



# Ducommun Overview for CABC

Sept 16, 2016



# Tod J. Brindlinger

## VP & GM Electronic Systems

Family



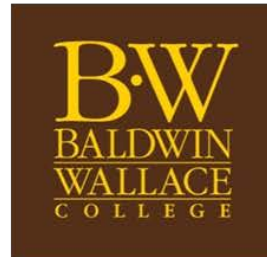
Hobbies



Education



BSME



MBA



1986



1988



1989



1994



1996 - 2015



2015 - Present



# Ducommun Incorporated Overview

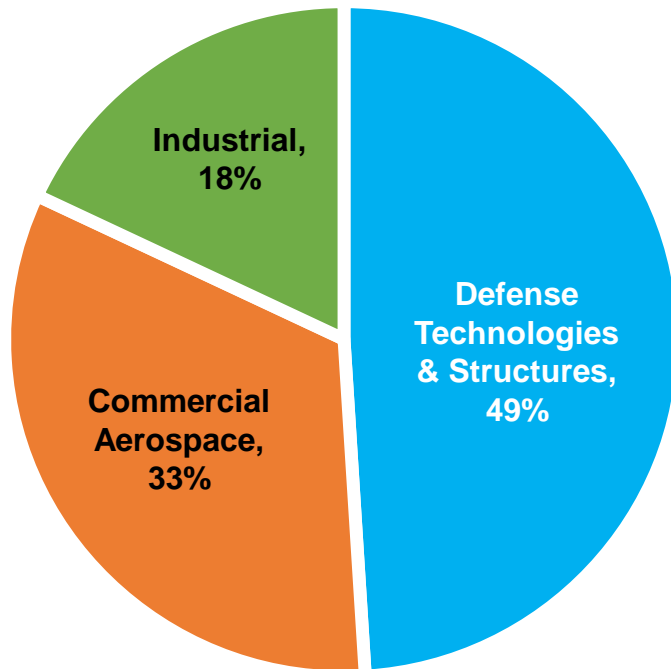
- We are the oldest Corporation in the State of California (1849), Operational in Arizona for over 50 years
- Today, Ducommun is a leader in manufacturing sophisticated solutions for the aerospace, defense, industrial and natural resources markets
  - Focused, niche approach capitalizes on growing market demand
  - Long-term relationships with blue-chip customers
- \$666 million in annual sales (2015)
- 19 manufacturing and engineering operations in 11 states, Mexico and Thailand
- 2,800 employees companywide





