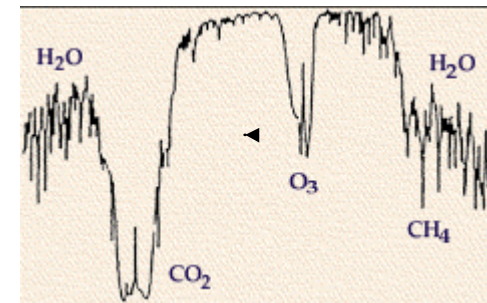


“To study all aspects of planets ranging from their formation and development in disks of dust and gas around newly forming stars to the presence and features of those planets orbiting the nearest stars. Specifically, to conduct a search for Earth-like planets in star systems located within 15 parsecs of our solar system.”

- To detect Earth-like planets around nearby stars, especially those in the habitable zone where liquid water is likely to exist
  - Bracewell Nulling interferometer

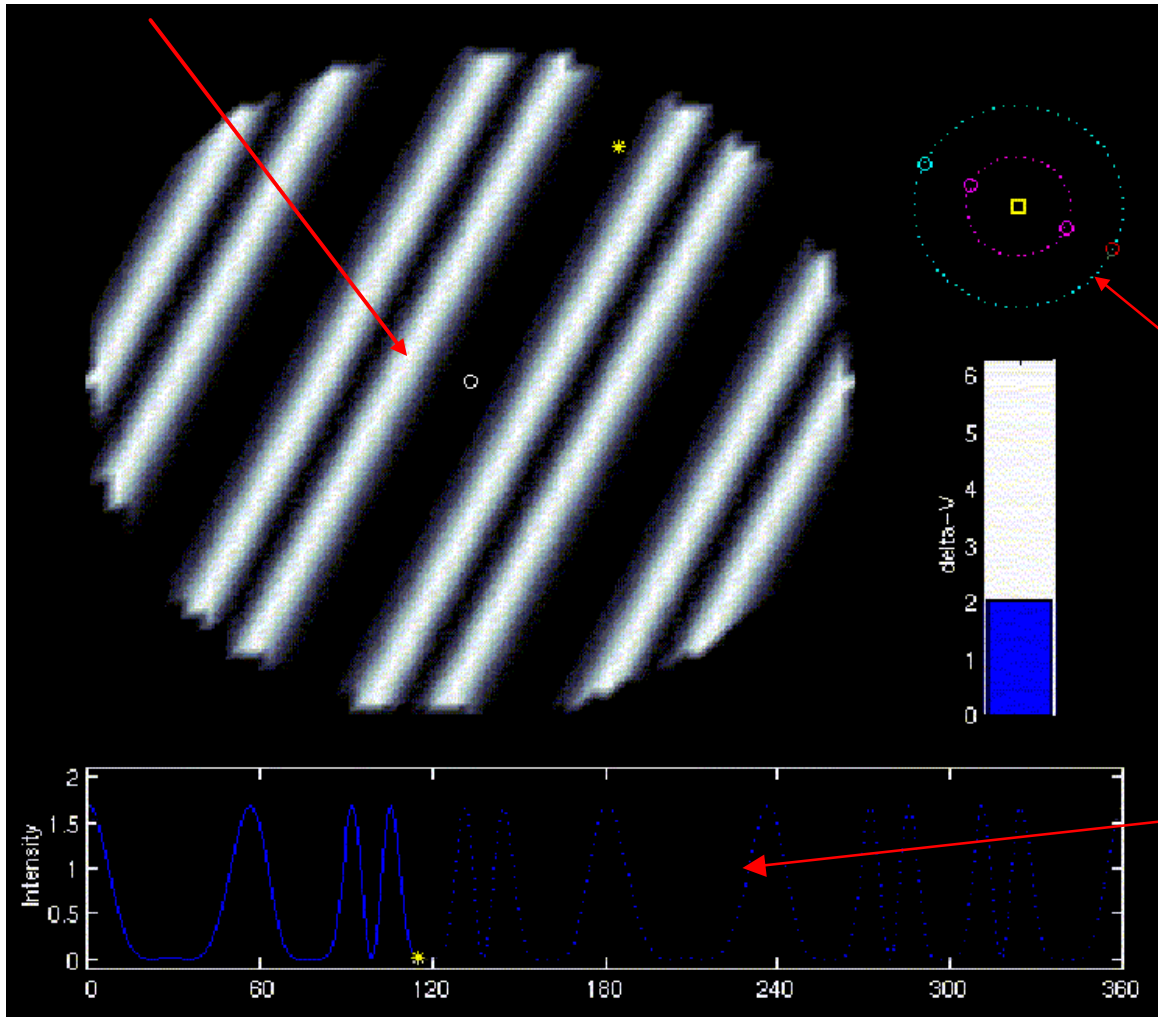
## Markers for “Life”

