



# Prioritized Technology: High Bandwidth, High Data Rate Communications Solid State Power Amplifiers

## Technical Goal

Flight qualified solid state power amplifiers for X and Ka bands

- Goals
  - Power levels of 5-50 Watts (maybe up to 100 W)
  - Wall-plug efficiency of > 60% for X-band and > 50% for Ka-band
  - Lower mass and volume than equivalent output power TWTAs
  - Improved manufacturability relative to TWTAs
  - Increased reliability relative to TWTAs

## Mission Applications

- Cube/SmallSats—requiring small mass and volume as well as power efficiency, usually < 50 W output power
- Outer Planets—limited primarily by prime power so 10-100 W “sweet spot” for GaN is appropriate; lower mass and volume; increased reliability over longer term
- Rovers and landers—requiring small mass and volume as well as power efficiency, usually < 50 W output power; better able to handle the mechanical “shock” of landing and roving.

## Technical Status

- Travelling Wave Tube Amplifiers (TWTAs) are the workhorse space power amplifier for X and Ka-band
  - Efficiencies of > 50% are typical
  - Power output levels up to at least 200W
- TWTAs require complex power supplies with large voltages (e.g., 300 V)
- TWTs are almost-hand-designed vacuum systems
- Sweet spot for GaN will be <100 W power output
- GaN SSPAs could significantly reduce the mass & volume and increase reliability relative to TWTAs
- Typical “production” GaN amplifiers for Ka-band are in the 10-40 W regime with 25-30% efficiency—lab devices better

## Development Cost and Schedule