



Enabling
Virtual
Access to
Latin-American
Southern
Observatories

<http://www.evalso.eu>

Work Package: **SA1 – Link Upgrade**

Deliverable No: **SA1-3**

Deliverable Name: **Link Delivery Report**

Date: **2010/12/31**

Nature¹: **REPORT (R)**

Dissemination Level²: **PP**

Abstract

This document is the acceptance report for the whole link and provides the references to the “as built” documentation.

¹ nature of the deliverable: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

² Dissemination level **PU** = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).

AUTHOR

Name	Affiliation ³
G.Filippi	ESO

Co-AUTHOR(s) LIST

Name	Affiliation

³ Project Members

Università degli Studi di Trieste (Coordinator) http://www.units.it/	UniTs	Italy
European Organisation for Astronomical Research in the Southern Hemisphere http://www.eso.org/	ESO	International
Ruhr-Universität Bochum http://www.astro.ruhr-uni-bochum.de/	RUB	Germany
Consortium GARR (Gestione Ampliamento Rete Ricerca) http://www.garr.it/	GARR	Italy
Universiteit Leiden www.leidenuniv.nl/	UL	The Netherlands
Istituto Nazionale di Astrofisica http://www.ts.astro.it/	INAF	Italy
Queen Mary and Westfield college, University of London http://www.qmul.ac.uk/	QMW	United Kingdom
Cooperación Latino Americana de Redes Avanzadas http://www.redclara.net/	CLARA	Uruguay
Red Universitaria Nacional http://www.reuna.cl/	REUNA	Chile

Contents

1	PURPOSE AND SCOPE.....	5
1.1	Applicable documents	5
2	EVALSO COMMUNICATION INFRASTRUCTURE.....	6
2.1	Optical Infrastructure	6
2.2	DWDM Equipment.....	7
3	OPTICAL INFRASTRUCTURE	8
3.1	Construction of new Fibre cables (OCA and PAO to Ruta 5)	8
3.2	Antofagasta Region, comprising: Ruta5 to Antofagasta, Connection to REUNA, housing in Antofagasta	9
3.3	Antofagasta-Santiago backbone (the “LAMBDA”)	10
3.4	Santiago Region, comprising the housing in Santiago and the connectivity to ESO and REUNA premises.	11
4	DWDM EQUIPMENT.....	12
5	EVALSO FINAL DELIVERY	14

LIST OF ABBREVIATIONS

ADSS	All Dielectric Self Supported (fibre cable)
IRU	Indefeasible Right of Use
MOP	Ministerio de Obras Publicas (Chilean Ministry for Public Works)
N/A	Not Applicable
OCA	Observatorio Cerro Armazones
PoP	Point of Presence
SLA	Service Level Agreement
TELCO	Telecommunication Company/Provider that will provide, at the very minimum, the Fixed Wavelengths (one Lambda) between Antofagasta and the Santiago areas

1 PURPOSE AND SCOPE

This document is the final acceptance of the overall link upgrade performed by the SA1 work package and provides reference to the “as Built” technical documentation of the various components.

1.1 Applicable documents

The following applicable documents form part of the present document to the extent specified herein. In the event of conflict between applicable documents and the content of the present document, the content of the present document shall be taken as superseding.

- AD1 EVALSO-SA1-1.1 Technical Specification for the procurement of the EVALSO optical infrastructure
- AD2 EVALSO-SA1-1.2 Area Survey
- AD3 SA1 1-1.4-103 As Built Technical Report
- AD4 SA1.1-1.4-018 Final Report
- AD5 SA1.1-1.5-101 Technical Report – SANTIAGO Area
- AD6 SA1.1-1.5-102 Technical Report – Backbone (LAMBDA)
- AD7 SA1.1-1.5-103 Technical Report – ANTOFAGASTA Area
- AD8 SA1-3 Link Delivery Report - DWDM Equipment Deployment

2 EVALSO COMMUNICATION INFRASTRUCTURE

The EVALSO Communication Infrastructure serves:

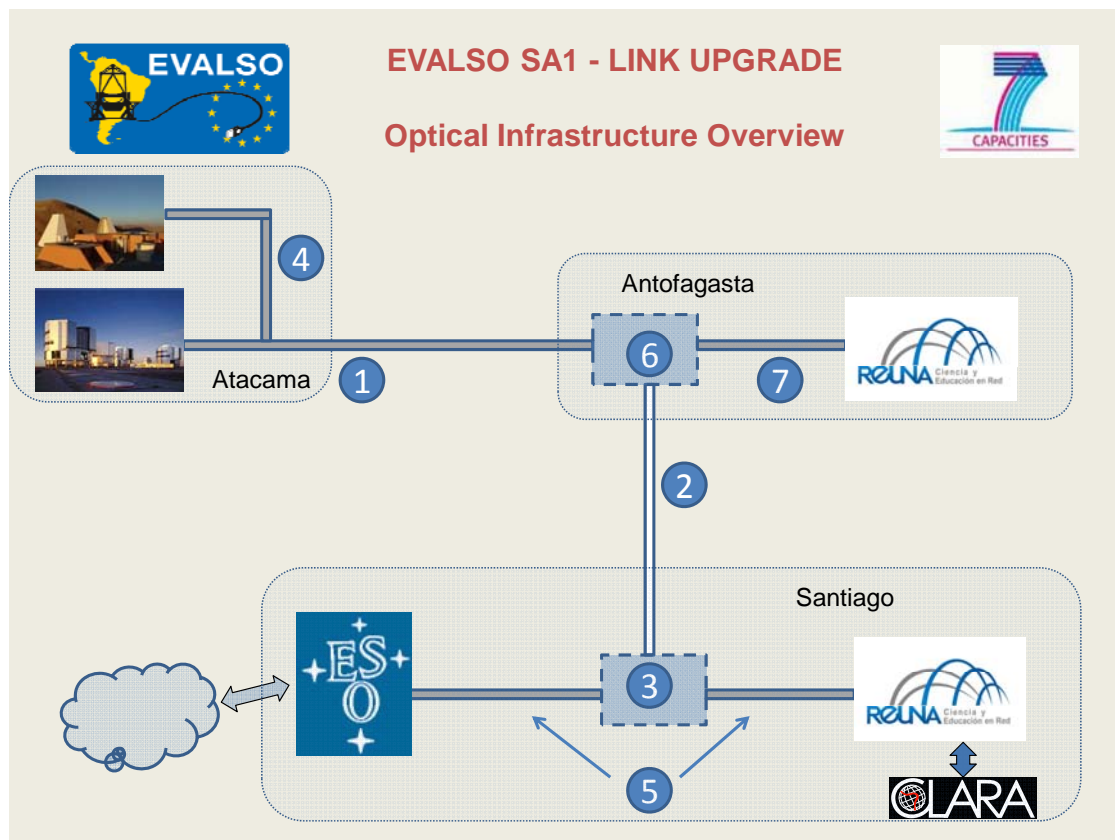
- the Observatories: ESO/Paranal and RUB/OCA
- REUNA Antofagasta,
- The end points: ESO/Santiago and REUNA/Santiago.

by means of:

- the EVALSO optical infrastructure connecting all the above locations.
- the DWDM Equipment in all locations served by the Optical Infrastructure.

2.1 Optical Infrastructure

The whole system is defined in has been divided in items according to the following schema (please refer to AD1 for the detail definition and AD2 for the involved locations):



During detailed technical analysis it became clear that a solution with an housing at the Antofagasta TELCO PoP would provide more options for future growth. The new layout was agreed with the provider and implemented as technical change (i.e., no impact on costs). At the end, the identified items are:

- Item 1: Dark Fibers between ESO Paranal and REUNA Antofagasta, divided into two sub items:
 - Item 1a: from the start of the road to Paranal Observatory to the “Panamericana road” (La Varilla)
 - Item 1b: from the “Panamericana Road” to REUNA/Antofagasta
- Item 2: Fixed Wavelengths (one Lambda) between REUNA Antofagasta and the Santiago area (TELCO PoP)
- Item 3: Housing space for EVALSO equipment at the TELCO PoP (Santiago)
- Item 4: Dark Fibres between OCA and ESO Paranal
- Item 5: Dark fibre between TELCO PoP and the end points in Santiago, namely ESO/Vitacura (5a) and REUNA/Providencia (5b)
- Item 6: Housing space for EVALSO equipment at the TELCO PoP (Antofagasta)
- Item 7: Dark fibre between TELCO PoP Antofagasta and REUNA/Antofagasta

