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MINUTES OF END OF PHASE-III MEETING. 17-20 MAY 2011

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Control	Name	Org.	Function	Date	Signature
Prepared	A. Pérez de Taoro	IAC	Project Manager	20/05/11	
Revised	All Meeting Attendants				
Approved	All Meeting Attendants				
Authorized	M. Collados	IAC	Project Coordinator		

EST Project Office

38200 La Laguna (S/C Tenerife) - ESPAÑA - Phone (922)605200 - Fax (922)605210

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DOCUMENT CHANGE RECORD


Issue	Date	Section	Change Description
Draft	1/06/11	All	First Issue.

LIST OF ABBREVIATIONS

AO	Adaptive Optics
BB	Broad Band
CFD	Computational Fluid Dynamics
DM	Deformable Mirror
EB	Error Budget
EST	European Solar Telescope
HS	Heat Stop
IR	Infrared
M1	Primary mirror
M2	Secondary mirror
M2TT	Second mirror in the optical path that works as a Tip-Tilt mirror
MCAO	Multi-Conjugated Adaptive Optics
TCT	Technical Core Team
TO	Transfer Optics
TT	Tip-Tit mirror
WFS	Wavelength Front Sensor
WP	Work Package

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1. SUMMARY

Minutes of end of Phase III meeting. 17th – 20th May 2011


Place: Freiburg, Germany (Novotel Meeting Room)

2. REFERENCE DOCUMENTS

RD.1	PRE-IAC-1010	WP1000 Coordination Introduction
RD.2	PRE-IAC-1011	WP1000 Management
RD.3	PRE-IAC-2005	WP2000 Scientific Requirement
RD.4	PRE-GTC-3005	WP3000 System Engineering
RD.5	PRE-IAC-2005	WP4100 Optical Design
RD.6	PRE-KIS-6005	WP6000 Adaptive Optics
RD.7	PRE-KIS-6006	WP6000 MCAO
RD.8	PRE-UUT-4406	WP4400 Polarization optics
RD.9	PRE-MPG-5003	WP5500 Coatings
RD.10	PRE-AIA-4203	WP4200 Auxiliary Full Disk Telescope
RD.11	PRE-MTM-5002	WP5100 Telescope Mechanics
RD.12	PRE-KIS-5004	WP5200 M1, Primary mirror
RD.13	PRE-GTC-5001	WP5400 M2, Secondary Mirror
RD.14	PRE-UTV-5003	WP5300 Heat Rejecter
RD.15	PRE-IDO-5002	WP5000 Transfer Optics
RD.16	PRE-GTC-9401	WP9400 CDF & Thermal Analyses
RD.17	PRE-UUT-9203	WP9200 Enclosure
RD.18	PRE-HAN-9201	WP9200 Enclosure. Mechanism
RD.19	PRE-UUT-9204	WP9200 Enclosure. Membranes
RD.20	PRE-UUT-9103	WP9100 Pier
RD.21	PRE-IDO-9302	WP9300 Building
RD.22	PRE-INA-7103	WP7100 Broad Band imager
RD.23	PRE-IAC-7306	WP 7300 Grating Spectrographs

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RD.24	PRE-KIS-7202	WP7200 Narrow Band Instrument
RD.25	PRE-IAC-7004	WP7000 Light Distribution System
RD.26	PRE-INA-0016	WP10000 Data acquisition and Control
RD.27	PRE-INA-0017	WP10200 Telescope Control and Monitoring
RD.28	PRE-INA-0018	WP10300 Instrument Control System
RD.29	PRE-INA-0019	WP10100 Data Handling System
RD.30	PRE-UPS-0006	WP10500 Post-telescope Data Flow and Science Database
RD.31	PRE-IAC-8103	WP8100 Site Characterization
RD.32	PRE-GTC-3006	WP3000 Operation
RD.33	PRE-IAC-1012	WP1000 Management. Costs, Schedule, Summary
RD.34	PRE-IAC-1013	WP11000 Financial feasibility and socio-economic impact
RD.35	PRE-IAC-1014	WP1000 Future Steps towards EST

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3. ATTENDEES

Wolfgang Schmidt	KIS
Angeles P. de Taoro	IAC
Reiner Volkmer	KIS
Rob Hammerschlag	UUT
Alex Feller	MPG
Hans Kommers	HANKOM
Paolo Di Marcantonio	INAF
Michal Sobotka	AIASCR
Miroslav Klvana	AIASCR
Johann Hirzberger	MPG
Roberto Cirami	INAF
Hector Socas Navarro	IAC
Joan Manel Casalta	NTE-SENER
Francesca Zuccarello	INAF
Lluís Cavaller	GTC
Paolo Romano	INAF
Salvo Scuderi	INAF
Ilaria Ermolli	INAF
Frédéric Sayède	OBSPAR
Manuel Collados	IAC
Thomas Scheffelen	KIS
Frédéric Paletou	UPS
Thomas Zimmerer	MTM
Dario Del Moro	UToV
Jorge Sánchez-Capuchino	IAC

