Capabilities Overview
2015
Corporate Overview

Established In 1969, Providing Space Systems Design And Development, And Reliability And Quality Assurance Consulting, First Units In Space In 1973

Steady Growth And Achievement, Applying Systems Development, Reliability And Quality Heritage To Space, Avionics And Ground Applications.

Annual Sales In Excess Of $80 Million With Approximately 350 Employees; And Over 100,000 Square Feet Of Facilities At Four Major Locations.

Corporate History

Typical Products And Services

- Space RF Payloads
- Space Weather And Other Scientific Instruments
- Payload Controllers And Processors
- Optical Payload Systems
- Software Definable Radios
- Embedded Real-time Software
- Power Systems
- C4ISR Systems
- Ground Support And Test Systems And Services
- Reliability, FMECA And Worst Case Analysis Engineering
- High Reliability Space Parts Processing
- Failure Analysis
- Destructive Physical Analysis
- Systems Effectiveness/Quality Assurance/CM
- Engineering And Management Consulting
- Documentation
ATC Major Areas Of Expertise

◊ Systems, Hardware And Software Development For Space, Avionics And C4ISR Applications

**Payload Controllers And Data Processors**
- SRP
- SRR, SRR 2.5
- ROEM
- RWR
- RDP
- CIE

**RF And Optical Payload Systems**
- FMDS
- DPU
- RPU
- SEPS
- Advanced StarTracker
- StarTracker
- MBS

**Power Systems**
- DPU
- RPU
- SEPS
- Advanced StarTracker
- StarTracker
- MBS

**Ground Support And Test Systems**

**C4ISR Systems**
- A2C2S
- JTRS
- SINCgars, SRW, INC
- UCIM
- Army Embedded GPS Receiver (AEGR)

**Space Weather Instruments**
- GOES-R SEISS
- GOES N/O/P
- WindSat
- POES/ METOP/SEM
- CEASE

- **Engineering And Management Consulting**
  - Programs Management
  - Systems Engineering
  - Design Assurance
  - Reliability And Maintainability
  - Quality Assurance And Parts, Materials And Processes Engineering
  - Program Documentation

- **Evaluation And Test Services**
  - Electrical, Structural And Thermal Modeling/Analysis
  - Space, Avionics And C4ISR Systems Qualification And Special Test Programs
  - Spacecraft EEE Parts Acquisition, Screening And Qualification
  - Failure Analysis And Destructive Physical Analysis
  - EMC/EMI Evaluation And Test Programs
  - Reliability And Maintainability Testing
Areas Of Software Expertise

- Embedded Controllers
- On Orbit Reprogramming
- VHDL Based Firmware
- Real Time Applications
- Data Acquisition And Processing
- Image Processing
- Software Definable Radios
- Communications
- Windows Development
- UML
ATC History In Space

- NAVSTAR (2)
  - GPS Navigation

- Gravity Gradient II
  - Upper Stage/Dispenser

- MSD (2)
  - Upper Stage/Dispenser

- LIPS
  - Comm. Experiment, Solar Array Experiment

- DMSP

- GOES (12 launches)

- APEX

- AIRS

- LACE
  - Laser Experiment

- TLD
  - Upper Stage/Dispenser

- ICM

- CRRES
  - Lunar Mapping

- DSCS III

- Clementine
  - Lunar Mapping

- GOES (12 launches)

- POES

- Space Shuttle

- ISS STS-129

- ST-7

- LRO

- RAPD Pathfinder

- GOES-R

- METOP

- Rapid Pathfinder
Recent ATC Payloads And Systems
GOES-R Space Weather Sensor Suite

**MPS-LO**
- 30ev – 30 keV Electrons & Protons

**MPS-HI**
- Electrons: 50 keV – 4 MeV
- Protons: 80 keV – 12 MeV

**EHIS**
- 10 MeV – 200 MeV H+He Heavy Ions To Iron

**DPU**
- Protons: 1 MeV – 500 MeV
- Alphas: 4 MeV – 500 MeV
- Integral Protons >500 MeV

**SGPS-1**
- Protons: 1 MeV – 500 MeV
- Alphas: 4 MeV – 500 MeV
- Integral Protons >500 MeV

**SGPS-2**
- Electrons: 50 keV – 4 MeV
- Protons: 80 keV – 12 MeV

**Assurance Technology Corporation - Capabilities 2015**
GOES NO/PQ

◊ ATC Designed, Fabricated, Calibrated and Tested the X-Ray and Extreme Ultraviolet Sensor (XRS/EUV), Magnetospheric Electron Detector (MAGED), Magnetospheric Proton Detector (MAGPD), Energetic Proton Alpha Detector (EPEAD) and High Energy Proton Alpha Detector (HEPAD)

