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 pointing and tracking

- 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

- Electrical Power Systems
  - 4 MW of standby electrical power generation capacity

- 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 4.2m diameter)

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

Engineering

- Steel structure fabrication
- Actuation & metrology
- Drive Motors & bearings
- RAMS and QA

Civil Engineering

- Dome construction
- Civil works
- Transport links
- Consultancy

Optics

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

Cryogenics & HVAC

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

Electronics & IT

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

Infrastructure

- Electrical Power systems
- Coating plants
- Heavy handling equipment
- Water treatment
## Opportunities in Mechanical Engineering

### Steel Structure Fabrication
- 3,200 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 segment
- High precision metrology for support structure
- Encoders for telescope rotation
- Direct drive motors to rotate entire 3,200 tonne structure about one azimuth angle
- Direct drive motors to rotate circa 1700 tonne sub-structure about one altitude angle
- Hydrostatic bearings to allow these movements

### Drive motors & bearings

## Opportunities in Civil Engineering

### Dome Construction
- Structure to enclose entire telescope structure (80 m 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 931 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, 2mm thick)
- 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