Martina Cocciolo	UToV
Bernard Gelly	THEMIS
Christine Grivel	IAC
Arturo Lopez	THEMIS
Francesco Berrilli	UToV
Ariadna Calcines Rosario	IAC
Mats Carlsson	ITA
Jesus Burgos	IAC
Thomas Kentischer	KIS
Matteo Munari	INAF
Christian Beck	IAC
Ales Kucera	AIAS
Jan Rybak	AIASCR
David Fischer	MTM
Hans Kärcher	MTM
Joost Hartman	PH
Oskar von der Lühe	KIS
Rolf Schlichenmaier	KIS
Michele Bianda	IRSOL
Dirk Soltau	KIS
Felix Bettonvil	UUT
Simon van Leverink	PMD
Javier Castro	GTC

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4. AGENDA

EST End-of-Phase III Meeting Freiburg, 17th-20th May, 2011 Final Agenda

Tuesday 17th (Welcome, Management, System Engineering, Optics, AO)

09:00 – 09:15 Welcome. (O. Von der Lühe)

09:15 – 10:00 WP01000 Coordination & Management. (M. Collados, A. Pérez) General overview of the project status.

10:00 – 10:30 WP02000 Science Requirements. (H. Socas)

10:30 – 11:00 Coffee break

11:00 – 13:15 WP03000 System Engineering. (L. Cavaller). System overview, System Specifications, Error Budgets, Configuration DB.

13:15 – 14:30 Lunch break

14:30 – 15:30 WP04000 Optical Design. (J. Sánchez-Capuchino)

15:30 – 16:15 WP06000 AO & MCAO. (D. Soltau, T. Berkefeld).

16:15 – 17:00 WP04000 Optical Design; Polarization. (F. Bettonvil)

17:00 – 17:30 Coffee break

17:30 – 17:45 WP05000 Optomechanics; Coatings. (A. Feller)

17:50 – 18:25 WP04000 Optical Design; Full disk telescope. (M. Sobotka)

Wednesday 18th (Optomechanics, CFD & Thermal Analyses, Enclosure)

09:00 – 10:00 WP05000 Optomechanics; Telescope structure and mechanics. (H. Kaercher)

10:00 – 11:00 WP05000 Optomechanics; Primary mirror. (R. Volkmer)

11:00 – 11:30 Coffee break

11:30 – 12:30 WP05000 Optomechanics; Secondary mirror. (L. Cavaller, J.M Casalta)

12:30 – 13:30 WP05000 Optomechanics; Heat rejecter. (F. Berrilli, M.Cocciolo)


13:30 – 15:00 Lunch break

15:00 – 15:30 WP05000 Optomechanics; Transfer optics. (R. Sanquirce)

15:30 – 16:45 WP09000 Building & Dome; CFD analysis & Thermal Control. (L. Cavaller)

16:45 – 17:15 Coffee break

17:15 – 18:15 WP09000 Building & Dome; Enclosure. (F. Bettonvil, H. Kommers)

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Thursday 19th (Pier, Building, Instruments, Control, Site Characterization)

- 09:00 – 09:45** WP09000 Building & Dome; Pier. (F. Bettonvil, J. Hartman)
- 09:45 – 10:45** WP09000 Building & Dome; Building. (A. Gómez, J. Aja)
- 10:45 – 11:15 Coffee break*
- 11:15 – 11:45** WP07000 Instruments; Broad-band Imager. (S. Scuderi)
- 11:45 – 12:20** WP07000 Instruments; Grating Spectrograph. (A. Calcines)
- 12:20 – 13:00** WP07000 Instruments; Narrow-band tunable spectropolarimeter. (T. Kentischer)
- 13:00 – 14:30 Lunch break*
- 14:30 – 15:00** WP07000 Instruments; Light distribution. (C. Grivel)
- 15:00 – 15:20** WP10000 Control System Architecture. (I. Ermolli)
- 15:20 – 15:40** WP10300 Instrument Control Design (P. Romano)
- 15:40 – 16:10** WP10200 Telescope Control Design (R. Cirami, P. Di Marcantonio)
- 16:10 – 16:40 Coffee break*
- 16:40 – 17:15** WP10100 On-site Handling (K. Reardon)
- 17:15 – 17:45** WP10500 Post-telescope Data handling (F. Paletou)
- 17:45 – 18:15** WP08000 Site Characterization; Seeing measurements. (M. Collados, G. Scharmer) Results. Future measurements.

