(motors and encoders) have been procured.

In September 1994 the FDR for some of the instrument control software modules was held and coding started immediately afterwards.

Data reduction software for FORS specific instrument modes (mainly MOS and polarimetry) is being implemented in Heidelberg. The first finished context (MOS) will be included in the 95NOV release of MIDAS.

Auxiliary Devices

Several auxiliary devices are under construction for FORS. The most important ones for the construction and test phase are the star simulator for the optics tests, which is partly finished, and the telescope simulator to be used mainly for the flexure tests of the integrated instruments; this one is under construction.

Another important device will be the transport carriage. It turned out that the requirements for handling the FORS instruments at the telescope are very similar to those of the Cassegrain adapters/rotators, e.g. weight to be transported, lifting height and mounting accuracy. In order to simplify maintenance procedures and to reduce the diversity of ancillary equipment at the VLT, the carriage is therefore being designed to accommodate both; two copies will be procured in 1995.

Detector

One of the most crucial components of an instrument is its detector. For FORS SITe (formerly Tektronix) 2048 × 2048 CCDs with 24 μm pixels were selected; the procurement of the CCDs including all peripherals (dewar, controller) is being done by ESO. So far we have received one CCD of grade 1 which is now awaiting full characterisation by ESO's detector laboratory.

Future Planning

Activities scheduled to happen in the near future include tests of the imaging optics and performance tests of the first MOS unit, both from a mechanical and control system point of view.

The long-term planning foresees the integration of FORS1 for 1996, system tests for 1996 and 1997, transport to the VLT Observatory in 1998 with an installation date on UT1 in the last quarter of 1998, according to the current VLT planning. FORS2 is then scheduled for an installation on UT3 in the year 2000.

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UVES (UV-Visual Echelle Spectrograph) for the VLT – a Status Report

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Introduction

UVES is a two-arm crossdispersed echelle spectrograph covering the wavelength range 0.3–0.5 μm (blue) and 0.42–1.1 μm (red), with a 2-pixel resolution of up to 90,000 and 120,000, respectively. It will be mounted at the Nasmyth of UT2.

Project kick-off for UVES was in spring 1992 with a plan [1] calling for two identical instruments, to go on UT2 and UT3, with a resolution of up to 70,000. An overview is given in [2]. In response to discussions on a redistribution of instruments at the foci of the VLT, it was decided in spring 1994 to build a single instrument with increased spectral resolution and versatility (by adding an Atmospheric Dispersion Compensator, an Iodine absorption cell, a depolariser and exposuremeters) [3]. The science objectives and expected performance of the upgraded instrument are given in Tables 1 and 2 and in [4].

UVES is being designed and built in-house. The instrument control and data reduction software is being developed in collaboration with the Observatory of Trieste. S. D'Odorico is the Instrument Scientist.

Status of the Project

Following the Preliminary Design Review in October 1993, UVES is now in the

TABLE 1. UVES SCIENCE OBJECTIVES

- Structure, physical conditions and abundances of interstellar and intergalactic gas at early epochs from the absorption spectra of high redshift QSO's
- Kinematics of gas and stars in galactic nuclei
- Kinematics and mass distributions of star clusters
- Composition, kinematics and physical conditions of the interstellar medium in the galaxy and in nearby systems
- Chemical composition and atmospheric models of galactic and extragalactic stars
- Substellar companions of nearby stars (high-precision radial velocity studies over long time scales)
- Stellar oscillations

TABLE 2. UVES OBSERVING CAPABILITIES AND PERFORMANCE

	Blue	*Red*
Wavelength range	300–500 nm	420–1100 nm
Resolution-slit product	40,000	40,000
Max. resolution	90,000	120,000
Detection efficiency	9% at 400 nm	10% at 600 nm
Limiting magnitude (3 h. exp. time, S/N = 10)	18 (R = 50,000) in U	20 (R = 45,000) 18.5 (R = 90,000 in V
Camera	dioptric F/1.8, 70 μm/″ field 43.5 mm diam.	dioptric F/2.5, 97 μm/″ field 87 mm diam.
Baseline CCD and pixel scale	2048 × 2048, 15 μm pixels (.215 ″/pix)	4096 × 2048 15 μm pixels, 2 × 1 mosaic (.155″/pix)
Echelle	41.59 g/mm, R4 mosaic	31.6 g/mm, R4 mosaic
Crossdispersers	CD1: 1200 g/mm, λ_b 380 nm CD2: 600 g/mm, λ_b 380 nm	CD3: 600 g/mm, λ_b 550 nm CD4: 316 g/mm λ_b 750 nm
λλ/frame (typ)	700 A in 20 orders	1000 A in 18 orders
Order separation (typ.)	> 15″ ↔ 70 pixels	> 15″ ↔ 100 pixels

detailed design phase. The Critical Design Review is planned for November 1995. Detailed status is as follows:

Gratings and Optics – In view of the new technology involved, a contract for the large (84×21 cm) echelles was placed already in December 1993 with Milton Roy (USA). They are monolithic mosaics: replicas on a single substrate of a 2 × 1 mosaic of submasters. The red echelle has recently been completed and is awaiting acceptance test. Manufacturer's preliminary test results indicate that this is one of the best gratings ever made (Table 3). Further testing, including the support system, is planned at ESO. The blue echelle mosaic will be delivered in 1996.

Offers from industry for detail design and manufacturing of cameras and preslit optics according to the ESO predesigns have been received; contract negotiations are in preparation. Deliveries are expected in 1996 (preslit optics) and 1997 (cameras).

Mechanics – Prototype drive units have been produced and tested. A first batch of 9 motorised functions (slides, filter wheels) has been delivered and electromechanically tested. Slit, derotator and crossdisperser units are in detail design and/or manufacturing. By the end of 1996, most fine mechanical and/or motorised units will have been delivered.

The detailed design of the table and support structures is almost complete. The earlier concept of the enclosure is being compared with a simpler concept with possibly lower cost and better thermal and light rejection performance. Also the handling tools are under review. A full-scale wooden model of UVES has been made to develop handling concepts, study cabling routing, etc.

Electronics and software – The first batch of UVES functions is under test. Electrical design for components that were added in the UVES upgrade (e.g. exposure meter) is in progress. An updated Electronic Design Report, addressing the new overall system architecture including the Scientific CCDs is planned for the 2nd quarter of 1995.

Various software specifications that between them address all aspects of operating UVES and reducing data obtained with it have been released. (*Software Requirements, Software Functional Specifications, Data Reduction Software Requirements*). A draft user's manual and a prototype Graphical User Interface are planned to be produced this year.

Detector systems – The parameters of the UVES cameras are matched to 2048^2, 15 μm pixel size chips (blue: single chip; red: mosaic up to 4096^2). The CCD detector systems for UVES are being developed by the newly created detector group within the Instrumentation Division.

ESO has placed a contract for the development of thin, 2K × 2K, 15 μm buttable CCDs with Thomson CSF in 1992. Recent negotiations with Thomson led to agreement on delivery within 1995 and a minumum QE of 75% at 600 nm (previously 60%). These devices would be well suited to the red arm. Another contract with the University of Arizona (Lesser) is in place that covers the need for a UV-blue sensitive 2K chip needed for the blue arm; several devices were recently supplied by this source with a QE of over 70% in the UV. ESO is closely following developments at SITe, MIT/LL and EEV; all potential sources of 2K × 2K or 2K × 4K chips with 13.5 or 15 μm pixel size.

The prototype ESO CCD Array Control Electronics (ACE) intended for use with FORS and UVES has been successfully tested at the NTT in early 1995. A prototype continuous-flow cryostat has been built and tested in the CCD detector laboratory and field experience with this system – containing one of the Lesser chips – is being obtained at the CES in La Silla.

Schedule

Important milestones for 1995 are the delivery of the red echelle and Thomson CCDs, placing of the optics contract and the Critical Design Review at the end of the year. 1996 and 1997 will be devoted to completion of hardware, software coding and lower-level testing. Extensive system testing, including calibration and data reduction procedures (using the Sun) will take place in 1998. Commissioning as instrument 1 on UT2 is planned to commence in July 1999.

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TABLE 3. PRELIMINARY MEASUREMENT RESULTS OF UVES RED ECHELLE (31.6 g/mm)

Spectral resolution	3.0 mÅ at 632.8 nm R = 2,100,000
Angular resolution in the direction of the slit	better than .1 arcsec on the sky
Blaze angle	75.07°
Ghosts	< .008%
Absolute blaze efficiency (including dead space)	72.4% at 550 nm