GENERAL DYNAMICS
C4 Systems

Products • Service • Solutions

General Dynamics Corporation

Aerospace

- Gulfstream
- Jet Aviation

Information Systems & Technology

- **C4 Systems**
- Advanced Information Systems
- Information Technology

Marine Systems

- Bath Iron Works
- Electric Boat
- NASSCO

Combat Systems

- European Land Systems
- Land Systems
- Ordnance and Tactical Systems

General Dynamics C4 Systems: Resources

Employees Worldwide

- Over 83 Major Locations in 19 Countries
- Approximately 7500 Employees
- Arizona: Over 2000 Employees
- Massachusetts: Over 1100 Employees
- Canada: Over 900 Employees
- United Kingdom: Over 450 Employees
- Page Europa: Over 140 Employees

Industry Certifications

- CMMI® Level 5 rating (CMMI for Development plus Integrated Product and Process Development)
- AS9100C Certified Quality Management System - Aviation, Space and Defense
- ISO 9001:2008 Certified Quality Management System
- ISO 14001:2004 Certified Environmental Management System
- OHSAS 18001:2007 Certified Occupational Health and Safety Management System
- OSHA VPP STAR site (Arizona)

C4S Programs Business

Markets Served

Government

- Military
- Intelligence
- Satcom Infrastructure & Networks

Commercial

- Satcom Infrastructure & Networks
- User Terminals

Scientific

- Astronomy
- Space Exploration

Programs Business
Scientific

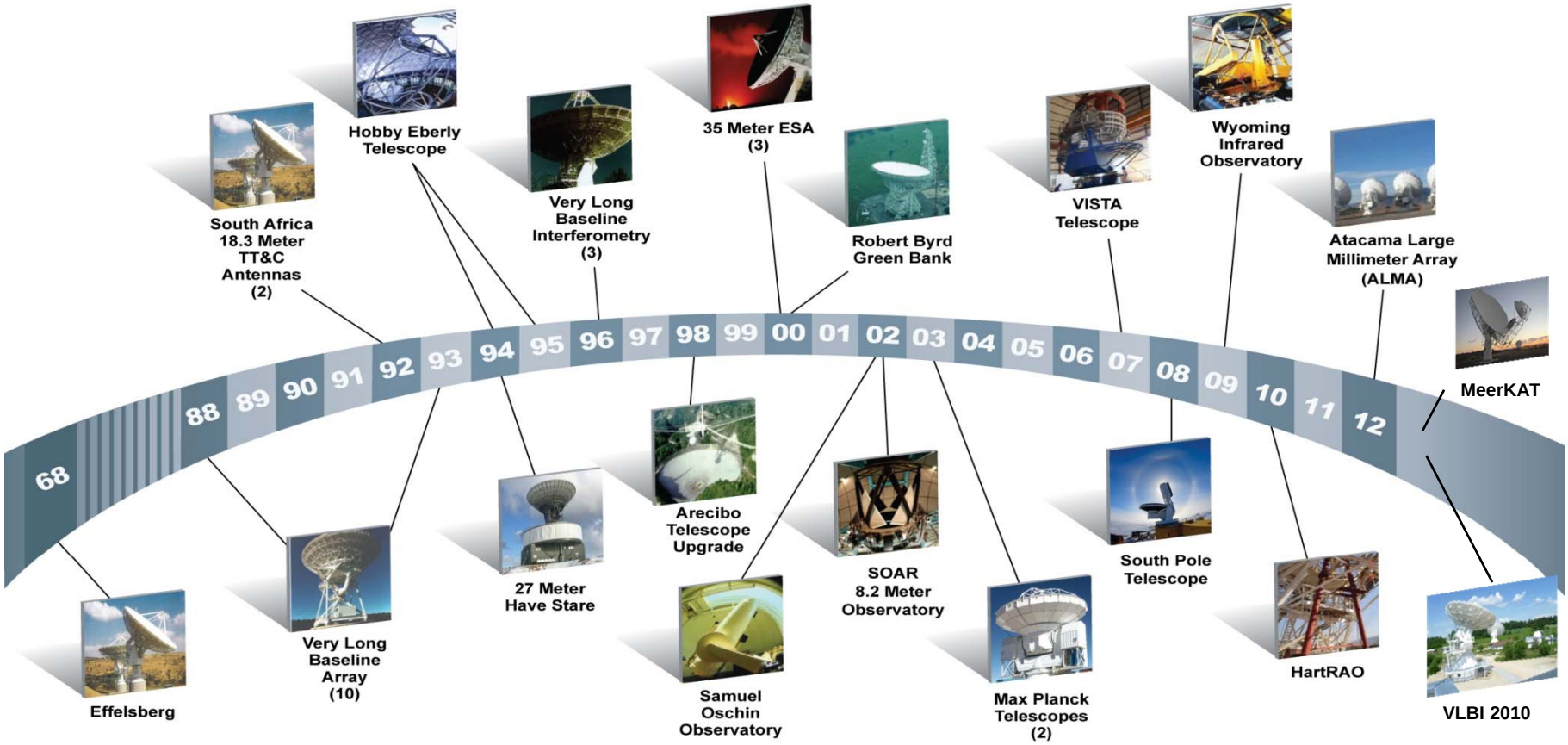
Our offerings to the Scientific Market for Astronomy and Space Exploration include:

- Radio Telescopes Pedestals and Positioners
- Optical Telescopes Pedestals and Positioners
- Telescope Domes and Facilities
- Large Communication Antennas
- Telescope Retrofits and Upgrades
- Optical Instrument Test Assemblies
- Concept / Design Studies





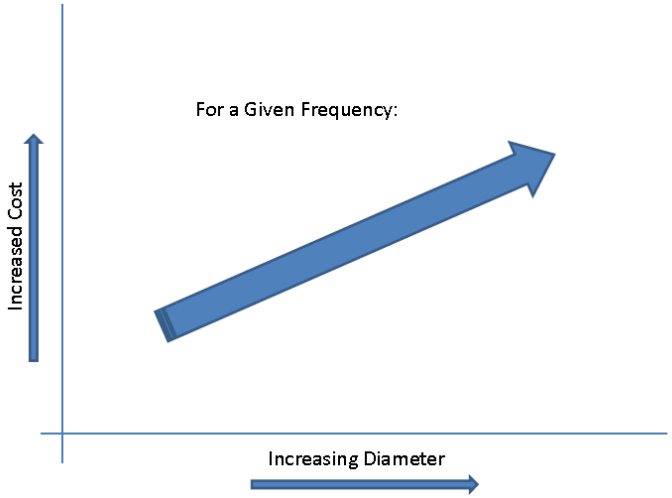
C4S Legacy Telescopes

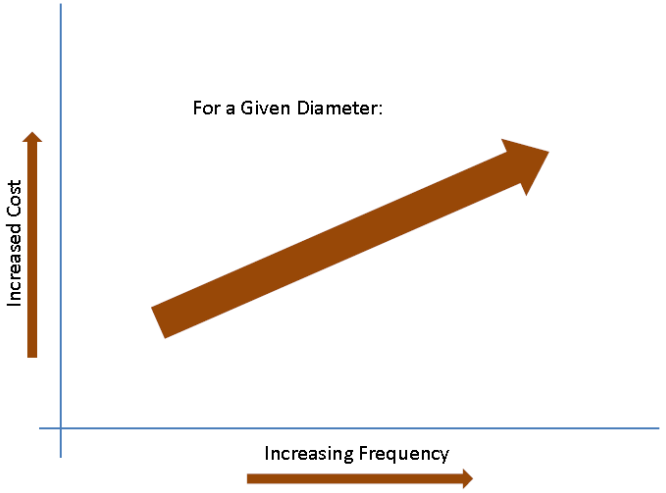


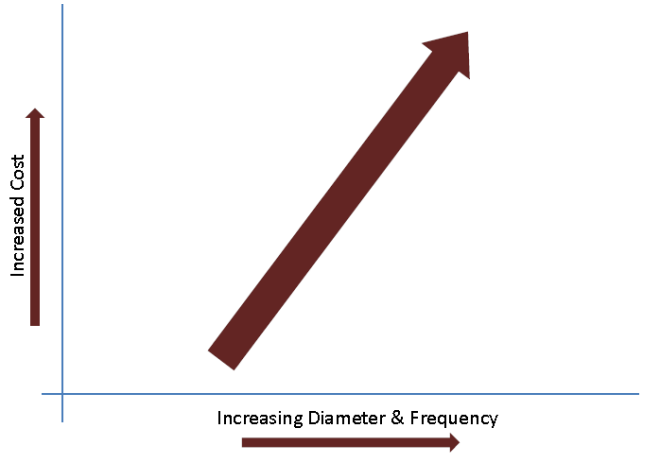
Past Performance Timeline

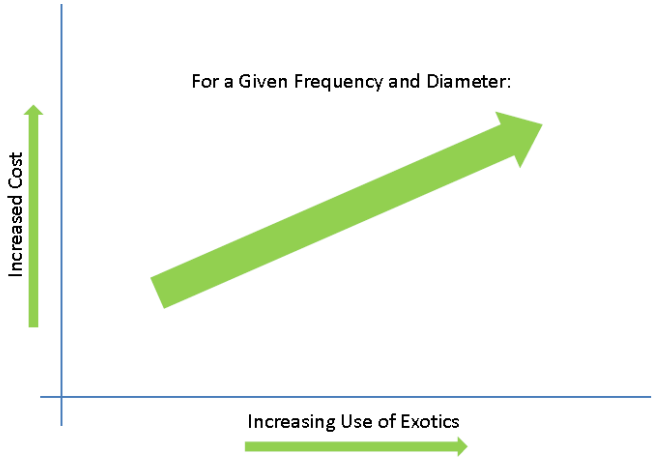
Legacy Produces Better Telescopes

Design & Cost Drivers









Integration & Logistics

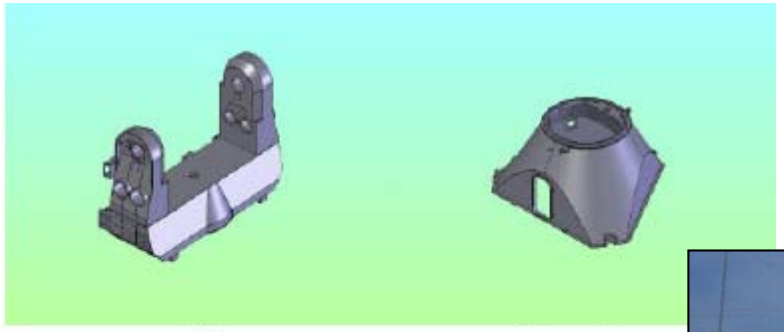
SHIFT FROM A ONE OF A KIND, ONE-OFF UNIT

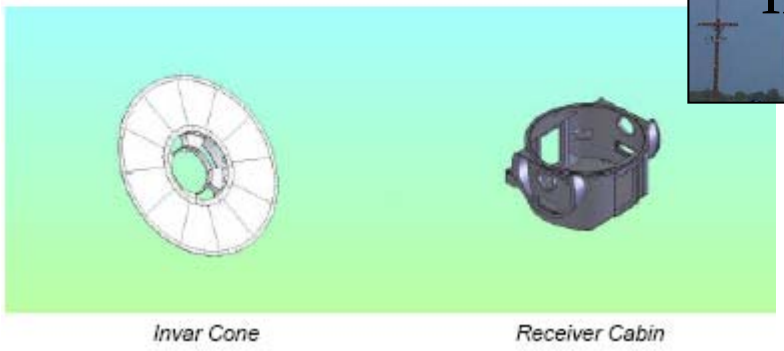
