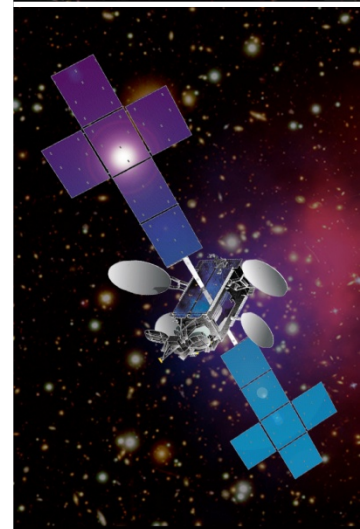


SSL Information Session

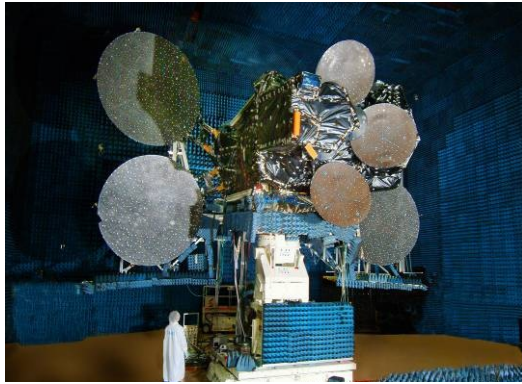
Systems Engineering



Contents

- ◆ **Introduction**
- ◆ **SSL Satellites**
 - **Standardization**
 - **Development Timeline**
- ◆ **Systems Engineering**
 - **Inter-disciplinary Engineering**

The World's Leading Provider of Commercial Satellites



- ◆ 75 GEO satellites currently on-orbit
- ◆ Over 2000 on-orbit years experience
- ◆ Workforce of ~2,800
- ◆ ~25% of U.S. Government commercial satellite leases are carried on SSL-built satellites
- ◆ 50+ years heritage of performance and reliability
- ◆ 22 awards and 22 launches since January 2010

- ◆ Industry leading GEO commercial backlog
- ◆ Decades of hosted payload experience



- ◆ Over 250 satellites built
- ◆ 19 satellites in current backlog



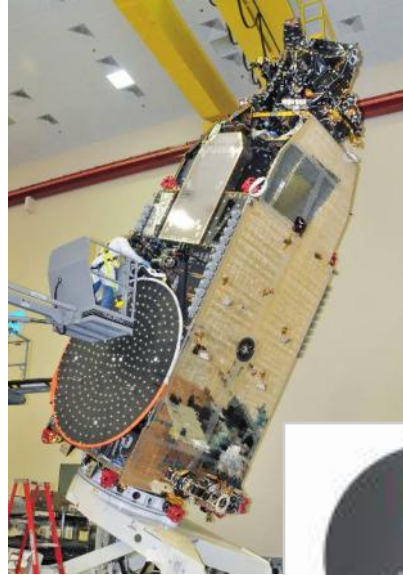
SSL Built Satellites Help Shape Today's World

Direct Broadcast Satellites



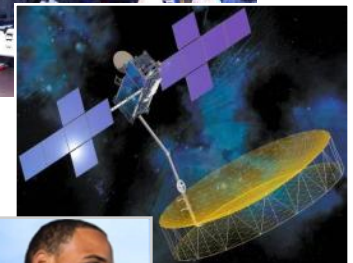
Entertainment

Two-Way Broadband Satellites



Internet Access

Mobile Comm. Satellites



Emergency
and Disaster
Response

Remote and Global Access

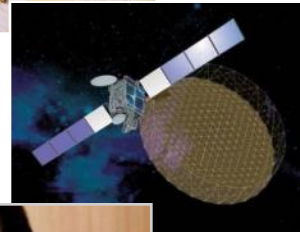
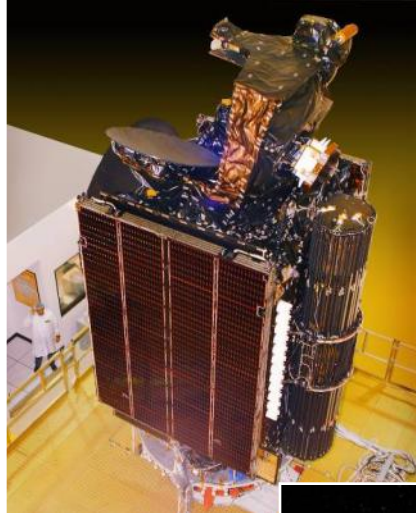
SSL Built Satellites Help Shape Today's World (Cont'd)

