Guide Star Laser Interface

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ENGN4221 Systems Engineering Project

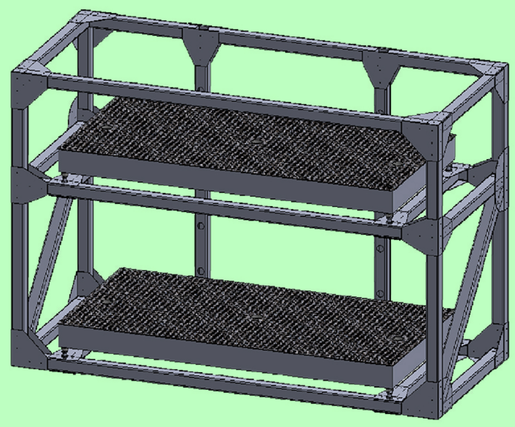
Project Summary

A **Guide Star Laser** (GSL) creates an artificial star in the atmosphere known as a **Laser Guide Star** (LGS), which enables the measurement of light distortion caused by atmospheric turbulence. **Adaptive Optics** (AO) systems use these measurements to correct for this distortion and improve image quality of ground-based telescopes.

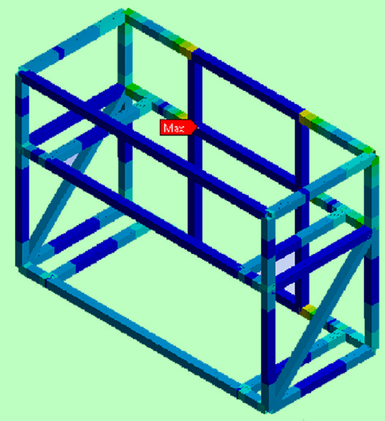
The ANU and Electric-Optic Systems (EOS) are currently designing two GSL systems for **Space Debris Tracking and Pushing**. The objective of this project was to develop the **concept design** for the system interface with the **1.8m telescope** at Mount Stromlo. This is the second phase of this student led project, with the first phase involving the development of a comprehensive requirements document.

Laser Enclosure

A **frame** was designed to mount the GSL Laser Heads to the 1.8m telescope. The frame accommodates **two optical breadboards** and is constructed from DragonPlate **Carbon Fibre/Epoxy** components, steel inserts and various fastener



