

# Opportunities for UK companies cover all aspects of E-ELT construction

## Mechanical Engineering

- Steel structure fabrication
- Actuation & metrology
- Drive Motors & bearings

## Civil Engineering

- Dome construction
- Civil works
- Transport links
- Consultancy

## Optics

- Manufacture of
  - Large (>1 m) optics
  - Small (<1 m) optics
- Optical coatings
- Optical systems

## Cryogenics & HVAC

- Cryogen storage and handling
- Compressors
- Cooling engines
- Vacuum equipment

## Electronics & IT

- Detectors
- Control electronics
- Safety & Interlock systems
- Software
- IT Hardware

## Infrastructure

- Power systems
- Coating plants
- Heavy handling equipment

# Opportunities in Mechanical Engineering

## Steel structure fabrication

- 5,500 tonne steel support structure for telescope
- Over 1000 precision machined support cells for mirrors, well suited to mass production techniques (dimensions c. 1.5m x 1.5m x 1.5m)

## Actuation & metrology

- 5 axes actuation (c. 3mm stroke) for each of 1000 mirror segments, and micron stroke actuation required to deform mirrors
- High precision metrology for each mirror segments
- High precision metrology for support structure
- Encoders for telescope rotation

## Drive motors & bearings

- Direct drive motors to rotate entire 5,500 tonne structure about one azimuth angle
- Direct drive motors to rotate circa 2000 tonne sub-structure about one altitude angle
- Hydrostatic bearings to allow these movements

# Opportunities in Civil Engineering

## Dome construction

- Structure to enclose entire telescope structure (80m diameter)
- Movable doors provide a 42m diameter opening
- Must withstand weather conditions at 3000m altitude

## Civil works & transport links

- Construction of foundations and concrete base structure for facility (c. 30,000 cubic metres)
- Construction of access roads for heavy construction and transport vehicles
- Water supply

## Consultancy

- General engineering consultancy
- Specialist consultancy on wind modelling (exposed location at 3000m altitude)
- Specialist consultancy on Earthquake modelling (quakes of up to 8 on Richter scale are regular)

# Opportunities in Optics

## Optics manufacture

- Manufacture of 1057 hexagonal mirror segments (1.4 m diameter) for the primary mirror
- Manufacture of large mirrors (6m convex, 4.2m concave, 2.7m flat)
- Assorted small optics

## Optical coatings

- Design of optical coatings for 0.4 – 30 micron
- Process design for coating segments *in situ*

## Optical systems

- Manufacture of one 2.7m adaptive mirror (flat)
- Laser guide star systems (laser source, launch telescope, collection optics)
- Alignment telescopes

# Opportunities in Cryogenics and HVAC

## Cryogen storage & handling

- Liquid nitrogen storage and handling facilities
- Liquid helium storage and handling facilities

## Compressors & Cooling Engines

- Nitrogen liquifiers
- Helium liquifiers
- Gas compressors

## Vacuum equipment

- Portable pumping stations
- Vacuum lines

# Opportunities in Electronics & IT

## Detectors

- Fast detectors for adaptive optics (Visible, IR)
- Fast readout electronics

## Control Electronics

- Control systems for active optics
- Fast control systems for adaptive optics
- Control systems for telescope orientation

## Safety & interlock systems

- Extensive interlock system to guard against damage to telescope and dome

## Software

- Observatory-level software and libraries
- Hardware control interfaces
- Embedded software in devices

## IT Hardware

- Facility control computer systems
- Data acquisition and storage systems
- Network infrastructure

# Opportunities in Infrastructure

## Power Systems

- 10 MW of redundant power generation capacity (diesel or electric)

## Coating Plant

- Coating plant for production-line cleaning and coating of primary mirror segments (1.4m diameter)
- Coating plant for cleaning and coating of large mirrors (up to 6m diameter)

## Heavy handling machinery

- Handling equipment for precision alignment of 1 tonne mirror segments
- Heavy lifting and manipulation machinery for 20 tonne instruments