Clio Instrument

Shipping Plan

Prepared By: **Name(s) and Signature(s)**		**Date**
T. McMahon		2012-Jun-13
Approved By **Name and Signature**	**Title**	**Date**

Revision History

Issue	Date	Changes	Responsible
A	2012-Jun-13	Initial Release	T. McMahon
B	2012-Jun-27	Schedule Mods	T. McMahon

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1. Applicable Documents

N/A

2. Acronyms and Abbreviations

AO	Adaptive Optics
AOS	Adaptive Optics System
AEAP	As Early as Possible
ALAP	As Late As Possible
ASM	Adaptive Secondary Mirror
ITAR	International Traffic in Arms Regulation
MagAO	Magellan AO
MMT	Multiple Mirror Telescope
TBC	To Be Confirmed
TBD	To Be Determined
TBR	To Be Reviewed
UA	University of Arizona

3. Scope and System Overview

The purpose of this document is to capture the essential requirements and the plan for transportation of the Clio Instrument from Tucson, AZ (UA) to Las Campanas, Chile. The hardware consists of:

- The Clio instrument
- Cables
- Electronics Support Rack
- NAS Ring
- Clio Storage/Service Cart

This document will be used as both reference and a tool for coordination of the shipment.

4. General Shipping Details

In general all units will be air-shipped, from Pasadena, CA to Las Campanas, Chile unless specifically noted. Sea shipments typically are only slightly less expensive than air, and sea shipments have more risk associated with wider temperature swings, opportunities for handling shocks, water damage, and shipping delays.

UA requests Carnegie to be responsible for shipping from Pasadena to Chile. UA will be responsible for shipping from Tucson to Pasadena.

All shipments will contain “Drop-N-Tell” shock indicators in increments of 5, 10, 25, and 50 g’s. For boxes within a box” the 10, 25, and 50 g indicators are mounted on the external side and internal sides of the box. Externally to let the shipping company know that shocks are being monitored and internally in case they are intentionally or unintentionally removed. The shipping company will be asked to alert the shipper if there are any shock indicators tripped, especially if it is transferring from one company to another during transit. On the internal box carrying the equipment we will add 5, 10 and 25 g indicators.

Additionally desiccant bags will be included in all of the crates to prevent moisture buildup during shipment. The numbers of bags are determined by the volume of each crate.

5. Clio Instrument

The Clio Instrument unit will be packaged into existing crates that were purchased for air-shipping instrument to the Magellan Facility. A single crate will be used for the instrument.

5.1. Shipping Requirements for Clio

5.1.1. Thermal

The Clio instrument was designed to operate in the extreme dome conditions of the MMT facility. Thermal variations during shipping should not exceed -15 to +40C.

5.1.2. Shock Absorption & Vibration Isolation

We classify the Clio instrument as “Moderately Rugged” and able to handle shocks up-to 80Gs. The size of the container, thickness and type of the foam have been tailored for the Clio shipping container. The vibration isolation will be provided by an appropriate thickness of foam. The selection analysis can be found in Figure 1.

Foam Selection

Parameters:

1) Survivable Shock upper limit of hardware (Clio 60-80Gs)

2) The Static Load of the hardware (Weight/Surface area).

3) The Approximate drop height (This parameter along with the static load determines the average acceleration that may be experienced by the hardware if dropped. We expect the average handling height of the crate will be ~36in).

Static Load:

Face 1& 3: 80 lbs/288sq. in. = 0.3 lbs/in^2
Face 2 & 4: 80 lbs/204sq. in. = 0.4 lbs/in^2
Top face: 80 lbs/144sq. in. = 0.6 lbs/in^2
Bottom face: 80 lbs./442sq. in. = 0.2 lbs/in^2

The largest static load being the top face at 0.6 lbs/in^2 drives the choice of material and thickness. Of the standard foam materials readily available the best fit for out needs is a 2 lbs/ft^2 polyethylene material whose characteristics are shown in the following graph. From the graph the appropriate foam thickness should be 2.5 to 3 inches.

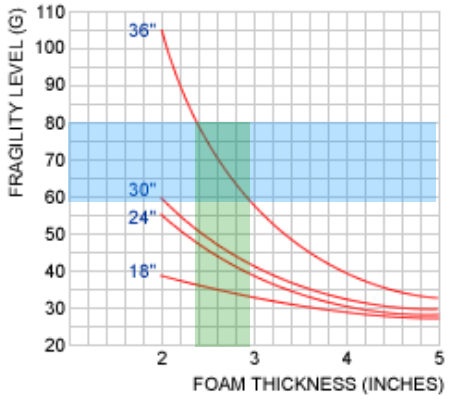

Figure 1: Static loading of Clio instrument and foam selection.