Friday 20th (Summary, Costs & Planning, Socio-economic impact, Future plans)

- 09:10 – 09:30** Operation Phase. Lluís Cavaller
- 09:30 – 10:00** WP01000; Summary, Costs, Planning. (A. Pérez de Taoro)
- General discussion and conclusions (all)
- 10:00 – 10:40** WP11000 Financial feasibility and socio-economic impact. (A. Sosa)
- 10:40 – 11:10** The future of the EST. (M. Collados)
- 11:10 – 11:45 Coffee break*

EoM

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5. MINUTES

5.1 Coordination & management

The hard work done is shown in the difference between the two images, at the very beginning of the project with just several mirrors floating in the air, and in the present conceptual model with such level of detail.

The amount of documentation is another index of the kind of work done. Most of documents are minutes and presentation meetings (98 and 105 respectively), which is reasonable taking account the great number of participants, but also technical reports are numerous (93).

5.2 Optical Design

Concerning the M1 movement, R. Volkmer asks how precise must be the actuator over M1? The tolerance analysis of the actuator movements, in order to achieve the correction needed to fulfill the image quality required, is not already done.

D. Soltau proposes that tilting M4 could be more effective to correct the pupil motion than shifting M2 because in that case the image motion is not too much affected. According the actual calculations both effects are well decoupled, but the proposal should be studied. Another advantage of having this performance on M2 is that M2 is already an active mirror, mounted over an hexapod, and an active M4 is not needed.

R. Hammerschlag asks about the vacuum option for the transfer optics tube. It is clarified that the vacuum option for the TO is not totally discarded, it is not the baseline design but is a backup solution.

Actually is not possible to bypass the MCAO although not too many changes would be needed.

The position of the MCAO mirrors could be changed within certain range easily in the current design, major changes on DMs position will affect to M13 design and position, and in any case, it is not designed to be changed on fly.

5.3 AO/MCAO


What is the reliability of the simulations? Around a10%

How representative is the seeing profile used in the simulations? The CN2 profile is estimated over 2 years, with night time data, no daytime data are available up to now.

5.4 Polarization

Does the air flow inside the TO increase or remove the dust over the mirrors? We don't know.

R. Hammerschlag asks about the procedure for washing/cleaning the mirrors. Polarization compensation depends on identical properties of pairs of mirrors, different orientation of mirror pairs can easily produce different dust deposit.

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5.5 Coatings

Recommendations:

- M1 bare Al
- White-light mirrors: protected Ag of Sagem GAIA, or SESO new blue enhanced Ag
- Color mirrors: depends on the spectral channel.
 - o VIS (<400nm) and IR: protected Ag
 - o UV: bare Al

The usual product to cleaning Al coating is CO₂.

Can coatings be removed without re-polishing the mirror? Yes.

J. Sanchez-Capuchino remarks that the degradation depending on the angle of incidence is not included in the report, but could be done.

A. Feller adds that the durability tests carried out over the coatings will be extended at least during this year.

What is the maximum size of the mirror to be coated with AG? Ag coatings are actually feasible until 2.2m in Europe.

5.6 AFDT

In the designer opinion, the optimal location to integrate the AFDT in the telescope building is the place where the crane is actually placed. Changing the crane to another location should be considered or placing the auxiliary telescope in an independent tower, which would increase its cost in a 50%.

I. Ermolli remarks that in the bandwidth of 0,1nm, the 60-80% comes from the photosphere, which is something to keep in mind; filter bandwidths may be rather large.


5.7 Telescope Structure

R. Hammerschlag asks if it is really necessary a Nasmyth platform, because of the difficulties added to the telescope structure. In fact the use of this focus is not still decided, but is part of the requirements. H. Kärcher comments that the requirement of 10Hz is the important difficulty not the Nasmyth platform. The Nasmyth platform has only influence on the dynamic behavior.

How is the wind effect compensated? By mean of encoders is it possible to estimate the overall behavior and establish an open loop to compensate the deviations.

F. Sayède comments that this structure is dominated by the wind load effect, instead gravity, because it is an open telescope, although the structure is designed to support weight not the wind. Is it possible to optimize the structure to support the wind load?

Wind load in horizontal is equivalent to gravity load in vertical, therefore the structural design is similar for both things. In any case the structure is already optimized to minimize the effect of the wind.