From the point of view of the implementation, the overall system has been divided in 4 areas, namely:

- Construction of new Fibre cables OCA and PAO to Ruta 5 (i.e. items 1a and 4)
- Antofagasta Region, comprising: Ruta5 to Antofagasta, housing in Antofagasta, connection to REUNA, (i.e. items 1b, 6, and 7)
- Antofagasta-Santiago backbone: the “LAMBDA” (i.e. item 2)
- Santiago Region, comprising the housing in Santiago and the connectivity to ESO and REUNA premises (i.e. items 3, 5a and 5b)

2.2 DWDM Equipment

The DWDM equipment provides the capability to create dedicated channels for the data transport among destinations.

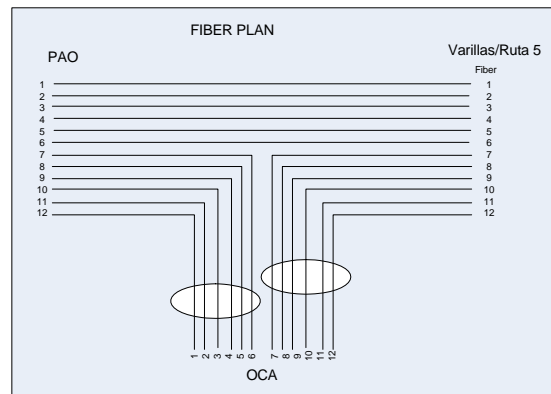
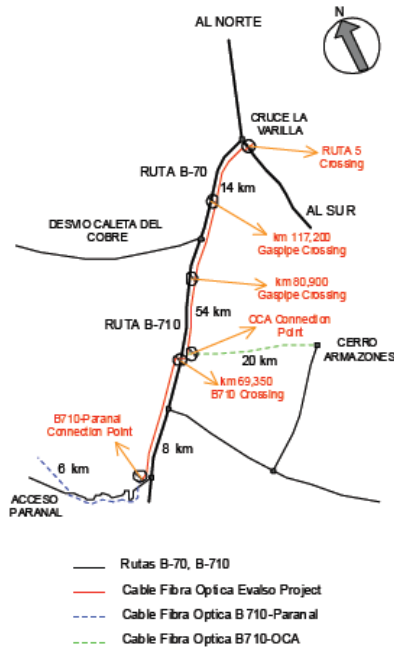
3 OPTICAL INFRASTRUCTURE

3.1 Construction of new Fibre cables (OCA and PAO to Ruta 5)

The project installed about 100km of new fibre cable along two main directions:

- Item 1a: From the ESO Paranal Observatory at Cerro Paranal to Ruta5 along the existing B-710 road
- Item 4: From the OCA Observatory at Cerro Armazones to the B-710 road.

Although from the formal point of view, item 1a was procured by ESO and item 4 by RUB-OCA, the installation of both has been done by AXYS and the technical supervision by the joint SA1 team.



The detail description of the installation of both new cables is provided in SA1 1-1.4-103 “As Built Technical Report” [AD3] that includes also the attenuation measurements. Some Key values of the system are provided here below:

Cable characteristics:

- 12-core fiber cable for direct installation underground
- Type of fiber: ITU G652.D
- Chromatic Dispersion: ps/nm 1258

Segment 1 (ESO Paranal to “La Varilla” cross road (B-710/Ruta5):

