigation network.** Raw Sonardyne logs (*Obs*.csv)* are in the *USBL/.../Ranger File/AcousticLogFiles* subdirectory.

Multibeam

Individual surveys are in separate subdirectories. A quick look map was produced using scripts based the MB-system software package. These scripts combined post-processed navigation with the raw Reson .s7k files, then applied automated cleaning, gridding, and imaging routines to produce the map. The map was gridded at **two and** five meter blocksizes, and **is in netCDF (Generic Mapping Tools .grd) and point cloud (XYZ) formats.**

Your post-cruise treatment of the survey data will be aided by knowing that:

1. Detailed events of the multibeam survey were logged by a science watchstander, who was asked to enter these events in both VirtualVan and to a text file. The text file is in the Documentation section of the data package. The VirtualVan content in the extracted .csv files.

2. Application of a time lag to navigation/attitude is likely required to account for latencies between the independent systems logging multibeam pings and navigation/attitude. *[The lag determined for the debut Jason/Seabat 7125 survey was -23.0 milliseconds.]* Navigation/attitude was not written in real-time into the .s7k files.
3. Pertinent processing information can be found from the MB-system script that made the quick-look map. These include the name of the file containing post-processed navigation/attitude, the start and stop times of the survey, and the pitch/roll biases used for the quick-look map.

Navigation

Delivered Product

Primary *Jason* navigation was derived from a Doppler Velocity Log (DVL) system in combination with heading from a high performance inertial navigation system (INS). DVL velocities were integrated to estimate dead reckoned position. Georeferenced information from **an ultra short baseline (USBL)/ a long baseline (LBL) acoustic navigation system** was also collected and was used to augment the dead reckoned history.

The 'csv' filetype under the 'Procdata' hierarchy tabulates navigation with a variety of sensor data. The '.CSV' files logged by *DVLNav* collected *DVLNav's* own version of a tablular format, provided in addition to the raw logs that *DVLNav* compiled. At a lower rate real time navigation was captured by VirtualVan and was used to tag framegrabs and logged events.

After a dive the *Jason* data processor performed a post-processing task we call "renavigation". Renavigation was performed using software developed in a cooperative effort between the Dynamical Systems and Control Laboratory (DSCL) at Johns Hopkins University and NDSF. In this task the raw *DVLNav* logs, which contained all records produced by navigation sensors at their native rate, were used to recreate the navigation history. This history was mathematically merged with a cleaned history from **USBL or LBL** to yield an improved result (Figure 1). The result was written in a variety of formats, suitable for use in a variety of post-processing applications, per table 1. If they were required, other formats accompany the standard navigation products described here; a notable example is the ppl-format file, which was required for Seabat 7125 multibeam processing.

The data processor had two algorithms available to him/her for the merge of dead reckoning with **USBL/LBL**, each with particular strengths. The Least Squares Fit (LSQ) technique maintains the dead reckoned history, shifting its centroid to the centroid of the **USBL/LBL** history. The complementary filter (CF) technique uses a more equal balance of **USBL/LBL** history and the dead reckoned history. Results from the CF technique are generally preferred and are usually delivered; however, poor quality **USBL/LBL** input to the merge, perhaps from noisy or null raw USBL measurements, can make the CF result inferior to the LSQ result. Therefore, for select dives or portions of dives the data processor may have provided additional or alternative renavigation products for your benefit.

[Jason DP: add a summary of what you did here.]

Table 1: Renavigation products description

File root name	Filetype	Description
{DIVEID}_1Hz_renav	*.txt	1Hz renavigated product, *csv format*.
{DIVEID}_1Hz_renav_nav	*mat	1Hz renavigated file, *matlab format*.
{DIVEID#}	*.jpg	JPEG image of real time and renav tracks
{date_time_stamp}_renav_vvan_v1	*.txt	Renav for ingestion into VirtualVan, *csv format*.
lbl_renav	*.mat	Renavigated LBL or USBL (only)
{DIVEID}_renav_navtrackLL	*.dbf, *.shx, *.shp	Arcview shapefile in latitude/longitude
{DIVEID}_renav_navtrackXY	*.dbf, *.shx, *.shp	Arcview shapefile in local coordinates
{DIVEID}	.ppl	Nav/att for 'mb7kpreprocess'. Sample rate at highest rate sensor. *Only when Reson Seabat 7125 is used.*
{DIVEID}	.ppi	Intermediate NDSF format, 1Hz. *Nascent.*
csv_raw	*.mat	Navigation data for use with Imagenex 881 sonar processing software. *Legacy*
csv_raw_origin	*.mat	Navigation metadata for use with Imagenex 881 sonar processing software.
nav_t.mat	*.mat	Navigation file for use with SM2000 sonar processing sw, unrenav'ed. *Legacy.*
bathyplot_renav	*.mat	Navigation file for use with SM2000 sonar processing software, renavigated. *Legacy.*

Science Party Post-processing

Most *Jason* users find the results of at-sea first-order renavigation processing to be adequate for their purpose. This section is a brief introduction for those who wish to implement more rigorous processing after the cruise.

