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COMMISSIONING PLANS FOR THE GTC

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RESUMEN

Los planes para la puesta a punto del GTC están siendo diseñados en la Oficina de Proyecto. Dicha puesta a punto comenzará antes de la primera luz del GTC, con la puesta a punto de la montura mecánica del telescopio, y continuará hasta después de que la operación científica normal haya comenzado. El propósito de la puesta a punto es convertir una serie de equipos y subsistemas en un único instrumento capaz de producir ciencia de alta calidad. Por lo que como parte de la puesta a punto tendrán que llevarse a cabo algunos proyectos científicos de prueba.

ABSTRACT

The plans for the commissioning of the GTC are being drawn up at the GTC Project Office. The commissioning will start before first light, with the commissioning of the telescope mount and will continue until after normal science operations begin. The aim of the commissioning is to convert a series of subsystems into a single instrument that is capable of delivering high quality science. Hence, as part of the commissioning tasks, some science demonstration projects will be undertaken.

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1. INTRODUCTION

The commissioning period of the telescope is a very important stage in its construction, as it is during this period that what is initially a series of subsystems is brought together to form a single unit. As the commissioning period is limited, it is important that the stages in the commissioning and their order are carefully thought through. In particular, the order in which each capability has to be added to the telescope needs to be planned in detail. In preparing the commissioning plan it is assumed that each subsystem has already been tested, so that the telescope moves, the mirror supports work, the cameras take images, etc. Hence, the plan is more concerned with combined capabilities rather than individual subsystems.

The guidelines used in developing the installation and commissioning plan are:

- Ensure that not too many components arrive in too short a period so as even out the work load.
- Obtain a minimum level of capability in all areas as quickly as possible. There is a bottle neck in the commissioning which is the ability to make a stable image in the focal plane. Once this is achieved then it is possible to concentrate on specific areas, pointing, tracking, image quality etc.
- If possible, do some initial tests well before the main tests in that area are scheduled. This gives time to play with the data and understand what is happening. Hence, when the full commissioning of that area begins the necessary tools are in place and tested. Furthermore, the initial test may reveal serious faults, which will need to be corrected. It is better to find out about these as early as possible.
- Ensure important areas of the operation are not left until very late in the commissioning period, which, if there were problems, could delay science operations.

2. THE MILESTONES

The commissioning plan is built around a series of five more or less evenly spaced milestones in the project time line, which are shown in Figure 1.

2.1. *Before first light*

The first milestone is reached when the telescope mechanics are handed over to Project Office and the integration of the the optics begins. There is then a period of about five months before first light during which the telescope is prepared for observations. However, the telescope can be moved during most of this time, which provides an opportunity to mount a small refracting telescope on the elevation ring of the telescope. Through use of this refractor, the motion of the telescope mount can be directly measured

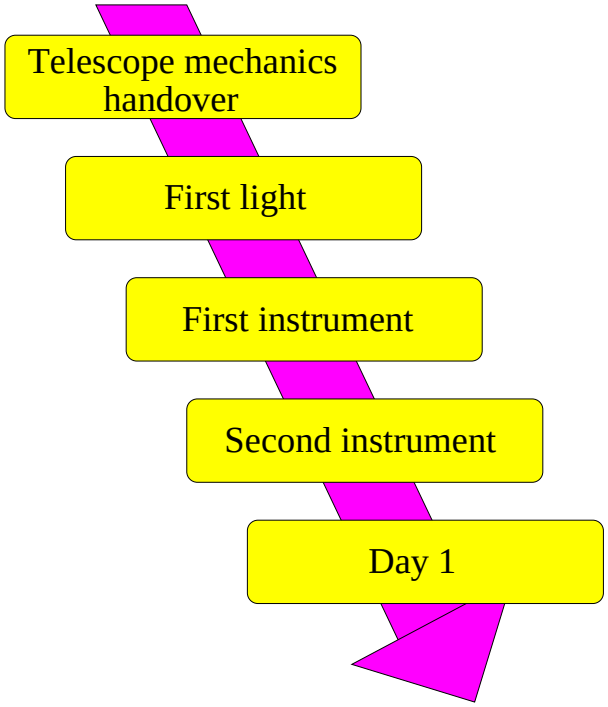

Fig. 1. The milestones in the time line of the GTC.

against the sky and an initial pointing model constructed. In fact, many of the commissioning tasks to do with pointing, tracking, and offsetting can be done during this period, so time need not be lost after first light.

