Optimizing the Telescope Assembly Alignment Simulator for SOFIA

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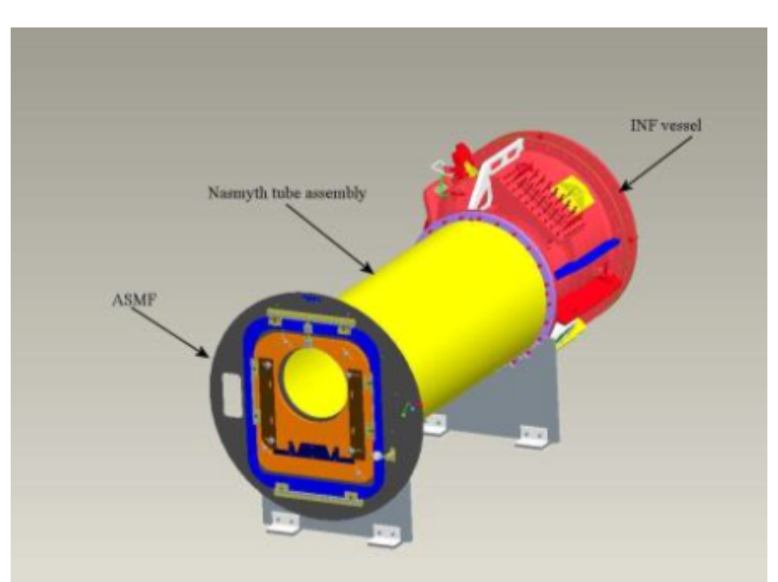
I. SOFIA Program

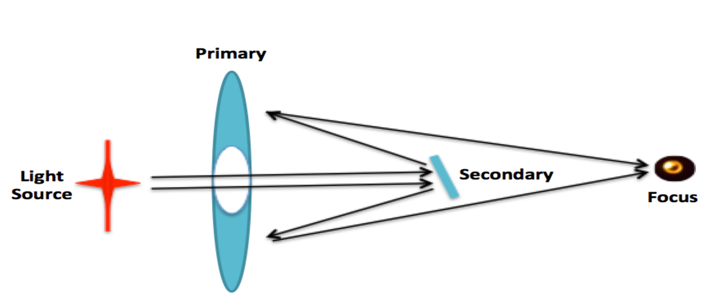
The Stratospheric Observatory for Infrared Astronomy (SOFIA) conducts research on a modified Boeing 747SP aircraft. Using a variety of infrared science instruments mounted on a 2.7 meter telescope, researchers can make discoveries about the galactic center, star formation, and various topics to gain a deeper understanding of our universe.

The SOFIA Program embarks on an annual deployment to Christchurch, New Zealand. In collaboration with The STAR Program and Chevron, SOFIA gave approval for two interns to travel to Christchurch and observe the 2016 southern deployment mission operations.

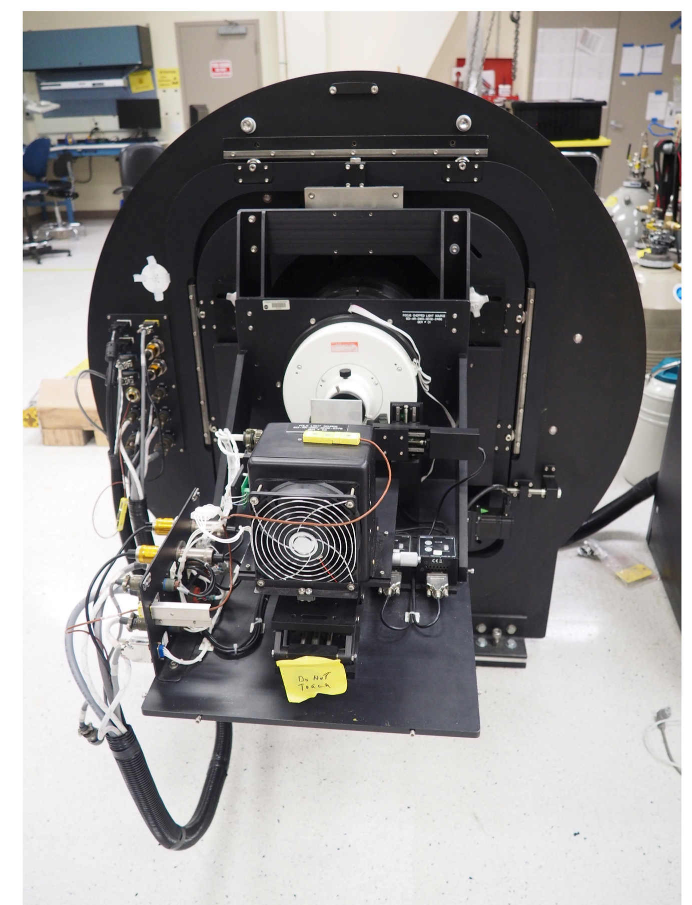
II. TAAS



The Telescope Assembly Alignment Simulator (TAAS) simulates an infrared light source through several installed plates. These plates allow researchers to design and construct improvements needed for instruments to perform efficiently during flight on SOFIA. It is crucial to have this testing mechanism before placing instruments on SOFIA as it allows engineers to check the fittings and calibrations for scientific instruments prior to installation.