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5.8 M1

Concerning the measurements of the displacement due to gravity deformations over the mirror, who does it, the WFS? With measurements coming from the WFS, this behavior is modeled.

M. Collados asks: will flushing system for mirror be run all the time? The flushing system is operating all the time, not depending on wind, because it does not disturb, not suppose much cost and helps when the wind is low.

M1 has not risk in the design; the only identified risk is the manufacturing, although the consulted manufacturer thinks there is not any problem to fabricate it.

F. Bettonvil points that the mirror cell, with all the systems included, seems too huge. What about the access and maintenance? The M1 removal must be done with the mirror in its cell. R. Volkmer proposes even to polish and to coating the mirror mounted in the cell, although these procedures have not been studied up to now. The major risk is to remove the mirror from the cell.

5.9 M2

It is remarked that observing nearer than 5° of the sun center, as specified, is not possible, because the light would enter directly over the mirror in a non safe situation, at 7° when the middle of the sun disk is inside the mirror, the temperature reached is safe but performances would be really degraded because of the mirror deformations. A similar situation occurs if the system is operated with the cooling system switched off, the heat load is not too much to put the system in a non safe situation although the image quality would be degraded.

M. Collados asks about the fans included in the M2 design. How many fans are in the telescope and which is the impact of the vibrations? The vibrations can be minimized and isolated. It is commented that in other telescopes vibrations coming from fans are really a big problem.

5.10 Heat Rejecter

Fluids fall from M2 to M1 occur often on solar telescopes. Is it the cooling system safety enough? It is, because coolant pipes are routed inside closed spiders. The coolant liquid is a mixture of water and glycol.


What is the accuracy of the pinholes position? It has not been studied. There is not an specific specification for this accuracy, although this tolerance analysis must be done in the future. Stray light produced by the HR is the more problematic topic, because of the high degree of polishing.

Could be changed the size of the hole during the observation? No, that option is not required.

Recoating would be necessary? The time needed for recoating have not been estimated. Having a spare HR “mirror” could be a good option.

Could the HR produce vigneting over the FoV? It is not calculated, although in any case the vigneting would be larger than the FoV, then the effect is not critical.

R. Hammerschlag asks if it is possible to couple the M1 shutter (to cover the mirror) in the case of an emergency stop of the cooling system. The answer is that it is not really necessary since the cooling system is designed safe enough and emergencies, like power cuts, are taken into account.

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Also the spiders do not support too much heat load, must be made safe enough in order to be sure that not much heat arrives to the cables and pipes inside. In any case, which directions are allowed for observations near the sun and which ones not, must be analyzed and defined.

5.11 Transfer Optics

(There is a mistake in the slide 14 of transfer optics presentation: pressure units are Pa instead bar.)

What is the confidence in the air conditioning system from the preliminary calculations? The values obtained in the results have margin enough.

What are the main results of the evacuated solution? The evacuated option has not been evaluated so deeply, it is more complex, the effect of the differential pressure over the window is risky.

From F. Bettonvil: Could the air conditioning system contribute in any way to the contamination and dust control? The air utilized is filtered, is used and works perfectly in cleaning rooms.

Concerning the power consumption of the system, the estimated value is around 40kw for the cooling system, 110kw for fans and others, 160kw in total.

C. Beck asks regarding the oil leakage from bearings and motors inside the TO: Could the oil drops fall on the mirrors? A shield system must be designed to avoid this kind of problems.

How the heat sources have been simulated for the calculations? In case of not using a cooling system, the heat generated is estimated in 10w/mirror, 2w is the residual heat generated by mirror when the cooling system is active.

5.12 Thermal analyses

It is clarified that the wind shield is retractable.


R. Hammerschlag considers that painting in white is better to undercool the Telescope platform in the morning, silver is better in noon, then, white would be the chosen option. In any case, the conclusion is that both elements, the structure and the Telescope platform, must have also an active cooling system because only passively, the temperature will increase over the ambient T.

From A. Lopez: Which is the allowed limit for heat build-up on spiders by an off-center pointing? Even if the incident light comes not from the focus but from another source over the spider, the temperature reached has not been calculated. The conditions in which observing near the solar disk is reasonable, with benefit but without risk, should be defined.

CFD analysis with the real topography have been performed at 2 and 5 m/s wind, but only with the pier and the telescope platform models, next step will be done adding the telescope structure model over the pier.

5.13 Enclosure

Could snow coverage turn into a problem? The experience in similar enclosures is that a large snow layer slide down by itself.

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It is clarified that the transparence of the membrane is enough because the enclosure has a double layer.

5.14 Pier

Has a chimney been previewed to avoid vibrations? Yes, it is previewed.