NDSF navigation logs are created by the *DVLNav* program. See https://dscl.lcsr.jhu.edu/Research/DVLNAV, especially for the file describing the formats of all sensor records and synthesized record types.

DVLNav logs three basic filetypes:

a. all sensors, native format, native sampling rate, hourly.
    yyyy_mm_dd_hh_MM_ss.DAT

b. summary files, interpolated to once/second, csv format.
    yyyy_mm_dd_hh_MM.CSV

c. configuration file describing sensor positions and alignments.
    yyyy_mm_dd_hh_MM_DVLNAV_INI.M

For lower rate needs, e.g., plotting realtime navigation tracks, use the CSV file. For more demanding needs such as re-navigation or multibeam mapping, use the information in the .DAT files.

For renavigation we extract sensor records by first concatenating all the hourly .DAT files into a single large file, then by parsing the sensor records into separate files. We use the unix utility 'grep', which is available for all platforms.

PNS (Platform Navigation String)
```
  grep  PNS infile | grep -v SDE | grep -v LBL | grep -v SHP | grep -v MED > out.pns
```
RDI (Doppler Velocity Log)
```
  grep RDI infile | grep -v SDE > out.rdi
```
SDE (DVLNav string log)
```
  grep SDE infile  > out.sde
```
Octans INS
```
  grep OCT1 infile | grep -v SDE >  out.ocn
```
LBL/USBL
```
  LBL: grep PNS %s | grep NTT > out.lbl
  USBL: grep PNS %s | grep OTT > out.lbl
```

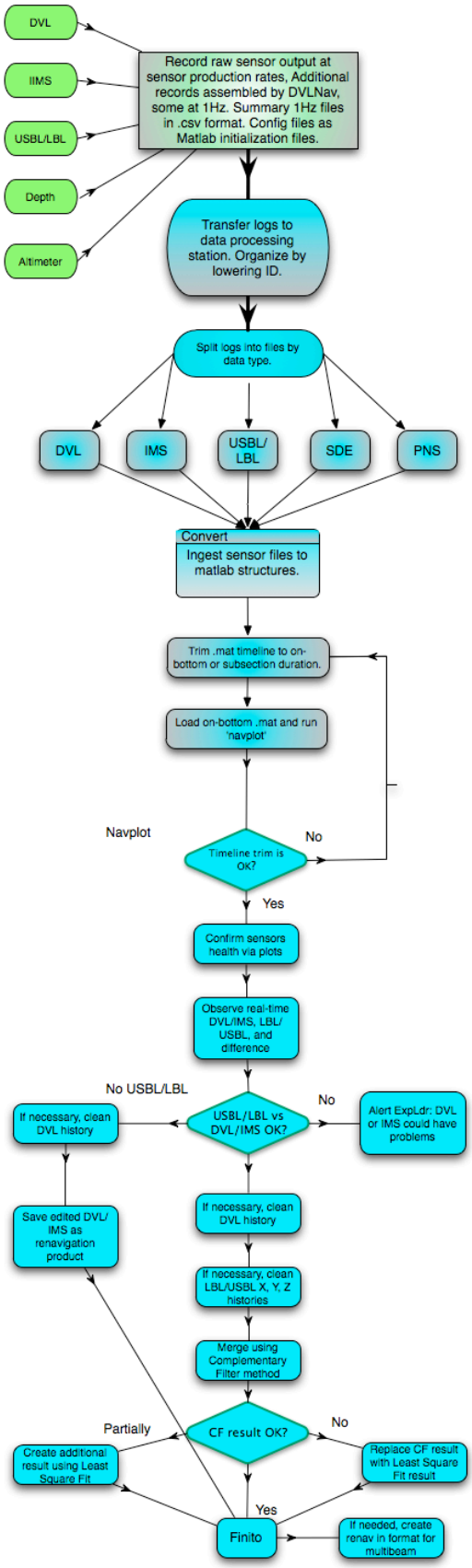

Figure 1: Flow of *DVLNav*-recorded navigation data

Suggested reading:

DVLNav Home Page: https://dscl.lcsr.jhu.edu/Research/DVLNAV
NDSF informational white papers http://www.whoi.edu/page.do?pid=51119

1) *Near-bottom Multibeam Surveys for Deep Sea Scientific Applications*, McCue, S, and Yoerger, D, Reson User Conference, St Petersburg, FL, Oct 2010.
2) *Alvin Multibeam Primer/Cooker*, McCue, S, 2010.

Nascent Data Products

[Jason DP: add descriptions of delivered nascent products here.]

Further Information

NDSF web site

Jason User Manual: http://www.whoi.edu/page.do?pid=10757
Logging and display: http://www.whoi.edu/page.do?pid=11035
Informative documents: http://www.whoi.edu/page.do?pid=51119
WHOI archive policy: http://www.whoi.edu/page.do?pid=11037
VirtualVan: http://www.whoi.edu/page.do?pid=12876
Answers to FAQs: http://www.whoi.edu/page.do?pid=20026
Jason Operational Metadata: http://www.whoi.edu/page.do?pid=20018
DVLNav Home Page: https://dscl.lcsr.jhu.edu/Research/DVLNAV,

NDSF contacts

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