◊ XRS Telescope Measures X-Ray Flux in Two Wavelength Bands:
  – 0.05 - 0.3 and 0.1 - 0.8 nm
◊ 3 EUV Telescopes Measure EUV Flux in Five Wavelength Bands:
  – 5-15, 25-34, 52-65, 73-90 and 119-127 nm

◊ Measures Low Energy Protons in 5 Energy Bands:
  – 80-100, 110-170, 170-250, 250-350 and 350-800 KeV
◊ Simultaneous Measurements in 9 Directions

◊ Measures Low Energy Electrons in 5 Energy Bands:
  – 30-50, 50-100, 100-200, 200-350 and 350-600 KeV
◊ Simultaneous Measurements in 9 Directions

◊ Measures the Following:
  – 350 to >700 MeV Protons in 4 Differential Energy Bands
  – 640 to 850 MeV/Nucleon Alpha Particles in 2 Differential Energy Bands
◊ Field-Of-View:
  – 34 Degrees Half Angle

◊ Measures the Following:
  – 0.5 to >4 MeV Electrons in 3 Integral Energy Bands
  – 0.8 to 500 MeV Protons in 7 Differential Energy Bands
  – 3.2 to 400 MeV Alpha Particles in 6 Differential Energy Bands
CMOS Imager Experiment (CIE)

◊ Developed by ATC in 20 months and Delivered to NRL in January 2009 for the MISSE7 Experiment on the International Space Station.

◊ Launched on the Space Shuttle STS-129, MISSE7 was Installed on ISS, and Became Operational on 23 November 2009. A 19 Month Experiment is Planned.

◊ CIE is Characterizing the Performance of Its Advanced CMOS Image Sensor in the Space Environment.

◊ CIE, a Self Contained Instrument, Includes a 1.2 Megapixel Imaging Array, Redundant Light Source and Light Source Monitor, Dosimeter to Monitor the Ambient Radiation Environment, an Image Controller, a Solid State Data Recorder and Embedded Processor for On-board Analysis of the Array Output, a Communication Interface for Command Upload and Data Download During on Orbit Operations, a DC/DC Power Converter, and a Radiator for Thermal Control. CIE Weighs Less Than 7 Pounds and Operates on Less Than 15 Watts of Power.
SASSA Flight Payload Systems

- Two SASSA Flight Payload Systems Were Developed For The Air Force Space And Missile Systems Center Space Superiority Wing (SMC/SY)

- The SASSA System Contains Five (5) Units
  - The Common Interface Unit (CIU), Which Provides Common Space Vehicle And SASSA Instrument Functional Interfaces, With The Processing/throughput Capacity, Interfaces And Power To Support Six (6) Instruments
  - The Radar Warning Receiver (RWR) Instrument, Consisting Of Three Units: The RWR Antenna, The RWR Antenna Module And The RWR Signal Processing Module (RSPM)
  - The Dedicated SASSA Communications (DSC) Instrument (Not Shown), Providing Communications With The AFSCN Ground Station
SASSA Ground Segment

◊ As Part Of The Efforts For The US Air Force Space And Missile Command (SMC), Self-awareness, Space-situational Awareness (SASSA) Program, Assurance Technology Corporation (ATC) Developed Two Deployable Ground Segments To Operate And Analyze The Data Received From The SASSA Payloads On Orbit. Features Include:

- Integrated Custom And Off-the-Shelf Hardware For Interfaces To The Host Vehicle Ground Segment And The Air Force Satellite Control Network (AFSCN)
- Ground Segment Has Full Red-black Separation Features For Division Of Host And SASSA Data Interfaces
- Full Mission Planning And Analysis Suite For Mission Operations
- Certification For IT Security At The Host Vehicle Level
- Radar Warning Receiver (RWR) Workstation In Parallel With Mission Operations
- Custom Telemetry Monitoring, Logging And Warning Screens

◊ Multi-Terabyte Redundant Data Storage Facility With Relational Database
◊ Signature Database For Signal Analysis Reference
◊ Remote Data Transfer And Operation Support At ATC Factory
◊ Ground Segment Can Operate Multiple SASSA Payloads Simultaneously
◊ Ground Segment Integrated And Operational At Site In Less Than One Week
◊ Currently Supporting Full Operations With Dedicated ATC Operator On Site
Software Defined Radio Technologies Overview

◊ ATC Has Developed Software Defined Radios For Space Applications Since 1989

◊ Recent Airborne and UAS SDR Systems Include The NRL SRP, Versions 1.0, 1.5 and 2.0