These configurations are very effective at attenuating the anticipated shocks experienced by the contents. Although shocks can be attenuated, they cannot be completely eliminated. During shipping, a few things can be done to minimize them.

1. Air transport from Pasadena to Santiago.
2. Enclosed “Air ride” trucks should be used for ground transport.
3. Appropriate labeling and communication to the shipping company to the fact that these are delicate instruments and should be handled with care.

5.1.3. Contamination Control

The Clio instrument, Support Electronics Rack, and Handling Cart have no external surface contamination requirements.

The Clio Instrument vacuum enclosure shall be be open only in a clean environment. Appropriate attire (gloves and surgical masks) shall be worn by personnel when performing these tasks.

5.1.4. Transport Loading and Unloading

Properly rated forklifts will be required for loading and unloading of the crates from the transport

5.2. Clio Unit Shipping Crate

The Clio instrument will be shipped in a Hardigg pallet-ready, hardened shipping crate. Figure 1 shows the Hardigg Shipping crate to be used for Clio instrument transport.

Figure 2. Clio Instrument packing crate.

The overall dimensions of the Clio Unit shipping crates

69 cm x 102 cm x 94 cm (WxLxH)
Weight: 150 kg (TBC)

6. Clio Electronics Rack

Clio electronics rack will be sealed using cellophane to protect the contents from dust and moisture contamination.

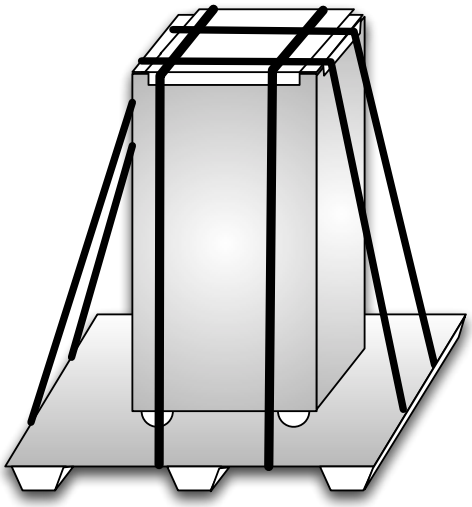

Figure 3. Clio support electronics rack and packaging configuration.

Rack Dimensions (WxLxH): 24” (61cm), 25” (64cm), 46” (117cm)
Weight (loaded): 110 kg

The rack will be strapped on to a plastic pallet to prevent damage from forklifts. The pallet specifications are:

Vendor: ULINE
Model #: H-1730
Dimensions (LxWxH): 48” (122cm), 40" (102cm), 5” (13cm)
Floor Weight Load: 3000 lbs. (1364 kg)
Fork Weight Load: 1200 lbs. (545 kg)
Unit Weight: 14 lbs. (7 kg)

48 x 40" Lightweight Export Pallet

Enlarge

ECONOMICAL

Sturdy, cost-effective pallet - Ideal for one-way shipping.

- Stack 45 pallets in 6 feet.
- ISPM 15 exempt for export shipping.
- Weather resistant, won't rot, split or mildew.
- 4-way forklift access and 9-legged support.
- Larger quantity quotes available.

Figure 4. Plastic lightweight pallet to be used for shipping electronics rack.

7. Clio NAS Interface Ring

The interface ring will be shipped in a custom built individual wooden crate with the external approximate dimensions of 58” (150 cm) x 58” (150 cm) x 12.5” (32 cm). The ring will be secured to the bottom of the box using 3-4 1/4-20 lag bolts and washers.