# Ducommun Incorporated at a Glance

## Diverse End Markets and Platforms \$666 Million – 2015 Sales



## Key Customers





# THE DUCOMMUN WAY

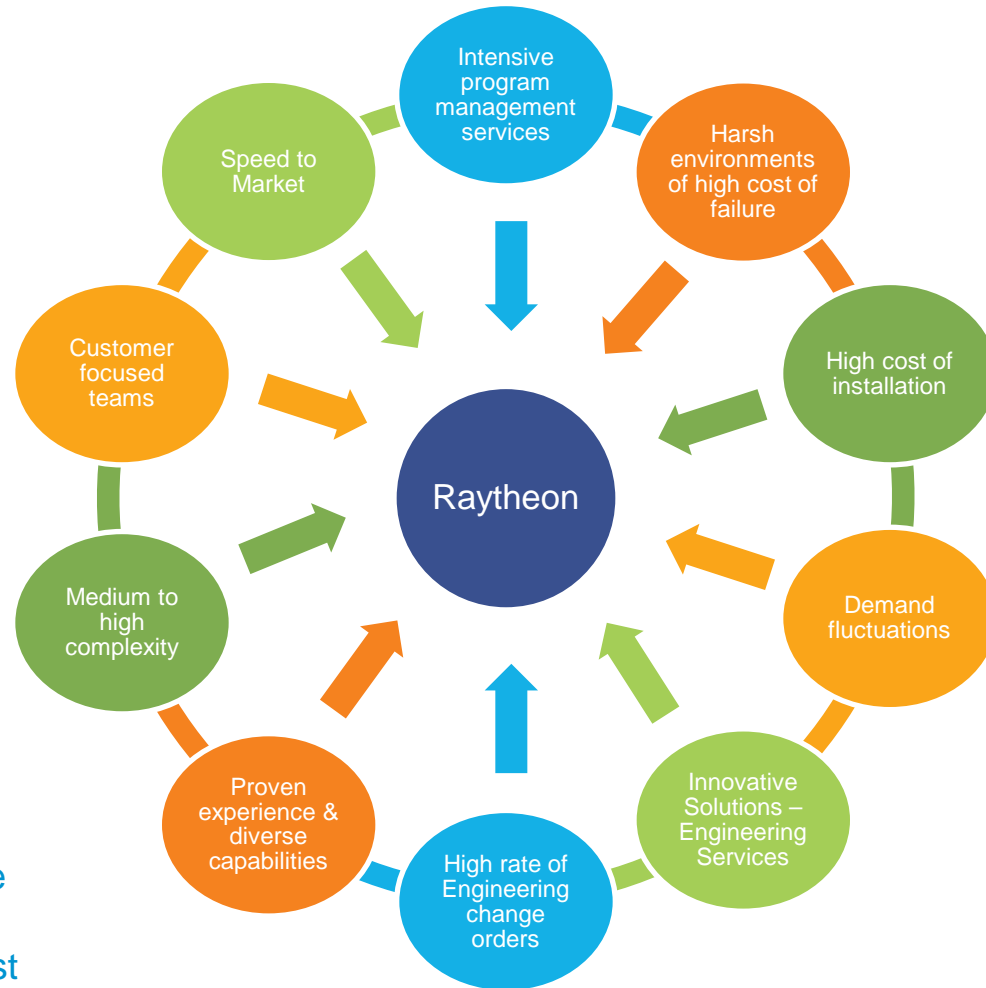
Honesty • Professionalism • Respect • Trust • Teamwork





# Value Proposition

Passionately deliver reliable and innovative solutions via collaboration & transparency ensuring customers' peace of mind – a (best value / lowest risk)



Ducommun offers value where one or more of these requirements exist



# We Go to Market as One Company with Broad Capabilities

Each SBU is built on a unique set of competencies

## Strategic Business Units

### Electronic Systems

#### Circuit Board Solutions



- Low-to-medium volume
- High mix
- High rate of change

#### Electronic Integrated Solutions



- Box-level electronic, electromechanical and mechanical assembly
- RF and HMI products

#### Interconnect Solutions



- Cables and wiring harnesses
- High-temperature, pressure, flexibility, and frequency

#### Bonded Component Solutions



- Composite materials
- Spoilers, winglets, tail cones, rotor blades

### Structural Systems

#### Structural Assembly Solutions



- Titanium forming
- Engine ducts, pylons, firewalls, exhaust ducts, nacelles

#### Structural Systems Solutions



- Metal forming and chemical milling
- Skins, leading edges, stabilizers, cargo doors



# Significant Content on Commercial and Military Fixed Wing Aircraft



## Electronics

- 1 Avionics systems
- 2 Cockpit controls, lighted panels and switches
- 3 Radar assemblies
- 4 Fuel management systems
- 5 Brake systems
- 6 Engine and nacelle electronics
- 7 Flight surface control systems
- 8 Communication and countermeasure systems

## Structures

- 9 Ailerons, spoilers, winglets and other flight control surfaces
- 10 Tail cones
- 11 Fuselage skins
- 12 Passenger and cargo doors
- 13 Window surrounds
- 14 Engine ducts
- 15 Exhaust ducts and nozzles



# Significant Content on Commercial and Military Rotary Aircraft



## Electronics

- 1 Cockpit controls, lighted panels and switches
- 2 Communication systems
- 3 Fuel management systems
- 4 Sensor suites
- 5 Avionics systems
- 6 Radar systems
- 7 De-icing systems

## Structures

- 8 Rotor blades and blade abrasion strips
- 9 Engine ducts, nozzles and heat shields
- 10 Door surrounds and bulkheads
- 11 Window surrounds