Digital Audio Radio Satellites



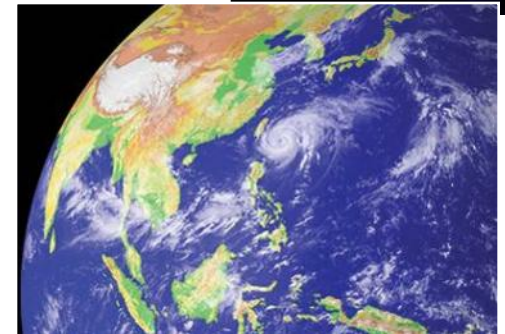
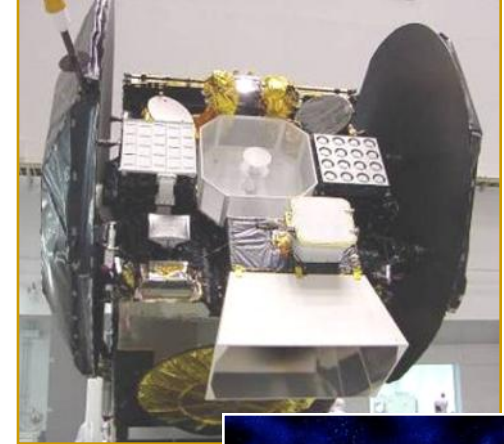
Mobile Audio and Data

