S5K Video Data Workflow

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Revision History

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Date	**Revision**	**ECO**	**Description**	**Author**
11/05/15	1.0		Initial version	NB
11/05/15	1.1		Expanded technical descriptions	NB

Introduction

The S5K ROV is planned to be equipped with six main cameras, specifically: a 4K situational camera, a 4K science camera, and four HD cameras (port side peripheral camera, starboard side peripheral camera, rear view camera, and umbilical camera).

The current proposal from the SOI data management team is to record all six of these cameras continuously during each dive, and to store a copy of the recordings from the 4K cameras in the Falkor ship's archive for six months, and a copy of the recordings from the HD cameras for one month. Additional copies of the recordings from the 4K situational and 4K science cameras are planned to be distributed to both the visiting principal investigator (for their scientific use) and to the SOI research manager (for publishing and/or archival) at the conclusion of each cruise.

The video data workflow can be broadly divided in to three steps: **recording** the data during each dive, **distributing** one cruise worth of recordings to the relevant parties (on the ship), and **archiving** all previous cruises' recordings (on the shore) for potential publication or other uses.

The scope of the HROV project currently extends to the first step: recording the data during each dive, whilst responsibility for the distribution and archival stages falls to the SOI data management team. This document describes the HROV project's currently-proposed recording arrangement, as well as some possible ideas which the SOI data management team might use to implement the distribution and archival steps.

Video Data Workflow

1 Recording

All modern systems use direct-to-disk video recorders. The HROV team currently plans to use six BlackMagic HyperDeck Studio Pro recorders (one for each of the six cameras), recording the video in Apple ProRes formats, which require 221 GB/hr for 4K, and 55 GB/hr for HD.

Each recorder can hold 2 x 1 TB drives, which is sufficient to record 9 hours of 4K video, or 36 hours of HD video, without changing drives. Assuming that a maximal cruise consists of two 4K cameras x 25 days x 9 hour dives, plus four HD cameras x 25 days x 9 hour dives, the output per-cruise would be around 100 x 1 TB drives for 4K video, plus 28 x 1 TB drives for HD video. The cost per set of 128 x 1 TB solid-state drives suitable for use in the recorders is approx. $45k at current street prices. Alternatively, if these drives can be duplicated overnight, fewer drives can be used, as the recording process only requires 8 drives per 9 hour dive (two in each of the 4K recorders, and one in each of the HD recorders).

The solid-state drives used in the video recorders are inappropriate for distribution or archival as they are many times more expensive than typical media for these purposes, and they generally have data retention times unsuitable for long-term storage. The most logical interface between the recording and distribution steps is probably for the HROV project to loan the SOI data management team the master solid-state drives, so that the data management team can create any necessary derivatives for distribution, archival, or publication.

2 Distribution

Because the distribution to the principal investigator and the SOI research manager (and storage in the ship's archive) need not be using the same solid-state drives specified for the video recorders, the cost to distribute the video data is much lower than it is to record it.

One approach would be to use a disk-to-disk duplicator to make the relevant copies of each of the master solid-state drives. The cost per set of 100 x 1 TB hybrid drives suitable for distribution is approx. $7k at current street prices. An alternative approach would be to use a disk-to-tape duplicator (or equivalently-configured PC) to copy the distribution data to 25 x 2.5 TB tapes instead. The cost per set of 25 x 2.5 TB LTO-6 tapes suitable for distribution is approx. $1k at current street prices.

The disk-to-disk approach could be accomplished using a commodity duplicator, selected on the basis of reliability/reputation, duplication speed, ease of loading/unloading, etc. The disk-to-tape approach is more complicated as it involves a many-to-one step, however, this approach has a lower distribution cost, and the tapes are less fragile, less numerous, less voluminous, and more appropriate for long-term storage than equivalent drives.

The distribution process would likely also require some type of video review/quality control step.

3 Archival

Because of the volume of video data involved, storage on this scale is typically done using magnetic tapes. If the distribution step adopts the disk-to-tape approach, the received tapes could be stored as archival copies in an in-house tape library without further processing. We note there is commercial software available to review and manage in-house tape libraries.

If sufficient internet bandwidth is available, there are also numerous cloud services available to make the video data available on a per-user retrieval request basis (e.g. Amazon IceBerg), on a per-user on-demand basis (e.g. Amazon S3), and of course as streaming video.