◊ The RF/Digital Payload (RDP) Was Developed in 2007/2008 for NRL and The Operationally Responsive Space (ORS) Program Under A BAA Award

◊ The RDP Is A Prototype Flight Unit With Three Processors, One Transmitter and Receiver, Power Converter and Digital Transceiver

◊ Both SRP And RDP Use A Modified JTRS Software Operating Environment. RDP was Demonstrated with Two Test Waveforms. A SGLS Waveform Was Prototyped in MATLAB

◊ The RDP Is Sized to Add An INFOSEC Module and Two More Transmitter/Receiver Modules

◊ ATC Leveraged It’s Experience Gained In Developing The JTRS SINCgars Operational Waveform, And Contributing To The Soldier Radio Waveform Development In The SRP And RDP Payload Developments, And Has Since Migrated To The Red Hawk Operating System

◊ The RDP System And Its Predecessors Provided Unique, Proven Advanced Technologies For The SASSA Radar Warning Receiver (RWR)
ORSTECH RDP
Advanced On-Orbit Software Reprogrammable RF/ Digital Payload (RDP)

◊ Background
  - High Priority Responsive Space Missions Enabled Through the Development of Space Based Software Defined Radio and Low Power Processing Technologies
  - On-Demand Tactical Mission Capability using In Theater and On-Orbit Reprogrammability
  - Flexible and Agile in Bandwidth and Frequency
  - Directly Applicable to 48% of the Missions Identified by the COCOMs for TacSat 3 and 4
  - Use of Open Standard Spacecraft Interfaces

◊ Includes:
  - Compact Tunable RF Transceiver
  - Wideband Digital Transceiver
  - Reconfigurable Low Power Computing Resources (3)
  - RDP Infrastructure Software
  - Web Based Ground Station Control Software
  - RDP Assembly with Power Converter
Software Reprogrammable Payload (SRP)

Military Relevance/Operational Impact
- Flexible: On-The Fly Reconfigurable, Multiple, Simultaneous Missions And Applications
- Extensible: Rapid Payload Upgrades In Response To Changes In Threats, Missions
- Modular And Open Standards, Formats And Protocols

Mission Areas Addressed
- Baseline: Communications – Voice, Data, IP Routing, Signals Intelligence (VHF/UHF), ECCM
- Near Term: Reconnaissance, Target Identification/Designation, Battle Management, Sensor Support – CBRNE, Other
Read-Out Electronics Module (ROEM)

◊ The ROEM Payload Provides Unprecedented Night Reconnaissance Capability And Sensitivity

◊ The Low Noise Front End Electronics Captures High Performance, Four Color 2880x12 Detector Focal Plane Array Outputs

◊ The Processor Digitizes 48 Channels Of Multiplexed Color Video Data At 260 Detectors Per Second

◊ It Also Provides On-Board Programmable Time Delay Integration, Gain, Offset, And Scene Based Offset Correction To Each Pixel

◊ The Digitally Multiplexed Fiber Optic Output Uses 1.06 GBPS Fiber Channel Standard
ATC Integrated C4I SR Systems Heritage

Universal Tool Kit
- Standard Interfaces
- Common Power
- Flexible Computing/Comms
- Modular Design

Analog/Digital Non-Converged Voice/Data

Digital Converged Voice/Data

Light Armored Vehicle (LAV) C2-Variant (USMC) (4 Versions)
Assault Amphibious Vehicle (AAV) C2-Variant (USMC)
Health & Human Services
HMMWV C2 System (Civilian & USMC) (4 Versions)
UH-1N C2 System (USMC) (2 Versions)
USMC Unit Operations Center (UOC) (4 Versions)
First Responder (FEMA)
Homeland Security

Army Airborne Command And Control System (A2C2S)
Universal Communication Interface Module (UCIM)

Advanced Business Concept (ABC) WHCA
High Speed Vessel Command & Control Center (HSV C³)
ATC Reliability And Worst Case Design Analysis Expertise

Assure Performance And Reliability Requirements Are Achieved Through Adherence To Parts Stress Limits, Redundancy Implementation (FMECA, FTA) And The Iterative Implementation Of Worst Case Performance Analyses (WCA) And Reviews In The Design Phase, Followed By Trend Analysis And FRACA In Support Of Parts Screening, Production And Test

- Derive Part Failure Rate Estimates
- Sum Part Failure Rates Into Module/PCB Totals
- Construct The Subsystem/System Reliability Block Diagrams And Mathematical Models
- Calculate The Reliability Prediction
- Recommend Reliability Improvements