Digital Multimedia Satellites



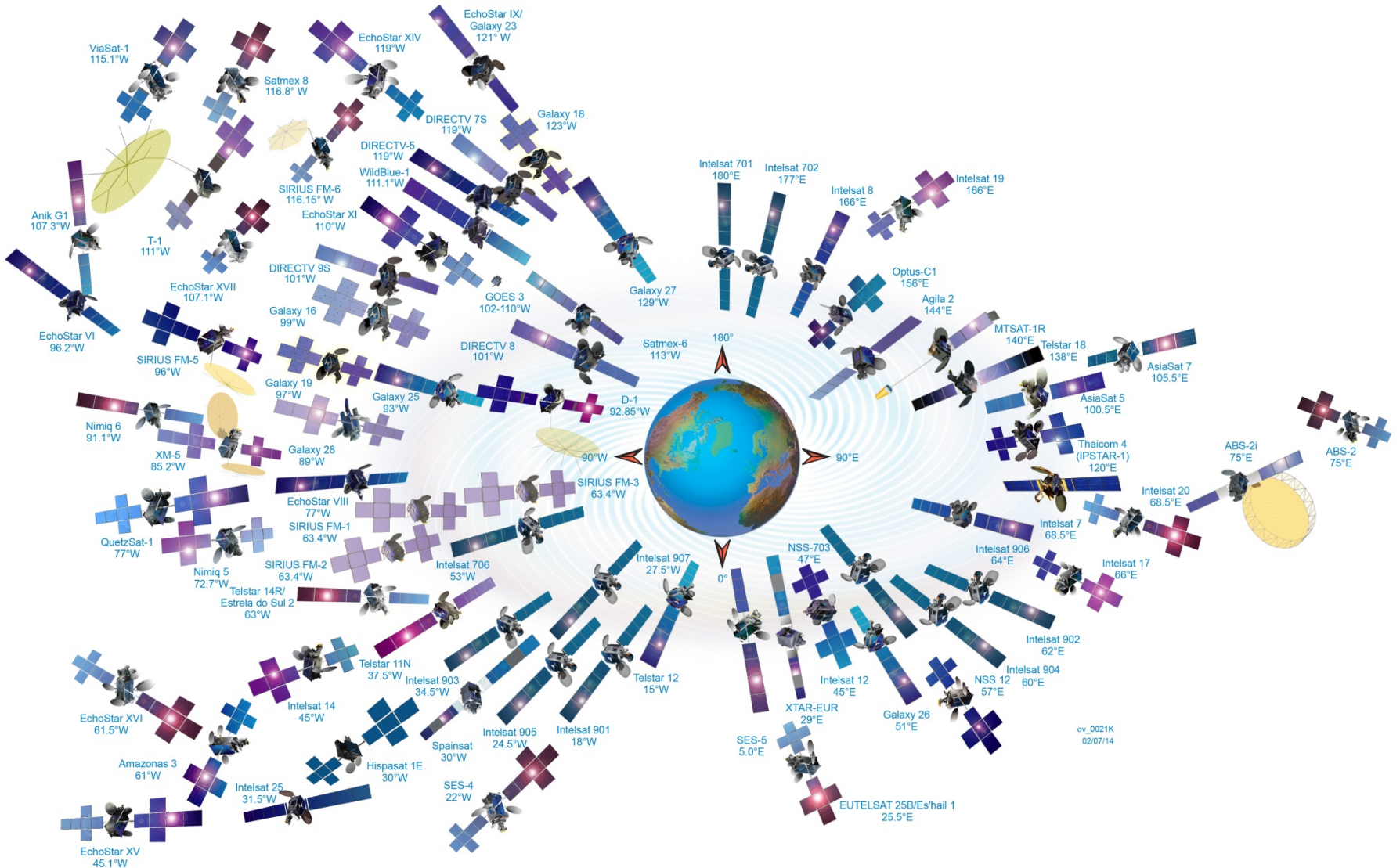
Mobile Entertainment

Meteorological Satellites



Weather

SSL Supplied 75 Active Commercial Satellites on-Orbit



ov_0021K
02/07/14

1206061
11/28/2012

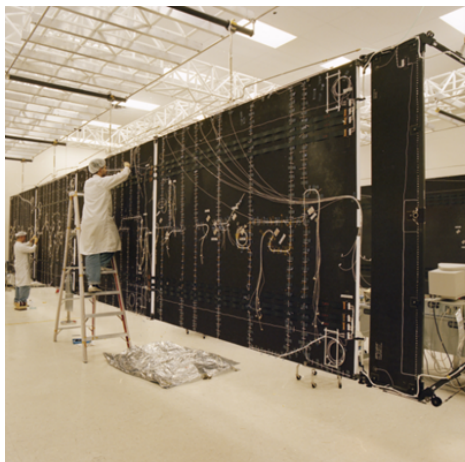


Satellite Production Facilities

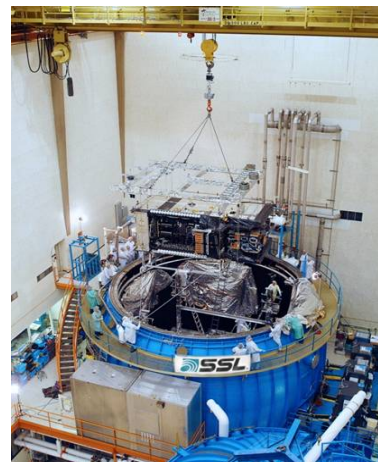
- ◆ Approx. 100,000 sq. ft. cleanroom capacity
- ◆ >165,000 sq. ft. general manufacturing space
- ◆ Second Thermal Vacuum facility available in Q4 2014
- ◆ Facility of 1.3M square feet spanning 37 buildings and approximately 79 acres



Integration and Test



Solar Array Integration



Thermal Vacuum Chamber



New TVC Under Construction

1300 Technology

- ◆ **The 1300 is a decades-proven platform with the industry's highest power capability and flexibility for a broad range of applications and technology advances**
 - **Sixteen 20-kW class satellites in orbit and under construction (high power capability up to 25 kW)**
 - **Modular building blocks to accommodate incremental technology advances (evolutionary, not revolutionary)**
 - **Well-suited for hosted payloads**
 - **Large Earth-facing deck**
 - **Standard interfaces**
 - **Applications include**
 - **Direct-to-user (TV, broadband, radio, mobile)**
 - **FSS, weather monitoring, government communications, optical payloads**

The SSL 1300 satellite platform is particularly well-suited to carry secondary payloads because of its size and power generation capability.

– Martin Halliwell, President SES Engineering



D-1: First two-way GBBF



T-1: Antennas up to 18 meters

The SSL 1300 Satellite Product Line

102" Cylinder
Dual Launch
Or Single Launch

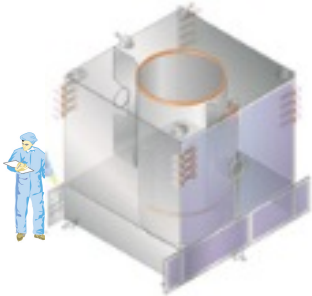
122" Cylinder
Telstar 11N
AsiaSat 5/6/8
Optus 10
THOR 7

140" Cylinder
Anik G1
Telstar 14R
Galaxy 16/18/19

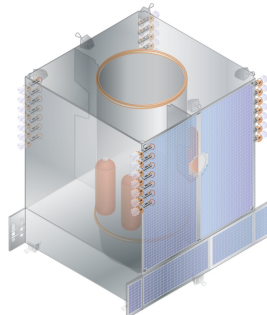
175" Cylinder
Intelsat 14/19/20
NSS-12
Satmex 8
EchoStar
XI/XIV/XV/XVI

175"+35' to 45"
Extension
XM-5
Sirius FM-5/6
ICO-1

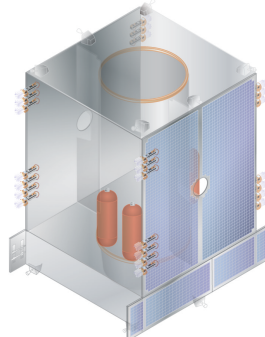
175+65"
Extension
T-1
EchoStar XVII
(Jupiter)



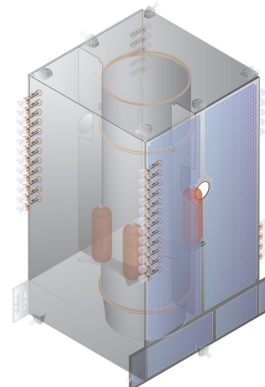
102"