# Diverse Content on Key Missile Platforms

## Land, Sea and Air



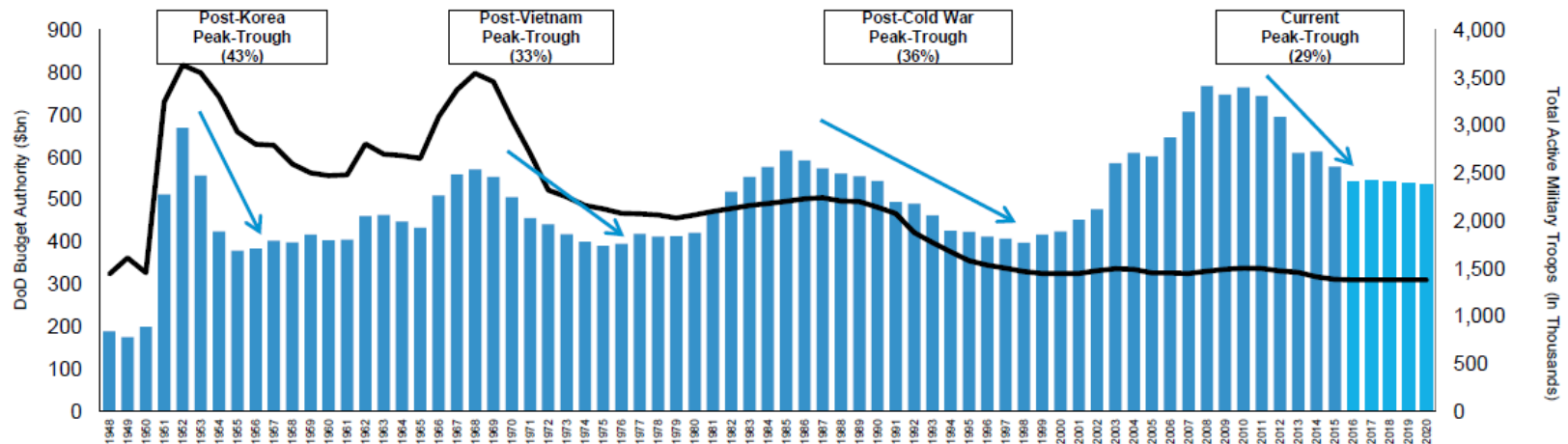
### Electronics

- 1 Target acquisition systems
- 2 Launch systems
- 3 Command and control systems
- 4 Range safety antennas
- 5 Guidance systems
- 6 Navigation systems
- 7 Warhead electronics
- 8 Umbilical container cables
- 9 Automated test systems

