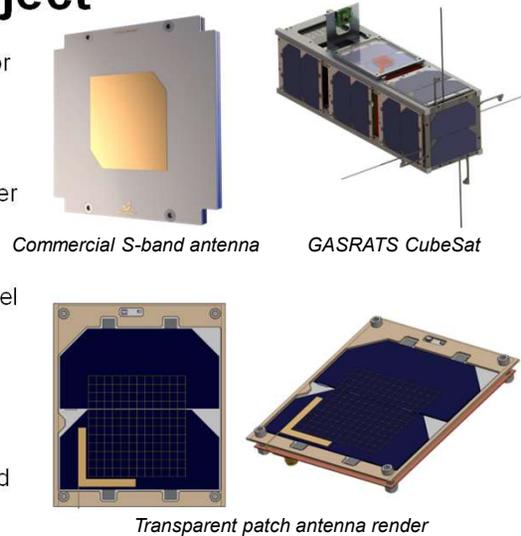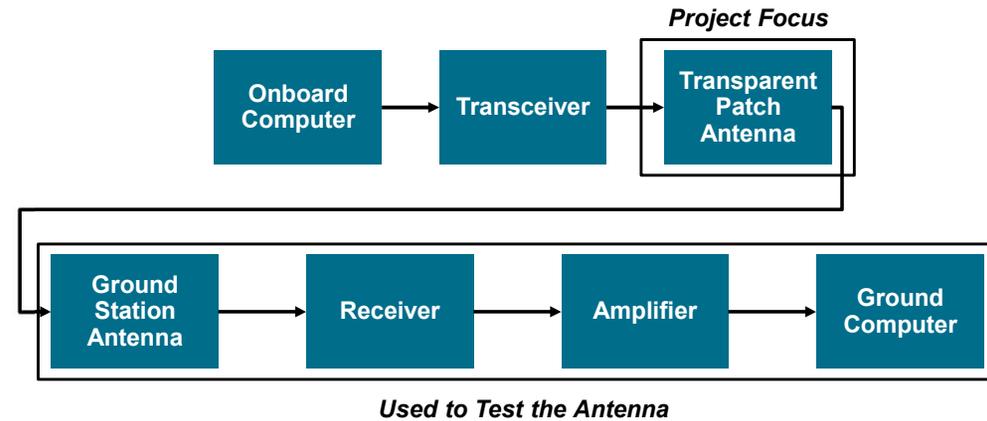# CubeSat Transparent Patch Antenna

Project

- CubeSats have limited surface area for solar panels, antennas, and instruments

- Commercial antennas often take the place of solar panels, decreasing power generation

- The transparent patch antenna (TPA) combines an antenna with a solar panel

- Add a high-gain S-band antenna and lose only 20% instead of 100% of power generation

- The TPA will serve as the payload for the GASRATS CubeSat with a planned launch in late 2027

Commercial S-band antenna

GASRATS CubeSat

Transparent patch antenna render

System

Project Focus

Onboard Computer → Transceiver → **Transparent Patch Antenna**

Ground Station Antenna → Receiver → Amplifier → Ground Computer
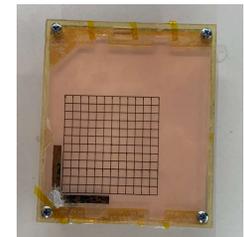
Used to Test the Antenna

Methods

- Designed in Ansys HFSS to optimize transparency and gain by reducing the thickness and number of mesh lines

- Printed on a 13-micron polyimide film, which is first UV treated for 1 hour to raise the surface energy to ensure the ink wets correctly into the designed geometry

- Antenna geometry is printed from a silver nanoparticle ink using an inkjet printer to ensure high quality mesh lines

- After printing, the antenna is cured in an oven at 195 °C for 35 min to achieve desired conductivity

- The antenna is then bonded to a custom machined PEI bedframe and suspended 2.54 mm above a ground plane

FujiFilm Dimatix DMP-2831 inkjet printer
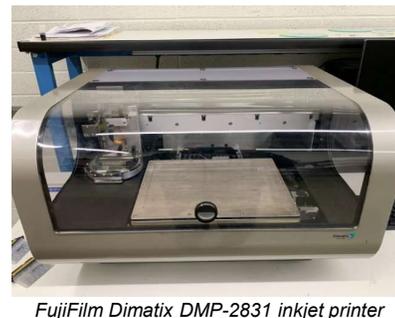
Conclusion

- Through many iterations, the team developed effective processes to design and print a functional TPA

- Testing the integrated antenna on a VNA revealed mismatched RF properties, likely due to issues in the integration process

- Further research is required to refine the integration process and perform environmental testing

- Upon demonstration of the patch antenna on GASRATS, the antenna can be scaled to more types of satellite missions and for use on deep space solar arrays

Constructed transparent patch antenna

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