TO A PRODUCTION PHILOSOPHY

- Material Resource Planning
- Supply Chain Management
- Multi-Point Production
- Fabrication Oversight, Monitoring and Quality Assurance
- Freight and Transportation
  - Permits
  - Freight Consolidation
- Modular Integration
- Mature Process Management
- Balanced Crew Expertise and Leveling – Experienced Field Assembly

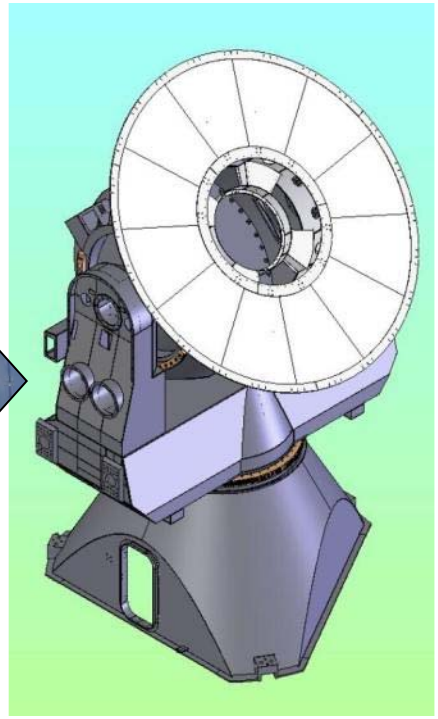
These Aspects of a Project Are Significant COST and SCHEDULE DRIVERS

ALMA Pedestal Integration & Logistics





Fabrication



Assembly
and Integration


Receiver Cabin #12
Invar Cone #10
Receiver Cabin #11
Support Cone #12
Invar Cone #11
Yoke #11
Support Cone #11
Yoke #10
Receiver Cabin #10
Support Cone #10