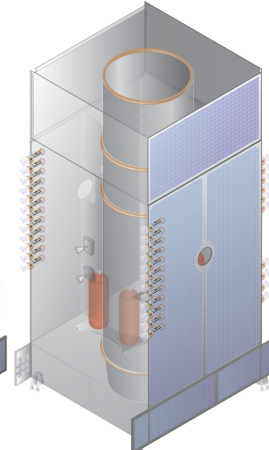
122"



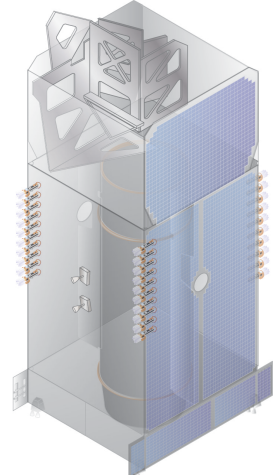
140"



176"



220"



240"

PL DC Power 5–9 kW
Dry Mass 1300–2400 kg
Solar Array 3–4 panels

7–9 kW
1500–2500 kg
3–4 panels

10–12 kW
1700–2400 kg
4–5 panels

13–15 kW
2100–3000 kg
5–6 panels

13–15 kW
2500–3600 kg
5–6 panels

15–20+ kW
3200–4200 kg
6–8 panels

Increasing Payload Mass, Power and Size

All Electric

All Electric,
Hybrid,
or
All Biprop

Hybrid
or
All Biprop

Hybrid
or
All Biprop

Hybrid
or
All Biprop

Hybrid
or
All Biprop

- ◆ 1300 satellite family is modular and scalable to higher power and more payload capacity
- ◆ All 1300 satellite family utilize the same qualified, building blocks

Development Timeline

- ◆ 2 to 2.5 year timeframe to build satellite
- ◆ Typical satellite will be in design phase for 1 year and about 1.5 years of building and testing
- ◆ Similar development cycle to the typical CubeSat
- ◆ Each satellite goes through 4 phases during its life
 - Proposal
 - Design
 - Assembly & Testing
 - Operations



Systems Engineering

◆ Systems Team

- **Manager**
- **Responsible engineers for each subsystem on a satellite**
 - **High level of responsibility and ownership**
 - **Direct interaction with Project Managers, other functional Managers and customers**

◆ Engineering Categories

- **Mechanical, Structural, Configuration**
- **Thermal**
- **Power**
- **Data handling**
- **Communications (Payload & TCR)**
- **Antenna**
- **Solar Arrays**
- **Assembly, Integration, Testing**
- **Propulsion**



Systems Engineering (Cont'd)

◆ Systems Engineering

- **Responsible for the satellite from cradle to grave**
 - **Contract evaluation**
 - **Design Trades**
 - **Test Planning**
 - **Troubleshooting**
 - **On-Orbit system verifications**
- **High level Design**
- **Focusing on reliability and high heritage**
- **Implement many tools to assist in testing and design**
- **Directly see impact**

◆ Interdisciplinary Engineering

- **Working as part of a team**
- **Interface with every major team / subsystem**
- **Communication is the most important skill**

Day in the Life

◆ Design

- Design tools are used to analyze and decompose top level requirements to unit level specifications
- Defining specification leveraging heritage performance with improved performance requirements of the Customer
- Constant conversations with Customers through weekly meetings and major design reviews

◆ Testing

- Oversight
- Data Evaluation and Approval
- Troubleshooting
- Performance Sell off

◆ Collaborative Meetings

- Customers
- Process Improvement
- Cross Functional i.e. Thermal, Mechanical, Power, Bus, etc.

Personal Development

◆ Company Wide Group Collaboration

- As a model for Satellite development
- As a method for Problem solving
 - Weekly Brain Storming across entire company
- Exposure to the entire company
 - Able to see everyone's role and find the perfect fit for you

◆ Encouraging Development

- Part of the personal review process
- Weekly Training Meetings
- Clubs
- Rotation programs
- Education Reimbursement



Summary

- ◆ **SSL is the world leader in commercial satellites**
 - **Industry leading backlog**
 - **SSL-built satellites provide communications services to virtually the entire populated surface of Earth — billions of people depend on SSL satellites every day**
 - **World's most advanced broadband satellites**
- ◆ **Space-proven 1300 satellite bus**
 - **Highest power; up to 25 kW**
 - **Flexibility for broad range of applications and launch requirements**
 - **Modular platform; standard interfaces**
 - **Well-suited to hosted payloads**
- ◆ **People · Passion · Performance**
 - **A culture of open collaboration with customers**
 - **Experienced and highly resourceful workforce with a passion for excellence**
 - **Stable management team has provided continuity and consistent leadership over the past 30 years**