- Length: 75 Kms
- Attenuation: 18,5dB @ 1550nm

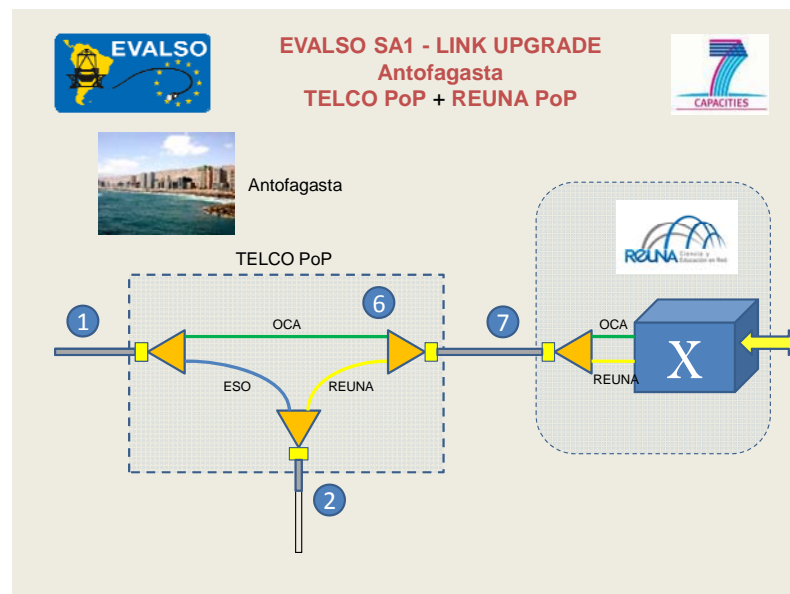
Segment 4: (Cerro Armazones Observatory to ESO Paranal)

- Length: 30Km (20 new cable, same as for 1a +10 from Segment 1a)
- Attenuation: 9dB @ 1550nm

The SA1 1-1.4-018 “Final Report” [AD4] provides evidence of the work completion (acceptance from Chilean Authority).

Item 1a was completed during August and item 4 in October.

3.2 Antofagasta Region, comprising: Ruta5 to Antofagasta, Connection to REUNA, housing in Antofagasta



At the crossroad between Ruta5 and the B710, the new cable joined the existing infrastructure owned by TELEFONICA. As part of the contract, one pair of fibres (item 1b) is used to reach the PoP in Antofagasta. From here a dark fibre (item 7) connects to the REUNA installation. At the TELEFONICA PoP a dedicate rack space provides housing for the DWDM equipment.

Segment 1b: one fiber pair from existing aerial cable (TELEFONICA)

- Type of fiber: ITU G652.D
- Length: 50 Kms
- Attenuation: 11,5dB @ 1550nm

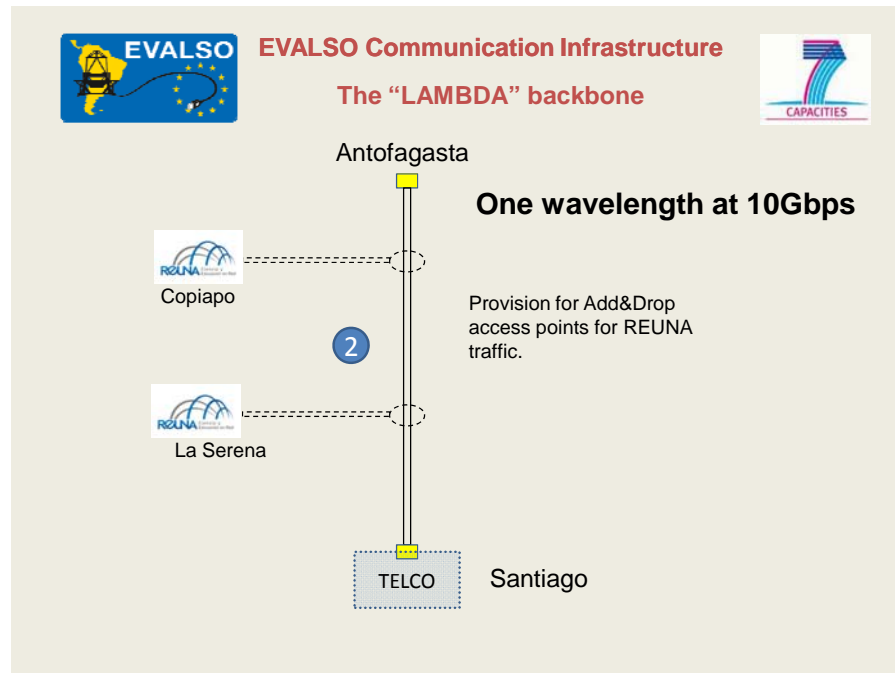
Segment 1a +1b

- Total Length: 125Kms

- o Total Attenuation: 30dB @ 1550nm ⁴

The detail description of the installation in the ANTOFAGASTA region is provided in SA1 1-1.5-103 Technical Report 0 ANTOFAGASTA Area” [AD7]

