The most important thing we build is trust

Cobham Semiconductor Solutions

2015 Circuit Card Assembly Overview

Commercial in Confidence
At a Glance

• What We Do

  – The Cobham Semiconductor Solutions CCA Team utilizes its differentiated technology and vast experience to meet customer needs with flexibility and agility. We offer a broad range of capabilities and services to solve challenging material acquisition, manufacturing and scheduling problems for high-reliability markets, with applications from deep space to military to the environment.

  – Located in Colorado Springs, Colorado, the CCA Team serves customers and maintains partnerships throughout the Aerospace and Defense electronics industry.

The Most Important Thing We Build is Trust
At Cobham Semiconductor Solutions, we have A Passion for Performance. It is this passion and commitment that propels us to continuously strive to do better for our customers by meeting or exceeding all requirements and expectations while maintaining cost-effectiveness. We are Solution-Minded, Performance-Driven and Customer-Focused, and we are committed to continually improve the effectiveness of our Quality Management System. Within this framework, we will establish and review Quality Objectives as we strive to grow and enhance our business, products, solutions, customer relationships, and industry recognition.

Key Principles

• Accountability
• Positivity
• Attraction
• Inspired Action
• Communication
• Integrity

An Organization Founded on Trust and Integrity
Circuit Card Assembly

Overview

Technology Differentiation
- Chip On Board / IC and Hybrid Assembly
- Ball Grid and Column Grid Array Assembly
- Flexible and LEAN Manufacturing Processes

Key Services
- Build-To-Print (BTP) Circuit Card, Slice, Module and Unit-Level Assembly
- Build-To-Specification (BTS) Single Board Computer (SBC), BEU, Hybrids and Modules
- Radiation and Up-Screening Services
- Supply Chain / Component Management

Certifications and Compliance
- NASA 8739 / J-STD-001 Space Certified
- ESD to ANSI-ESD S20.20
- FOD Prevention to NAS412 and MIL-STD-980

Key Customers
- Boeing
- General Dynamics
- Lockheed Martin Missiles and Space
- Northrop Grumman
- NASA
- Ball Aerospace
- Pacific Scientific Energetic Materials Corp
- Massachusetts Institute of Technology
- Sandia National Labs

Key Programs
- THAAD / FBM / AMDR
- Commercial Crew / CST-100
- WGS, Intelsat, Inmarsat, Viasat 2, JPSS, OMPS, LCRD, ISS, SLS, GPS III

Proven Leadership in Material Management and Assembly Technology
Circuit Card Assembly

Services Overview

Supply Chain and Component Management
- Part Procurement
- Obsolescence
- Counterfeit
- Hi-Rel Up-Screening

Space Systems Manufacturing
- SLS
- WorldView
- CST-100
- HIRDLS
- IRIDIUM
- JPSS
- X37B
- CALIPSO
- MRO
- WGS
- MMS
- ATMS

Defense Systems Manufacturing
- THAAD
- AMDR
- AARGM
- LRDR
- IDECM
- F22

Module and Unit-Level Assembly Services

Circuit Card and Slice-Level Assembly Services

Component Up-Screening and Reliability Testing

High-Reliability Components and Materials Procurement (ASICs, FPGAs, Memory, Filters, Passives, PWBs, chassis, etc)

From Component Procurement to Unit-Level Assembly and Test
Circuit Card Assembly

Personnel Overview

• Approximately 70 Employees
  – 35 Operations
    • 31 Certified to J-Std-001 Class 3 and Space Addendum
    • 22 Certified to NASA 8739.x
    • 22 Certified to Boeing Space Workmanship Standard
    • 9 Certified to LM Space Workmanship Standard
  – 13 Engineering (Process or Test)
  – Remainder Support
    • Program Management
    • Quality Assurance
    • Documentation & Configuration Management
    • Procurement & Materials
    • Administrative

A Stable, Flexible and Committed Workforce
Circuit Card Assembly
Material Management Services Overview

• Material Procurement
  – Turnkey (Prohibited and Counterfeit Material Compliance)
  – Full Consignment
  – Mixture of Turnkey and Consignment

• Management of IC Screening and Value-Added Processes
  – Radiation Lot Acceptance Testing (RLAT)
  – Destructive Physical Analysis (DPA)
  – PIND Testing
  – Hermeticity Testing
  – Electrical Testing
  – Packaging
  – Lead Forming and Solder Dipping
  – Component Programming
Circuit Card Assembly

Production Services Overview

• CCA, Module and Unit Production
  – Certification to Multiple Workmanship Standards
    • IPC-A-610 / J-STD-001, Classes 1, 2, 3 or Space Addendum
    • NASA-Std 8739.1, 8739.2 and 8739.3
    • Boeing SCGPS and SCGMS Specifications
    • Lockheed Martin LAC / MAP Specifications
  – Low Volume, High Mix Production
  – High Volume, Low Mix Production Qualification in 3Q15
  – Surface Mount Technology (SMT)
  – Plated Through-Hole Technology (PTH)
  – Electrical and Environmental Testing
  – Conformal Coating
  – Slice, Module and Unit-Level Assembly

Full-Service, High-Reliability Manufacturing and Test Capabilities
Circuit Card Assembly

Generic Process Flow – Low Volume, High Mix, Hi-Rel

- Component Prep
- Screen Printing
- Paste Integrity
- Component Placement
- Reflow
- AOI
- Functional Test
- Flying Probe
- Semi-Aqueous Cleaning
- Wave Solder
- Xray
Circuit Card Assembly

Key Customers and Partnerships

Established Relationships and Partnerships with Proven Industry Leaders
# Program Partnerships