- To characterize approximately 150 of these Earth-like planets
  - Medium spectroscopy (50 planets)
  - Detailed spectroscopy (5 planets)



- To image astrophysical structures to within milli-arcsecond angular resolution (Michelson interferometer) requires longer baselines

## Fringe Pattern in Transmissivity Function

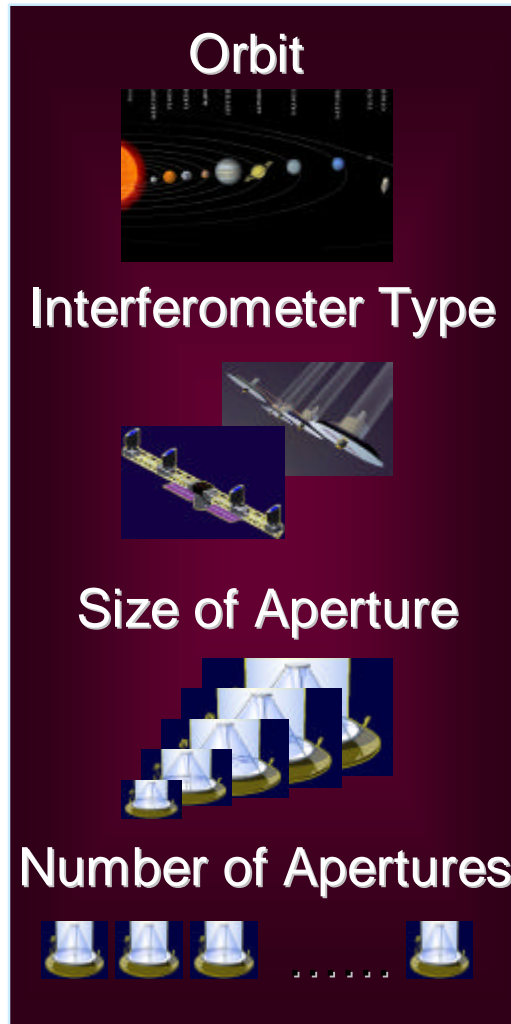


The following animation illustrates the basic principles of exo-solar planet detection

Aperture Locations and Orientation

Normalized Intensity of IR signal

## Inputs (Design Vector)



**TPF Mission  
Analysis Software**



## Key Outputs





- **Generalized Information Network Analysis (GINA) methodology**
  - A systems engineering and architecting methodology, based upon information network theory, that facilitates quantitative comparisons between viable architectures competing to satisfy a mission's needs
- **Comprehensive Metric Set**
  - Capability “Quality of Service” Metrics
    - Isolation - ability to separate the desired signal from competing signals
    - Integrity - quality of signal characterized by noise or anomalies
    - Rate - throughput of the system
    - Availability - temporal and spatial variability of isolation, integrity & rate
  - Evaluation Metrics
    - Performance - productivity over mission lifetime in presence of failures
    - Cost per Function - mission efficiency: lifecycle cost per performance
  - Adaptability - sensitivity analysis
- **GINA derives these metrics from physics models**

# Metrics Capture for TPF



## Integrity

### Signal-to-Noise

- Detector Noise
- Optical Bandpass
- Center Wavelength
- Mirror Surface
- Aperture Diameter
- Thermal Noise
- Glint
- Zodiacal Noise
- Vibrations
- Particulates
- Plume Effects
- IR/RF Discharge

## Availability

### Operational Efficiency

- Calibration
- Retargeting
- Deployment Time
- Anomaly Recovery
- Alignment

## Rate

### Integration Time

- Zodiacal Distribution
- Collecting Area
- Detector Noise
- Propulsion Profile

## Isolation

### Transmissivity Function

- Apertures
- Baseline
- Geometry

## System Cost

### Lifecycle

- P/L - aperture diameter
- Bus - mass & power
- Launch - mass & orbit
- Ops - complexity & orbit
- Learning Curve

## Performance

### Productivity

- Mean time to failure
- Mission Lifetime
- Rate times Availability