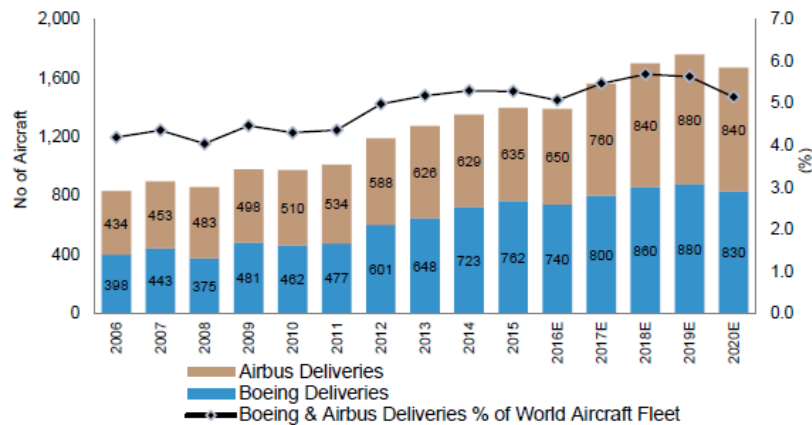


# Macro Trends

## Historical Defense Spending <sup>(1)</sup>

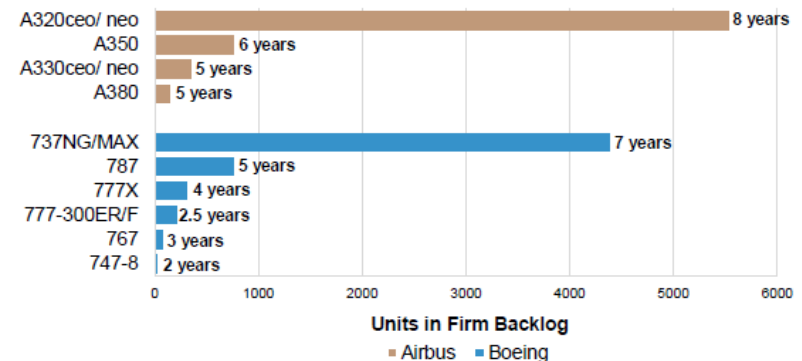


## Commercial Aircraft Build Rates | # of Aircraft



## Air Transport Aircraft Backlogs

Airbus and Boeing have record backlogs, approaching 8 years even at increased production rates



Sources: Airline Monitor Report, AeroDynamic Research, Boeing and Airbus

<sup>(1)</sup> Department of Defense Comptroller, National Defense Budget Estimates for FY16



# Where We're Located



Ducommun  
Incorporated  
Headquarters

## BONDED COMPONENT SOLUTIONS

- Guaymas, Mexico
- Monrovia, California

## CIRCUIT BOARD SOLUTIONS

- Appleton, Wisconsin
- Tulsa, Oklahoma

## ELECTRONIC INTEGRATED SOLUTIONS

- Carson, California
- Huntsville, Arkansas
- Phoenix, Arizona
- Saraburi, Thailand
- Tulsa, Oklahoma

## INTERCONNECT SOLUTIONS

- Berryville, Arkansas
- Joplin, Missouri

## STRUCTURAL ASSEMBLY SOLUTIONS

- Cocksackie, New York
- Parsons, Kansas

## STRUCTURAL SYSTEMS SOLUTIONS

- El Mirage, California
- Gardena, California
- Orange, California

## SYSTEMS DEVELOPMENT & INTEGRATION

- Huntsville, Alabama
- Iuka, Mississippi
- Oxford, Mississippi





# Electronic Integrated Solutions

## *Display Assemblies*

*Tod Brindlinger, VP & GM*

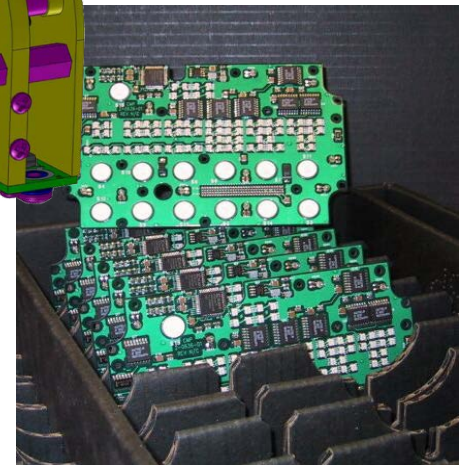
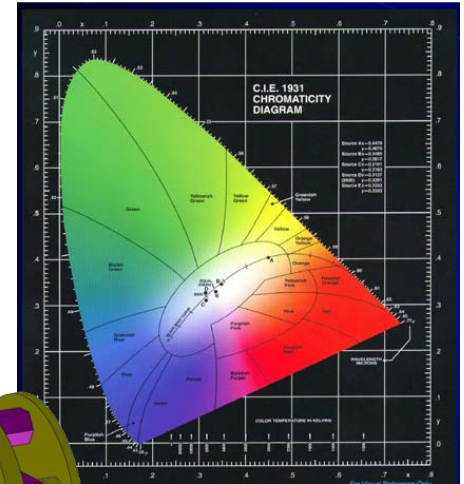
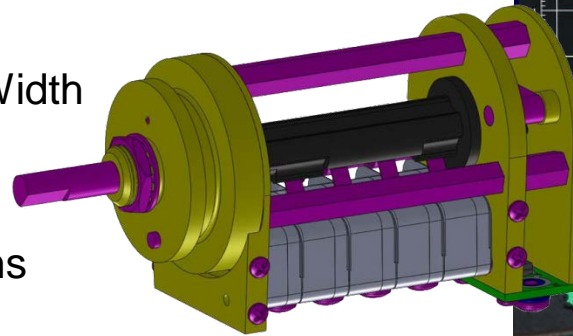
*Andy Wu, GM*