- Identify Potential Failure Modes And Categorize Their Effect On System Performance
- Identify Single Point And Reduced Capability Failure Modes
- Identify Alternate System/Mission Capability For Reducing The Failure Mode Effects
- Verify That Interfacing Test Equipment Will Not Damage End Item Hardware

- Verify Performance Within Spec For Worst Case Stack Up Of:
  - Tolerance Effects
  - Temperature Effects
  - Aging Effects
  - Radiation Effects

- Parts Stress Analysis
  - Verify Electrical And Thermal Stresses To Be In Compliance With The Applicable Derating Criteria
  - Input Results Into The Part Failure Rate Calculations
  - Input Results Into The Thermal Analysis
ATC High Reliability EEE Parts Processing Overview

- ATC is one of the foremost independent EEE parts screening and qualification firms in the U.S. space industry, successfully servicing over 430 customers over the past four decades.

- The ATC facilities and equipment enabling this success include advanced technology test systems, comprehensive software test libraries, special test fixtures, and a wide array of environmental test equipment.

ATC Specific In House Parts Screening Capabilities

- Functional and DC Electrical Test
- AC Electrical Test
- High and Low Temperature Electrical Test
- Power Burn-In
- High Temperature Reverse Bias (HTRB) Testing
- Voltage Conditioning
- Surge Current Testing
- Device Marking
- High Reliability Device Packaging
- Destructive Physical Analysis And Failure Analysis Using Equipment Such As:
  - Optical Microscopes
  - Scanning Electron Microscopes
  - Energy Dispersive X-Ray Micro-Analysis System (Quantitative Material Composition)
  - Photographic Equipment
  - Bond Pull/ Die Shear Machines
  - Radiographic System
  - Wet Lab- Potting And Cross-Sectioning
Samples Of ATC Failure Analysis, Construction Analysis And Destructive Physical Analysis (DPA) Results

Overall Optical View Of A Typical Hybrid
Overall SEM View Of A Typical IC
Detailed SEM View Of Fracture Near Die Attach
Overall SEM View Of Diode Showing Good Ball Bond
Detailed SEM View Showing Intermetallic Formations
SEM View Showing Lifted Bond (No Force Applied)
SEM View Showing Lifted Bond Failing Bond Pull Test

Detailed SEM View Showing Attached Silicon From The Chip
Microscopic View Showing Chip Out Under Ball Bond Induced During The Bonding Process
Chip Out Induced During The Wire Bonding Process
Die Surface Damage Induced During Wafer Handling
SEM View Showing Exogeneous Metal In Close Proximity Of Adjacent Metal
Cracked Or Reduced Metal Greater Than 50%
Cracked Metal Greater Than 50%

Capacitor Lead Separation With Epoxy Filled Voids
Acceptable Capacitor
Delaminated Capacitor Plated (Fixed Ceramic)
Void In Dielectric
Through The Glass Inspection Showing Fractures In The Die

Cross Sectional View Of Diode Showing Fractures Die
Diode Anode Showing Fractures
Poor Die Attach Diode
Cracked Magnetic Core
Tin Whiskers On 100% Tin Lead
Tantalum Capacitor (Typical)
Poor Anode Weld (Tantalum Capacitor)
ATC High Reliability Production And Test Facility
Chelmsford, MA

◊ This Modern 35,000 Square Foot Facility And Its Equipment Are Tailored To The Production And Test Of Space, Aerospace And C4ISR Systems And Units.

◊ It Is An Advanced Technology, Vertically Integrated System And Unit Development Facility With The Facilities, Equipment And Trained Personnel To Accomplish:
  ◊ Parts Procurement And Processing,
  ◊ Surface Mount Technology (SMT) Production
  ◊ High Reliability Manufacturing, Assembly And Integration,
  ◊ System And Unit Qualification And Acceptance Testing, Including Performance And Environmental Testing

◊ Quality:
  - ATC is certified ISO 9001:2008 and AS 9100:2009, renewed as of the 24 September 2013. These certifications are valid through 24 September 2016.
  - ATC Calibration System Conforms To Z540-1-1994
ATC Facilities And Equipment Overview

- ATC Facilities And Equipment Have Evolved Over A Four Decade History In Space, Avionics And Ground Systems Development For Over 100 Government And Civilian Customers
- These Facilities And Equipment Have Enabled The Design, Development, Production, Test And Operational Support Of Over $1 Billion Dollars In Advanced Technology ATC Space/Aerospace Electronics Systems
- ATC Facilities And Equipment Offer The Most Advanced, Proven Technologies Available To Support The Design, Development, Test, And Documentation Of High Reliability Electronic Systems For Space, Aerospace And C4ISR Applications