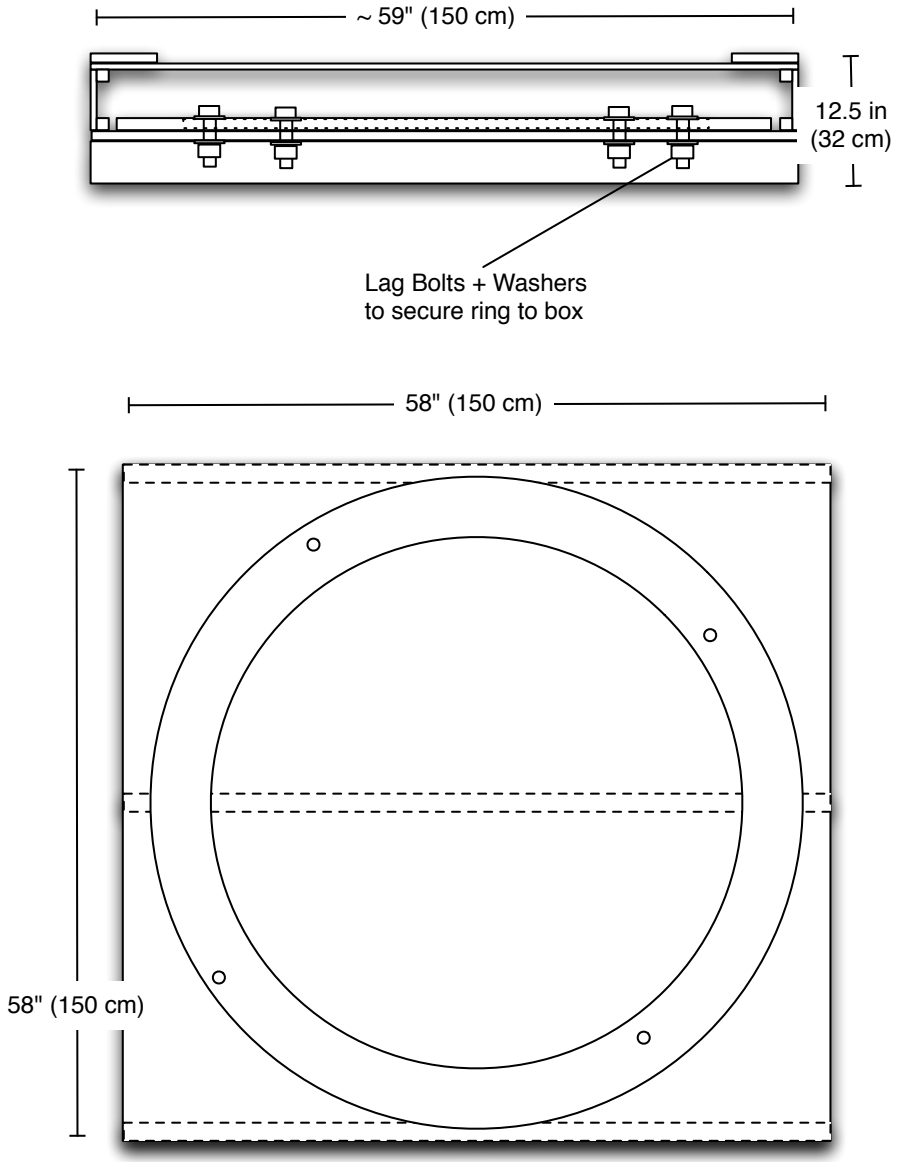

Figure Figure 5. Proposed shipping configuration of Clio mounting ring.

8. Clio Storage Cart

The Clio Storage Cart shall be shipped disassembled. It will be wrapped in cellophane and strapped to a plastic pallet for shipping. Figure 6 shows a cartoon of the assembled cart.