M. Sobotka: Concerning the crane placed over the platform, is just below the light path. How it affects to the seeing? Has been considered, it is oriented in the main wind direction and the T deviation of the crane has been estimated and is not critical.

R. Volkmer remarks that the wind speed will be critical for using the crane during the exchange of M1, a lift would be more secure (operation at higher wind speeds is possible). Another possibility is to install guiding slots at the tower, to be used together with the crane.

Is it not possible to store the crane below the platform when is not in use? In this case, it will disturb the path of the air below the platform.

5.15 Building

The preliminary estimated power consumption is: 1MW general supply line + 100kW clean supply line.

M. Sobotka remarks that the cooling system room must be located away enough in order to avoid the seeing could be affected. Actually the distance from that service building to the main building is still not decided, could be located as far as the terrain allows it. In the GTC case, the hot air is ejected on the dominant winds direction.

R. Volkmer asks if it is planned reusing the heat for warming, f.i., taking into account the large amount of energy generated. It is not contemplated up to now, although this possibility should be analyzed.

5.16 Instruments

No relevant question.


5.17 Light distribution system

It is clarified that this coudé room does not correspond exactly to the coudé room shown in the building presentation, because the design is actually more evolved.

J. Rybak asks if it is guaranteed the access to all optical elements. The beamsplitters have 450mm and they are well accessible; the spectrographs are not so easily accessible. The lower floor needs more study in matter of accessibility.

Is it planned a focus compensation due to the beamsplitters that can be removed and inserted? Yes it is previewed. The focal plane in the detector can be displaced. The spectrographs have four mirrors for refocusing. In the case of the BBI a focus mechanism is needed.

Could wedged plates be used to balance astigmatism? That possibility must be studied.

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5.18 Control

From M. Collados to P. Romano: How difficult is the implementation of guest instruments? Will require effort, but with defined commands should not be critical in any way.

From H. Socas to K. Reardon: Is it possible to use lossless mpeg format? Not investigated yet. Real data rates may be reduced with respect to maximum number by mean of an on-site data selection, in order to keep only the best ones.

M. Collados remarks that the EST observing time at good resolution will be more than 15 minutes.

C. Beck asks if compression would be possible for max data rate of 3 TB? The equipment needed is not fully clear, could be possible. S. Scuderi points that the 3-D compression might be possible.

W. Schmidt comments that at the beginning of the operation the data rate will be a factor 2 less than expected, after, hardware may develop faster providing more than a factor of 2 in e.g. disk space or bandwidth instead.

Hector points, concerning the rejection criteria suggested to not accumulate the data, data that cannot be redone should receive more hesitation before deletion.

L. Cavaller asks to F. Paletou: What is the total operation budget, taken into account 1k€/yr/kW? No first order estimate is yet available; presumably 5-10 % of project costs can be used for estimate.

5.19 Site testing

T. Berkefeld recommends comparing the results with Salina data.

R. Volkmer remarks that could be interesting comparing with Gregor shabar data too.

5.20 Operation

Concerning the queue observing mode, is important to have a clear proposal from the very beginning, because the implication in the control system. What has been shown in this presentation is a preliminary proposal just to have in mind that is needed to consider it from now on.


In the case of combining telescopes observation, for example with aircraft,

O. vd Luehe comments that EST needs, in their evolution in time, some group to study the improvement in new instrumentation. Who will decide about these upgrades? The institutions involved in the European Solar Community must be involved in that.

W. Schmidt remarks that the telescope operation must include the data handling. It is not included because there is not still an estimate on that.

A. López points that night time operations will require significant changes and could increase staff demand. The response is the operation contemplates different teams for day and for night time observation.

Regarding the definition and scheduling of maintenance tasks, all tasks that do not require sunlight should be scheduled for night time.

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5.21 Costs & Planning

O. vd Luehe asks how is the cost profile of the money spend per year. The profile will be shown in the next presentation.

W. Schmidt remarks that the inflation should be included in the cost estimate.

5.22 Financial Feasibility

A summary of the work done is presented, the final complete feasibility report will be ready in three weeks.

L. Cavaller asks if there is any study about the technology return due to GTC in Canary Island up to know? There is not.

From F. Sayède: What is the comparison to GTC similar impact report? GTC is a Spanish investment based project, and then the impact is not well comparable.

R. Hammerschlag suggests that local contacts should be intensified: cooperation with industry, development of new technologies, etc.

The importance of this document is that EST team has a tool to present to the authorities, and it is important to complement it with other documentation oriented to our regional and national governments.

5.23 Future steps towards EST

No relevant question