Moreover, the same detector and readout system that will be used in the acquisition and guiding systems can also be mounted. Hence, a significant part of the subsystems needed for first light can be tested and debugged well before they are needed, thereby significantly reducing the workload at first light.

2.2. *First light and immediately afterwards*

First light is the detection of the initial photons through the telescope optics. Although the telescope optics have to be in operation, only six to twelve segments of the primary mirror will be mounted. As the initial pointing is likely to be poor, first light itself is likely to be detected using a piece of white card and the human eye. With this method, it will be possible to detect the brightest stars and it is the simplest wide field detector available. Once the first star has been located and centered we shall switch to the acquisition camera for the initial tests, and soon afterwards the commissioning camera will be mounted.

The initial aim will be to stabilize the image in the focal plane, as without this it is impossible to correctly characterize the system.

2.3. *The arrival of science instruments to Day One*

Whilst the arrival of the science instruments is important in itself, for the telescope commissioning its significance is that various performance requirements need to be met by this point.

The arrival of the first science instruments will occur about four months after first light. The first instrument will be the optical as this does not make as many stringent demands on the telescope performance. For example, the primary mirror does not have to be phased and in fact the current plans mean that the full primary mirror will not be in place at this point. None the less, the image quality, tracking, and guiding all have to have reached acceptable levels.

The infrared (IR) instrument, scheduled for about 8 months after first light, is expected to achieve diffraction-limited imaging, which will require the whole mirror to be in place and for the segments to be phased. Also, the chopping secondary must be available, and hence by this point the telescope performance should be approaching the required levels.

On Day One the full science operation of the telescope will begin, and so by this point it is important that telescope is routinely producing excellent image quality. Furthermore, most of the operational procedures need to be optimized.

3. PERFORMANCE TARGETS

In order to gauge the progress in the commissioning of the telescope a series of performance test have been made which are associated with the milestones (see Table 1). Whilst some of these requirements need to be reached if the science instruments are to perform correctly, the main aim is to give the commissioning team a benchmark by which to judge the improvements in the system.

4. SCIENCE DURING THE COMMISSIONING PERIOD

The GTC is designed to produce high quality science, and although obtaining a high quality image, etc., is a major factor in this, it is also important that all aspects of the life cycle of a science proposal are dealt with. This includes accepting the proposals, preparing the observations, taking, and finally reducing, the data. The best way of doing this is to actually carry out science projects in collaboration with members of the community; hence, we shall be approaching the community for proposals to be attempted during this period. However, these proposals will be ranked according not to their

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TABLE 1

THE TARGE PERFORMANCE REQUIREMENTS (THE OPTICS ERRORS DO NOT INCLUDE ATMOSPHERIC EFFECTS)

Errors	Before 1st light	1st sci. inst.	2nd sci. inst.	Day One
Pointing	10″	6″	4″	3″
Tracking in 10 min	1″	1″	0.5″	0.2″
Single segment		0.5″	0.2″	0.1″
Stacking		0.2″	0.1″	0.04″
Phase			100 nm	50 nm
Total optics		0.75″	0.5″	0.2″

scientific merit but rather to how much useful information for commissioning the telescope they will provide. Hence, for any project that is undertaken, we would expect rapid feed back on the quality of the data obtained.

5. CONCLUSIONS

This paper presents an overview of what will happen to the GTC during the the period between first light and the beginning of full science operations. The commissioning will be built around the natural milestone in the project time line; the hand over of the telescope mechanics, first light, the arrival of the science instruments, and finally Day One. The aim at each stage is at least to meet minimum performance levels in all necessary areas. The goal is to obtain an instrument ready to produce high quality science in the minimum time.

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