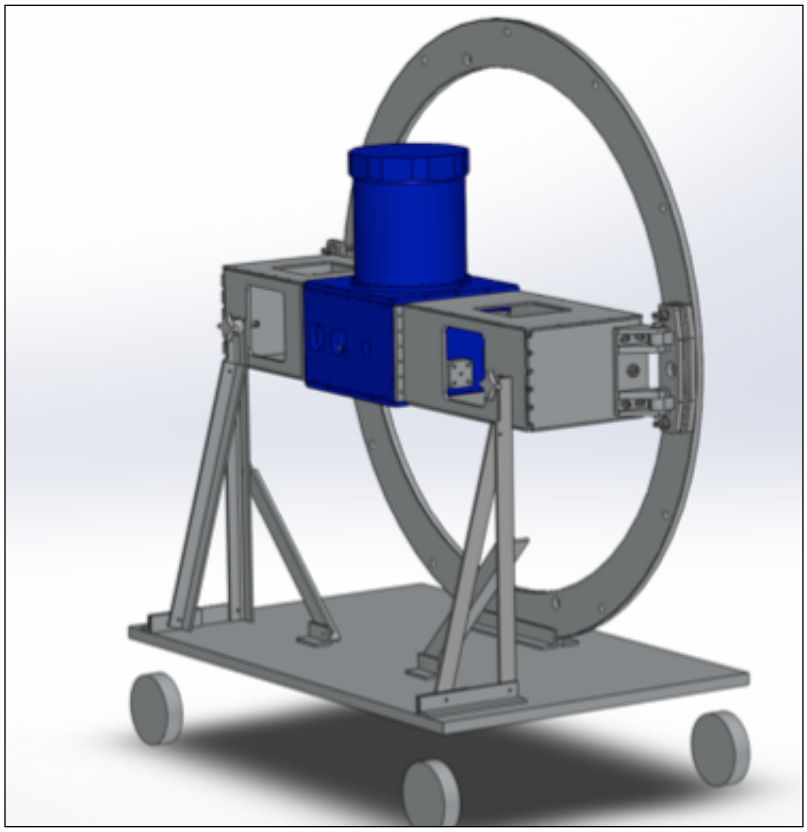

Figure 6. Clio mounted on storage cart.

The dimensions of the Clio cart package are:
Dimensions: 122 cm x 76 cm x 30 cm (WxLxH)
Weight: 80kg (TBC)

9. ITAR Export Permit

The export of the Hawaii-1 MBE array used in the Clio camera is governed by the International Traffic in Arms Regulation (ITAR) rules of the U.S. Government.

The U.S. Government views the sale, export, and re-transfer of defense articles and defense services as an integral part of safeguarding U.S. national security and furthering U.S. foreign policy objectives. The Directorate of Defense Trade Controls (DDTC), in accordance with 22 U.S.C. 2778-2780 of the Arms Export Control Act (AECA) and the International Traffic in Arms Regulations (ITAR) (22 CFR Parts 120-130), is charged

with controlling the export and temporary import of defense articles and defense services covered by the United States Munitions List (USML).
An export license, issued by the U.S. Government, is required for transfer of certain technology, software, and equipment to non-U.S. persons or entities, whether this transfer takes place inside or outside the United States. Any person who intends to export a defense article must obtain the approval of the Defense Trade Controls prior to the export or temporary import, unless the export or temporary import qualifies for an exemption.

The export license will be the longest lead-time item and the critical path of the project schedule. To date, the provenance of the Hawaii-1 array is unknown. The array is a first generation Hawaii-1 MBE detector. The UA is continuing a dialog with the manufacturer (Teledyne) to determine the details needed for the export license.

10. Schedule

The shipping schedule is the following:

Earliest Shipping Date: All Clio elements will be shipped simultaneously. UA will have a weekly opportunity, starting on August 28th, for a Monday arrival at the Carnegie Observatories in Pasadena. Shipments can leave LAX each Friday for arrivals at Las Campanas the following Friday. The First expected date for shipment will be early September (4th arrival in Pasadena, CA) for a desired Magellan Facility arrival of mid-September (two month prior to installation on the telescope). UA will be ready to ship the instrument and support equipment by the end of July. The actual shipment date will depend on the export license.

Export License on Critical Path: In the event the export license is delayed beyond September, UA can ship late to accommodate an “As Late As” October 19 delivery in Chile. The schedule can therefore accommodate a 3 month export licensing process.

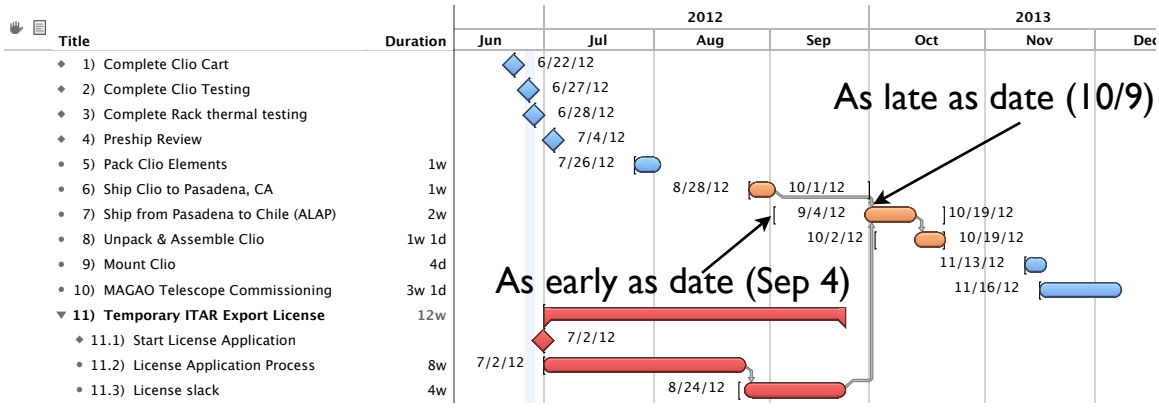

Figure 7. Proposed shipping schedule.