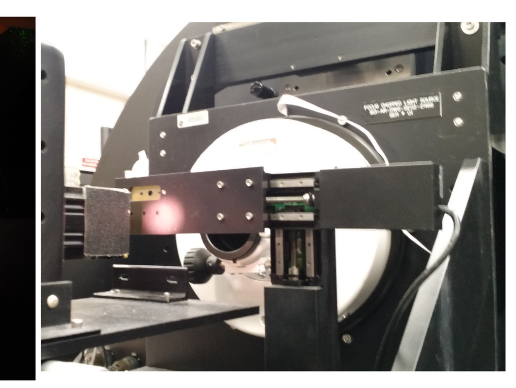
The light source passes through the telescope, which is a flipped Cassegrain assembly.



The Focus Chop Light Source (FCLS) is one of several installed plates that simulate a light source for the TAAS. This plate has 6 aperture holes that vary in size to represent a different magnitude of star. The FCLS is being modified and improved for an installation of The High-resolution Airborne Wideband Camera-plus (HAWC +), a science instrument that will fly on SOFIA.

III. FCLS

Background:



The focus for this investigation surrounds an inefficiency with the FCLS. The light source of the installed plate was allowing an abundance of light to hit the apertures. Researchers tried to remedy this occurrence by swapping out the light source with an alternative infrared source that they designed. However, this bypassed the original light source and was not formally constructed. Therefore, this investigate sought out to find a simple, effective solution to block the abundant light.

Development:

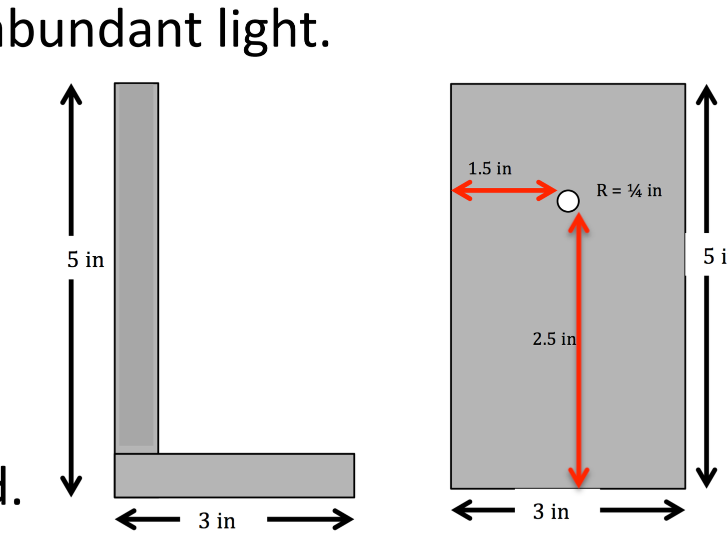


Figure 7

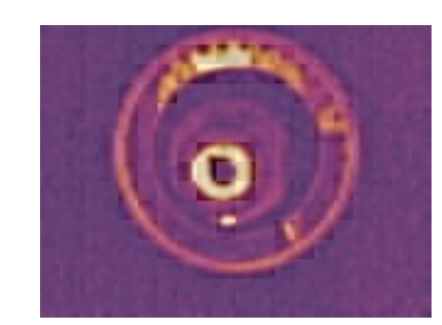
Testing began by investigating various ways in which the abundant light could be blocked. Options included adapting the light source itself or creating a new alternative light source, however, creating a part to fit the FCLS was the most efficient way to keep the light source intact and meet the specific requirements.

Testing:

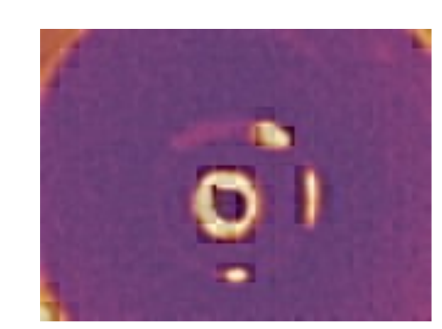
After creating an initial design of the needed piece (Figure 7), the research team met with the NASA Fabrications lab to confirm the part, create a work order, and develop the official piece needed for the light source.

In order to test, we needed to secure the part onto the FCLS in order to check the basic slots. Then, we began calibrating the telescope using the original coordinates on the *TAAS Server Aperture Control* to determine whether the light source aligned accurately and correctly compared to the original numbers. Finally, we used an IR Camera to confirm the abundant light was reduced.

Conclusions IV.



Before



After

The engineered piece blocked the abundant light from the sides and top of the FCLS. There is a clear indication through the IR Camera photos (before and after) that the new piece is an improvement from the old due to the decreased aberrations. However, there is an apparent reflection of the primary mirror that can be seen between the mirror assembly and light source. This does not affect he IR camera image but does affect visible light cameras. It may be improved by adding a baffling to the designed part.

Future Works:

1. Add IR blocking paint on designed part.
2. Test for telescope reflections on FCLS plate.
3. Add baffling to designed piece to reduce aberrations.

V. Acknowledgments

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1: Cal Poly, San Luis Obispo, 2: STAR Program 3: University of Texas at Arlington, 4: Boise State University, 5: Universities Space Research Association (USRA)