# Complete Product Lifecycle Capabilities

## Design Engineering

- Systems Engineering
- Electrical & Mechanical Design
- Manufacturing Engineering
  - Design to Cost
  - Tooling, Assy & Test Fixtures
- Optical/Lighting Engineering
  - Design for optimum brightness, chromaticity, uniformity, redundancy, power
  - Custom dimming curves using Pulse-Width Modulation, etc.
- Test Engineering
  - LabView based functional test programs
- Reliability Engineering
- Obsolescence Management
- CAD / CAM Capabilities:
  - SolidWorks 3-D Modeling
  - Innoveda (PADS) PCB CAD application w/auto-routing
- Configuration/Document Control





# Complete Product Lifecycle Capabilities

## Manufacturing

- CNC machining
  - Various materials (e.g. Acrylic, polycarbonate, aluminum, composites, stainless steel)
  - Capable of close tolerances, complex geometry, special components (guards, knobs, pointers, diffusers , etc.)
  - Molding
  - Painting/Laser Etching/Engraving
- Assembly
  - Component assembly to ANSI-IPC-A-610
  - Cabling to ANSI-IPC
  - Soldering to MIL-STD-2000A and J-STD-001B
  - ESD compliance to EIA-625
  - On-going training
- Complex Electrical Sub-Assemblies
- Electronic Circuit Assemblies
- Wire Harnesses
  - NASA Certified Soldering
- Dedicated assembly cells
- Class 10,000 clean rooms w/ class 100 flow benches
- Material & Component Traceability

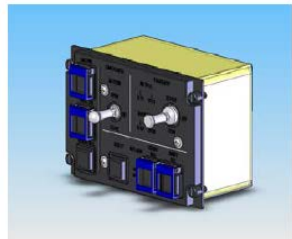




# Complete Product Lifecycle Capabilities

## Testing

- Light lab capability:
  - Computerized luminance & contrast to SAE & Mil-Specs
  - Sunlight readability & NVIS testing system
  - Spectral radiance and chromaticity testing
- Automated Test Equipment (LabView-based):
  - System and subassembly test
  - Discrete, serial, parallel and bus interfaces to panels
  - Generation of PWM dimming signals
- Electronic Functional Testing:
  - LED/LCD display testing
  - Switch testing
  - Encoder testing
  - Open/short testing
  - EMI testing (out source)
  - Capable of performing continuity & leakage test per customer's requirements
  - From 4,500 to 12,000 Test Points
- Environmental:
  - Thermal/Vibe ESS
  - Vacuum
  - Humidity
- High power RF to 50 GHz
- Hardness Testing





# FOCUS ON QUALITY

- AS9100 / ISO-9001
  - Quality System registered to AS9100 Rev. C and ISO-9001:2015
  - NQA USA, Certificate No. 13179
- Qualified Products List (QPL)
  - MIL-PRF-22885 Illuminated Push Button Switches
  - MIL-DTL-7788 Integrally Illuminated Information Panels
- Workmanship
  - J-STD-001 Class 3 and IPC-A-610 Class 3
  - J-STD-001 Space Addendum
- Continuous Improvement
  - 6 Sigma / Lean Manufacturing Certification Program
  - 6S Program
- Federal Aviation Administration (FAA)
  - FAA Parts Manufacturer Approval (FAA-PMA)
    - 14 CFR part 21.303(h) Inspection System
    - 14 CFR part 145 Repair Station (Repair Station Certificate No. D5YR708X)
    - European Aviation Safety Agency (EASA) Part-145 Approval (EASA.145.5946)





# Human Machine Interface

- **Solid Pedigree**

- First development in 1958 for the Lockheed L1011 Tri-Star

- **Products**

- Illuminated Pushbuttons, Switches/
- Switch Matrices, Keyboards, & Annunciators
- Illuminated Display Panels & Bezels
- Time Delay Modules
- Rotary Switches
- Caution Warning Assemblies
- Integrated Control Panel Assemblies
- Complete Subsystems
- AM/LCD Touchpanel Displays

- **Product Technology**

- Incandescent & LED
- Night Vision Imaging System (NVIS) Compliant
- Sunlight Readable
- SPST; SPDT; DPDT; etc.