## Boeing 702HP Satellite Platform

<table>
<thead>
<tr>
<th><strong>Customer</strong></th>
<th>Boeing Satellites and Space</th>
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<tr>
<th><strong>Program Description</strong></th>
<th>Virtual Manufacturing Partner for Boeing 702HP Bus and Boeing’s State-of-the-Art Channelizing Payload</th>
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<tr>
<th><strong>Cobham Semiconductor Solutions Content</strong></th>
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<tbody>
<tr>
<td><strong>Hybrid</strong></td>
<td>• Class K Hybrids and COB</td>
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</table>
| **IC**      | • Digital ASICs  
|            | • Memory, Interconnect, Logic and Analog Standard Products  
|            | • Gaisler IP in Satellite Control Electronics |
| **CCA**     | • CCA, Unit and Test Bus Electronics  
|            | • Battery Electronics Unit  
|            | • Payload and Bus Subsystem  
|            | • Power Distribution Modules  
|            | • Assemblies and Slices |

Virtual Manufacturing Partner for Boeing Satellites and Space
Program Partnerships

Terminal High Altitude Area Defense (THAAD)

Customers
Lockheed Martin/ Various Subcontractors

Program Description
The THAAD Missile System consist of Radar, Launchers and Missiles providing a rapidly-transportable, forward-deployable interception and destruction of ballistic missiles in the exo-atmospheric, terminal phase of flight. Current customers include US Army and Foreign Military.

Cobham Semiconductor Solutions Content

| Hybrid  | • Class K Hybrids for Thrust Vector Control System in Booster  
|         | • Mission Computer used in Missile Avionics Assembly |
| RFMW   | • JANTXV and JANS |
| CCA    | • CCAs for Flight Termination System  
|         | • CCAs for Attitude and Rate Sensor System |

Teamed with Lockheed Martin Missiles and Space, Contractors and the MDA
Program Partnerships

Laser Communications Relay Demonstration

Customers
MIT Lincoln Laboratories / NASA

Program Description
LCRD will demonstrate sustained optical communication links over a multi-year trial period, as NASA continues to develop optical communication satellites that will one day bring to life an entire satellite network that uses optical communication.

Cobham Semiconductor Solutions Services

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<tr>
<th>RAD</th>
<th>• SCD’s, Component Radiation and Hermeticity Testing</th>
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<tbody>
<tr>
<td>CCA</td>
<td>• Component Management, Assembly, and Environmental Test Services</td>
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Enabling the Future’s Space Communication Technology
Program Partnerships

Air & Missile Defense Radar (AMDR)

Customers

General Dynamics / Raytheon

Program Description

The AMDR is an active, electronically-scanned array air and missile defense radar under development for the United States Navy. It will provide integrated air and missile defense, and even periscope detection, for Flight III Arleigh Burke class destroyers. This suite consists of an S-Band radar, an X-band radar, and a Radar Suite Controller.

Cobham Semiconductor Solutions  Content

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<tr>
<th>MS</th>
<th>Digital Receiver Exciter (DREX) LRU</th>
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<tr>
<td>RFMW</td>
<td>Switches, Limiters, Couplers on Sub-Array Cal System</td>
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<tr>
<td>CCA</td>
<td>Component Procurement and Management</td>
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<td>Circuit Card Assembly</td>
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Manufacturing the Next-Generation U.S. Navy Radar
Program Partnerships
Mars Reconnaissance Orbiter

Customers
Lockheed Martin / NASA / JPL

Program Description
The Mars Reconnaissance Orbiter (MRO) is a multipurpose spacecraft designed to conduct reconnaissance and exploration of Mars from orbit. It paves the way for future spacecraft by monitoring Mars' daily weather and surface conditions, studying potential landing sites, hosting a new telecommunications system, and will serve as a highly-capable relay satellite for future missions.

Cobham Content
Motion • Wheel, Steering, Robotic Arm, Antenna, Mast and Camera Actuators • Various Motors for Science Instruments

CCA • Circuit Card Assembly

Furthering Understanding of Our Place in the Universe
# Program Partnerships

## CST-100: Crew Space Transportation Vehicle

### Customers

GDAIS and Boeing

### Program Description

The CST-100 is designed to transport up to seven passengers or a mix of crew and cargo to low-Earth orbit destinations such as the ISS.

### Cobham Content

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<tr>
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<td>Class K Hybrids in Station Keeping</td>
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<td>Power Hybrids and Voltage Regulators in Avionics</td>
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<td>Motion</td>
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<td>Motion Control and Attitude Determination subsystems</td>
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<td>IC</td>
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<td>Digital ASICs in Avionics</td>
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<td>Memory, Interconnect, Logic, Analog Standard Products, Telemetry, Power, Sensors</td>
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<td>CCA</td>
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<td>Circuit Card and Module Assembly</td>
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**Manufacturing Flight Computers for America’s Manned Space Program**
Program Partnerships
Space Launch System (SLS)

**Customers**
Boeing / Various Subcontractors

**Program Description**
SLS will provide an entirely new capability for human exploration beyond Earth orbit. It also will back up commercial and international partner transportation services to the International Space Station. First launch is scheduled for 2017.

**Cobham Content**

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</tr>
<tr>
<td>CCA</td>
<td>Flight Control CCA and Module Assembly, Command and Telemetry CCA and Module Assembly</td>
</tr>
</tbody>
</table>

**Working to Enable Inter-Planetary Travel**
Circuit Card Assembly

Additional Information and Hyperlinks

• CCA Equipment Overview

• Custom Packaging Solutions

• Cobham RAD Assembly Screening Services
  [http://ams.aeroflex.com/pagesproduct/presentations/Cobham_RAD_Assembly_Screening_Services.pdf](http://ams.aeroflex.com/pagesproduct/presentations/Cobham_RAD_Assembly_Screening_Services.pdf)