ALMA Pedestal Integration & Logistics

- Unit #1 Assembly

Pedestal Rotated, Positioned in Shipping Skid

Permit Load Departing Kilgore

Pedestal Prepared for Final Loading

Pedestal Loaded on Vessel

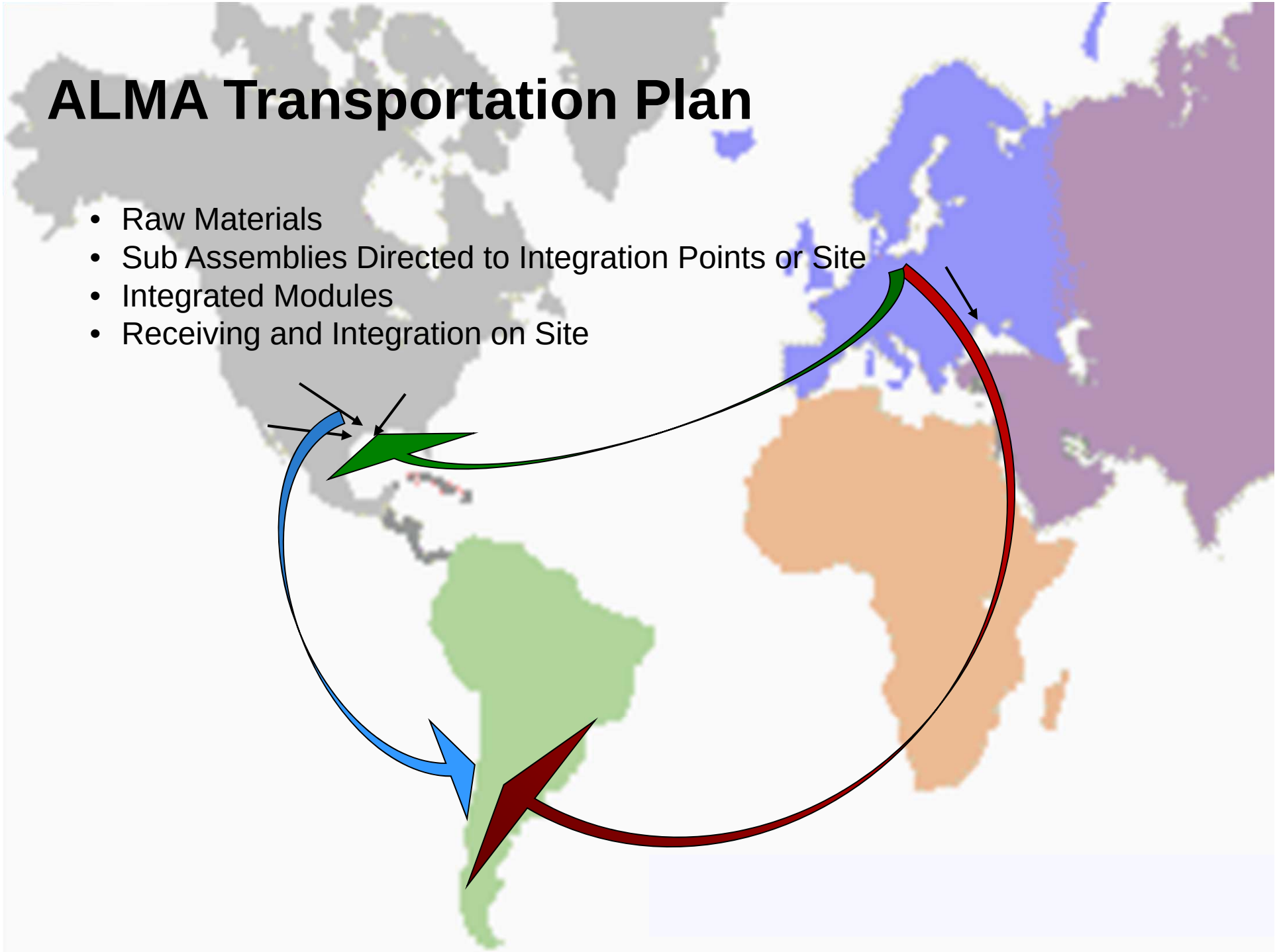
Factory Integration and Test
SOAR and VISTA

- SOAR – 4.2 Meter; f 1.6:1
- Meets or exceeds all performance requirements

- VISTA – IR and visible light survey telescope
- British customer PPARC; end user is ESO at the Paranal