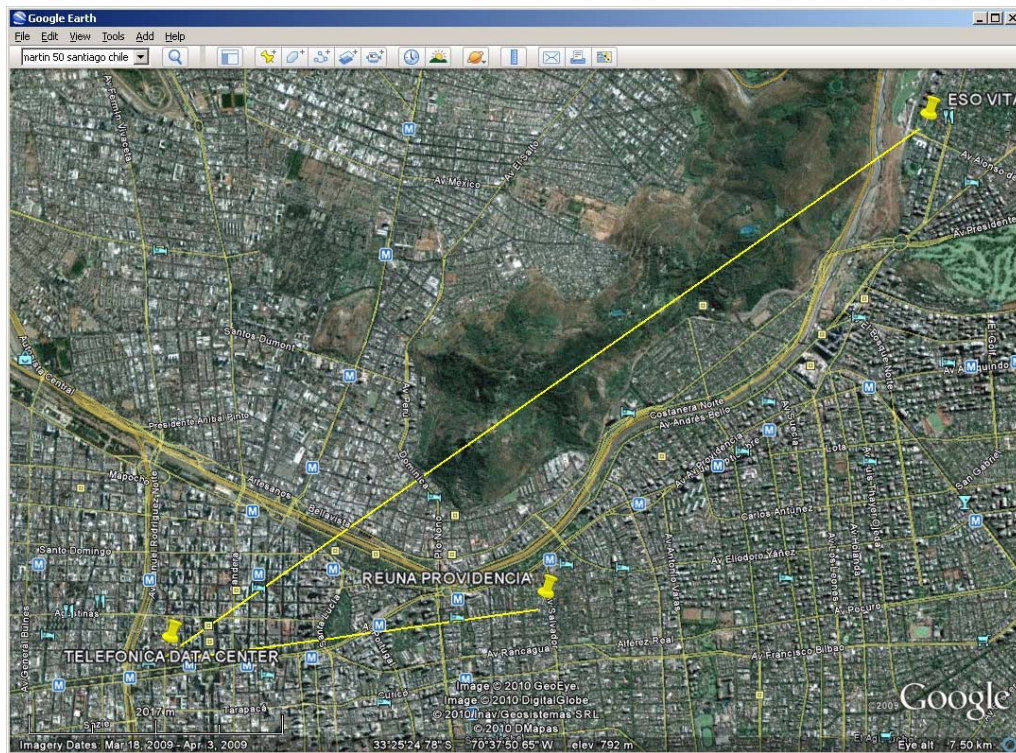
3.3 Antofagasta-Santiago backbone (the “LAMBDA”)



The detail description of the configuration of the 10Gbps backbone is provided in SA1.1-1.5-102 “Technical Report – Backbone (LAMBDA)” [AD6].

⁴ for unclear reasons, one of the two cores has a higher attenuation than expected. Although this is not impacting the functionality, it has been agreed with TELEFONICA that, as part of the operation and maintenance, the problem will be analysed and possibly solved. At the time of writing, it seems that the root cause is a defective cable in the internal TELEFONICA infrastructure that will be replaced during first half of 2011.

3.4 Santiago Region, comprising the housing in Santiago and the connectivity to ESO and REUNA premises.



In the metropolitan area of Santiago there are:

- Item 3: Housing space for EVALSO equipment at the TELCO PoP (Santiago)
- Item 5a: Dark fibre between TELCO PoP and ESO/Vitacura
- Item 5b: Dark fibre between TELCO PoP and REUNA/Providencia