Mounting frame



FEA stress analysis

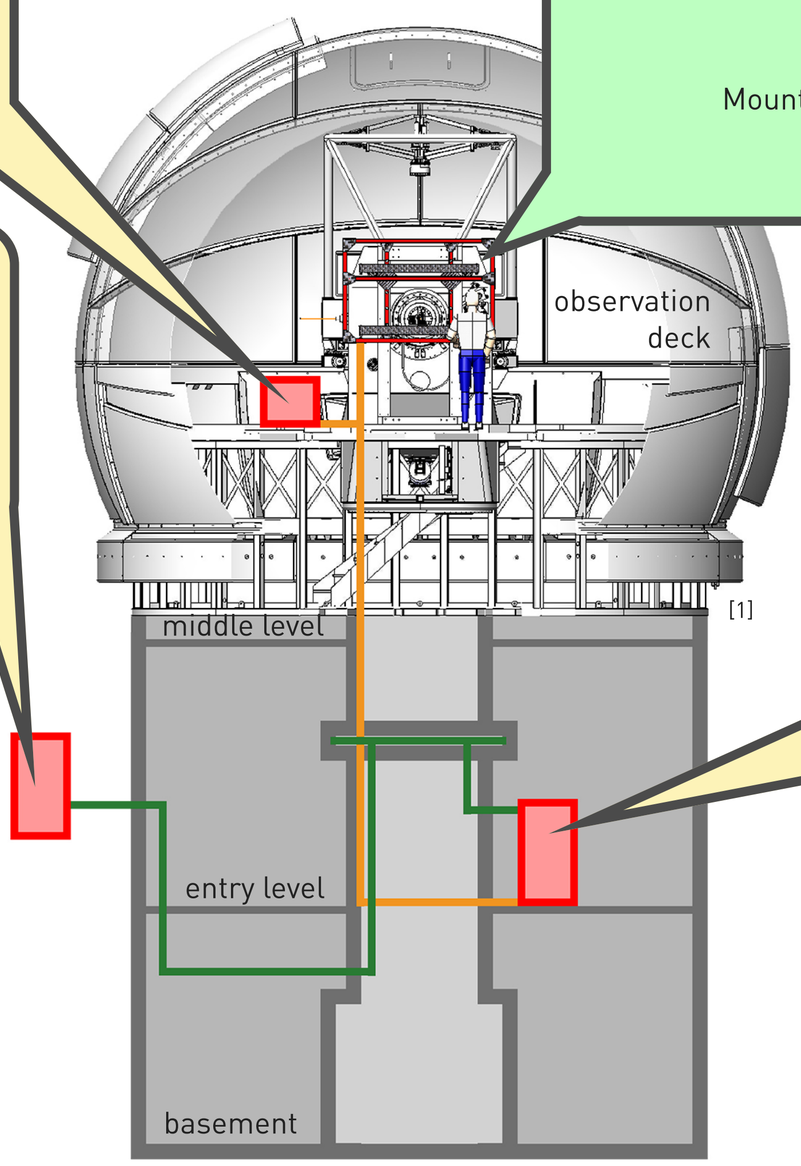
ANU Auxilliary Electronics

The ANU laser **auxilliary electronics** cabinet is placed directly under the laser enclosure due to **cable length constraints**.

The AEC requires at most **800W of cooling** at two different temperatures.

EOS Oscillators

The EOS Oscillators are sensitive to vibrations and have been relocated to an **external clean room**. This requires approx 35 m of **additional wiring** to connect the oscillators to the observation level.



[1]

1.8 m telescope building cross-section

[1] - Image courtesy of EOS

EOS Auxilliary Electronics

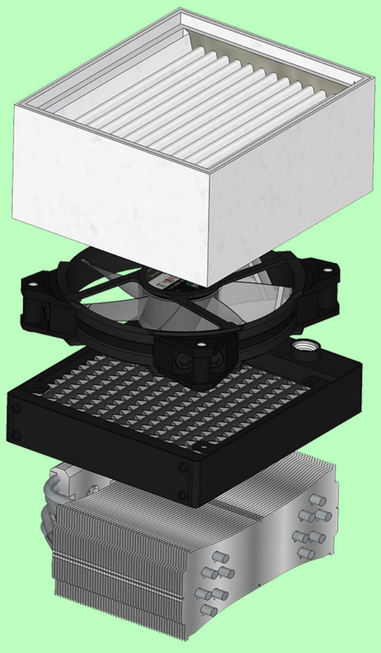
The EOS **auxiliary cabinet** will be placed on the **entry level**, with cabling running to the laser enclosure on the observation deck. The cabinet contains **coolers**, **heaters** and **control electronics** for the laser head.

The EOS GSL is powered from a single General Power Outlet (GPO), connected via a **CAN bus**, and cooled by a **400W chiller**.

Environmental Control

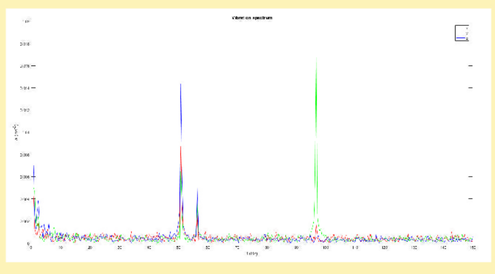
Two **30W heaters**, **insulation panels**, a **radiator** and a **fan** are used to keep the temperature in the laser enclosure between 10°C and 30°C.

A **HEPA filter** is installed to maintain ISO 7 standard air quality



Heater and fan arrangement

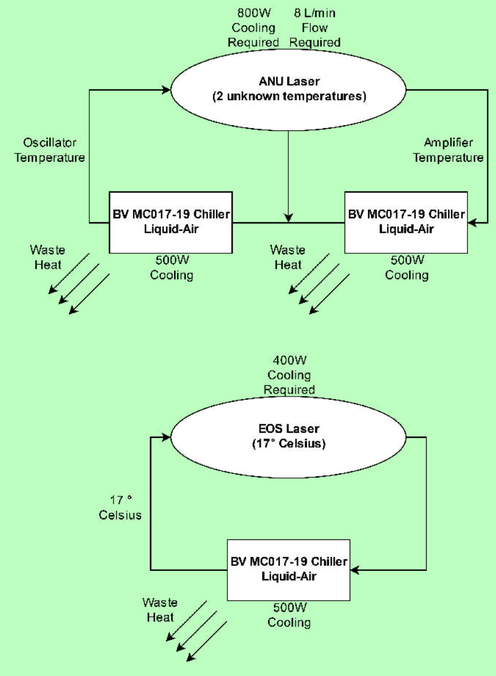
Vibration Analysis



Telescope vibration spectrum was tested with the dome moving. Further testing of GSL required.

Cooling System

Both GSLs operate at **different temperatures**, requiring separate coolers to operate.



Conclusion

Review and additional development of the **interface requirements** was undertaken by the team. **Conceptual designs** for the various **subsystems** were then developed. The designs and recommendations were provided to the client in a **Concept Design Report** and **Subsystem Design Reports**. The **next phase** of the project will involve the development of **detailed designs**. The team produced a **handover document** that introduces the new team to the project and outlines the recommended next steps.

Acknowledgements

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