ALMA Transportation Plan

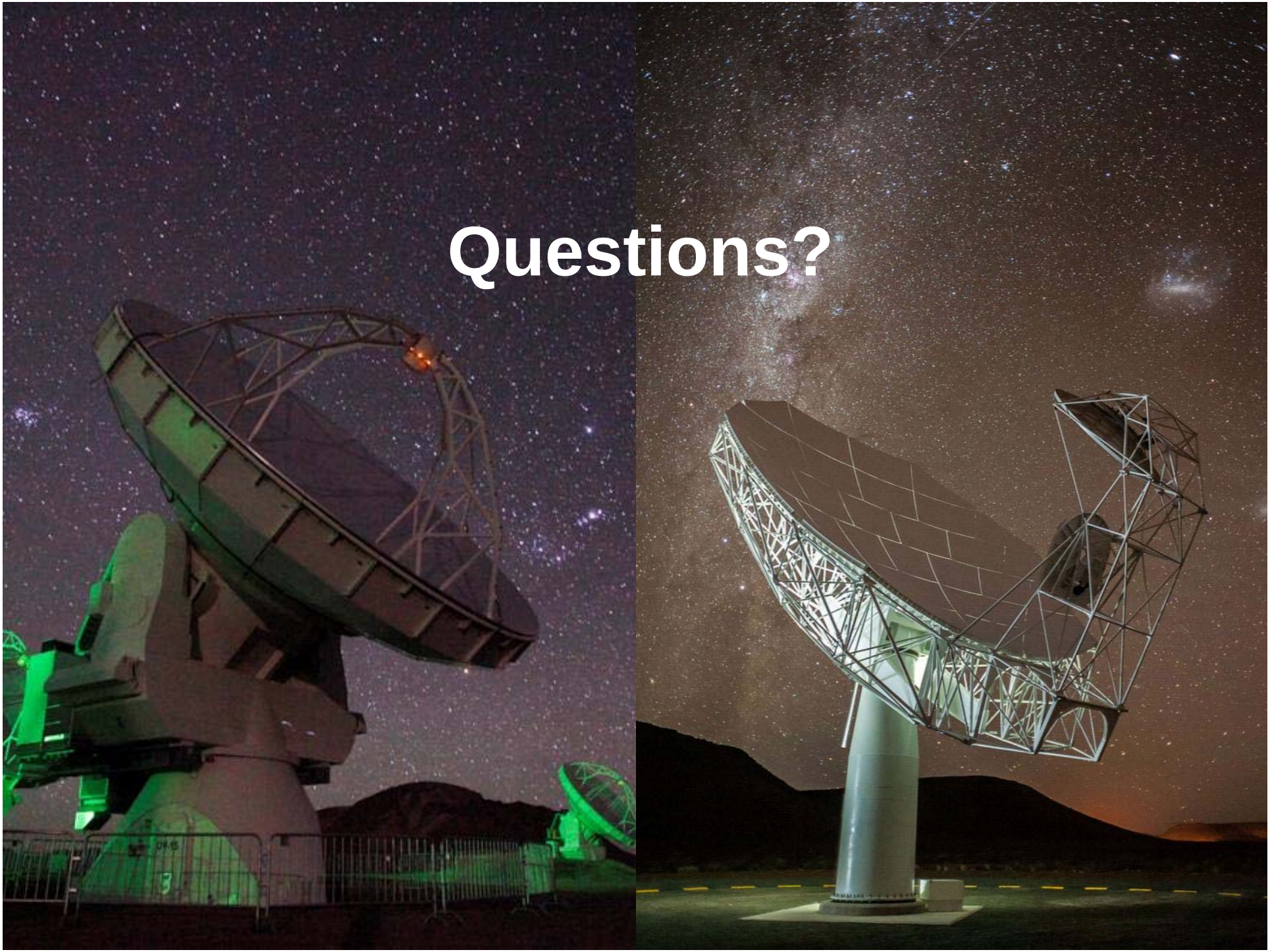
- Raw Materials
- Sub Assemblies Directed to Integration Points or Site
- Integrated Modules
- Receiving and Integration on Site



Considerations for the Specification

1. Do Not Compromise Performance, Yet **Avoid Over-Specifying**:
   A. Take Advantage of Control and Servo Modeling Technology and Error-Correction Parameters to the Fullest Extent (e.g., pedestal tilt, non-orthogonalities) so as to **Avoid Over-Constraining** the Design
   B. Minimize Constraints Upon Axis Intersections and Other Geometric Conditions

2. **Avoid Specifying a Solution**
   A. Instead, **Define the Problem / Performance**, Then Let Industry Choose the Best Technologies and Implementation Approach to Propose a Cost Effective Solution.
   B. Capitalize on Inherent Stiffness and Masses


Questions?