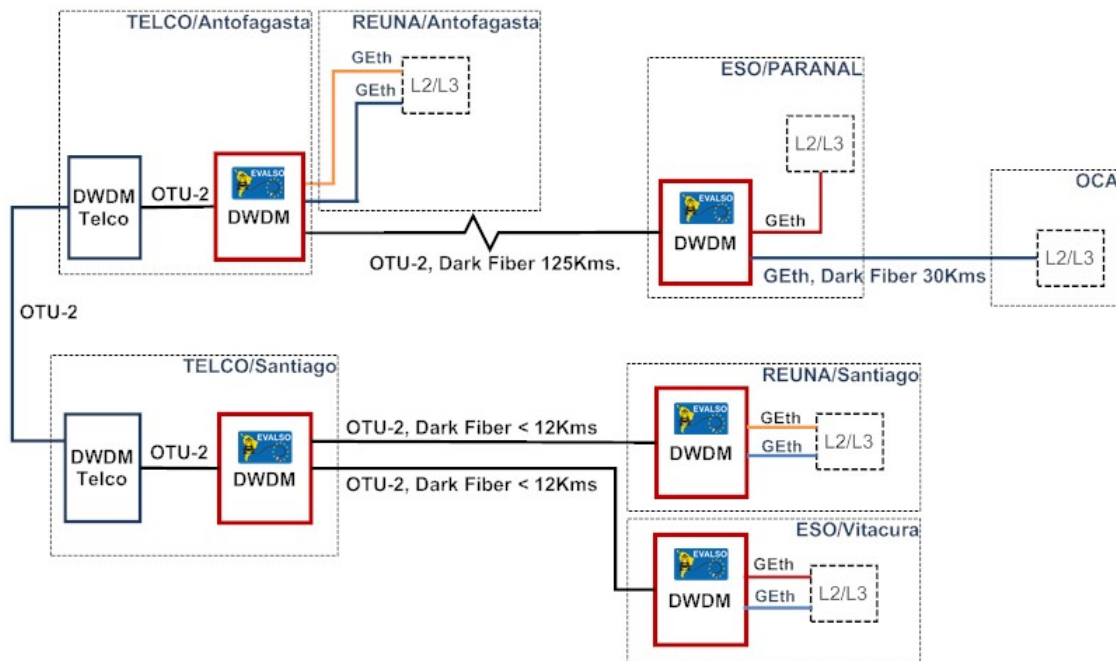
The detail description is provided in SA1 1-1.5-101 Technical Report - SANTIAGO Area” [AD5].

4 DWDM EQUIPMENT

There are five nodes where EVALSO equipment is installed:

- At the ESO Paranal Observatory. This unit manages the traffic that ESO PAO and OCA will generate and send using an OTU2 channel to the Antofagasta node.
- At the TELCO PoP in Antofagasta. This unit receives the traffic from the Observatories and from REUNA offices in Antofagasta and feeds the OTU2 to Santiago.
- At the TELCO PoP in Santiago. This unit receives the traffic from Antofagasta and distributes to the Santiago end points, ESO and REUNA.
- At the ESO Offices in Vitacura, Santiago. This unit receives the traffic from the ESO Observatory and feeds the traffic to Europe via REUNA.
- At the REUNA Offices in Providencia, Santiago. This unit will receive the traffic from REUNA Antofagasta and ESO Santiago and forward it to the academic and research networks (ALICE, GEANT, etc).

The overall schematics is provided by the figure below:



The selected equipment is CIENA CN 4200 family with two kind of chassis, classic one (4 slots) and RS (17 slots).

The link Antofagasta-Paranal is 130Kms so was necessary to add an amplifier specifically a Variable optical amplifier and a Chromatic Dispersion Compensation module.

The SA1-3 Link Delivery Report - DWDM Equipment Deployment [AD8] provides detailed explanation on the equipment, topology, installation and first measurements.

Although formally speaking they are not part of the EVALSO scope, the additional nodes of La Serena and Copiapo have been also installed by REUNA.

5 EVALSO FINAL DELIVERY

All parts of the EVALSO Communication Infrastructure have been completed and functionally tested within the end of October 2010.



A complete description of the event is available on the EVALSO WEB site:

<http://www.evalso.eu/evalso/2010-nov04-launching-event/>

In the official inauguration ceremony held in Santiago on November the 4th a functional demonstration has been given linking all sites.

Although already available before, the system has been formally delivered by SA1 to the JRAX activities on November 5th.