# Lighted Push-Button/Switches & Annunciators

- All of our product series' offer customizable features such as:
  - Color (bezel, back/foreground & light)
  - NVIS filtering; dimming curve
  - Display etching & font size
  - Number of poles & switch action
  - EMI shielding; type of grounding; contact type; sealed/unsealed
  - Visit our Website for a complete listing of options
- Below are just a few samples of our discrete products:



- 10530 Keyboard/Keypad
- 10620 Mark 8 PB Switch
- 10648 Mark 11 PB Switch
- 10706 Mark 10 PB Switch
- 10732 Mark 15 PB Switch

- 10785 Mark 20 PB Switch -
- 10800 Mark 7 PB Switch -
- 10820 Mark 18 PB Switch -
- 30288 Mark 12 PB Switch -
- 30295 Microlite PB Switch -

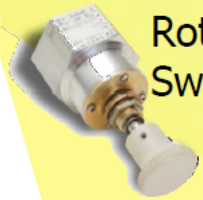


- NOTE: All parts are MIL-STD on the Qualified Parts List (QPL)



# Other Discrete Components

- In addition to our line of lighted push-button switches & annunciators, DLT offers several other HMI components utilized on aircraft, specifically:



Rotary Dimmer  
Switch Module

- 5 Dimming Positions
- Supports 12V & 28V
- On/Off Capability
- Bushing mount for ease of panel assy

Engine Start  
Rotary Switch



- 4 Positions
- 60K cycles
- DC-28V
- 7.5A res
- 10A ind

Time Delay  
Relays



- Solid State
- Hermetically Sealed
- 2 AMP Contact Rating
- Timing from 0.1 to 600 seconds



# Keyboards/Keypads

- Custom Keyboards/Keypads:
  - Reverse engraved legends for greater durability
  - Low profile, lightweight design
  - Pretravel, tactile/audible snap and overtravel
  - Environmentally resistant construction
  - Sunlight readable indicators and keys
  - Compatible with night vision goggles
  - Meets or exceeds all applicable military standards
- Options for Flexibility:
  - Machined acrylic, aluminum, or poly-carbonate face plate
  - Single or multiple pole switching
  - Individually lighted or edge lighted keys
  - Splash proof key seals
  - Electrically conductive nylon faceplate for EMI screening applications
  - Electroluminescent (EL) or Light Emitting Diode (LED) lighting
  - Flexibility of interface termination





# Illuminated Panels & Lightplates

- Custom Illuminated Panels, Lightplates, and Bezels:
  - SAE-AS7788
  - Precision Machined and Tested
  - Laser-etched for consistent readability
  - NVIS Compatible
  - Light balanced and tested to meet all luminance, chromaticity, uniformity, and radiance requirements
  - Meets or exceeds all applicable military standards
- Options for Flexibility: Type III thru VII
  - Machined acrylic or poly-carbonate face plates
  - Incandescent; electroluminescent; or LED
  - Complex curved configurations
  - Available in any Fed-STD 595 color
  - Custom connector or cabled termination





# High Volume Illuminated Panels



- Ducommun is committed to becoming the pre-eminent high volume, high quality, low variability lightplate manufacturer
- Manufacturing capacity expansion focused in Carson facility
- Currently in Phase I of a three phase implementation plan to establish dedicated lightplate manufacturing cells



# Integrated Assembly Technology

- Integrated illuminated display panel assemblies with one or more of the following features:
  - Integrated Switches:
    - Toggle/Push Button/Rotary
    - SPST: Momentary Contact, SPDT, DPDT
  - Custom Key Caps with/without annunciation
  - Rockers 2/4 way Switch elements (enviro sealed.
  - Annunciations (LED & Incandescent):
    - Sunlight readable/dead front NVIS compliant
    - Encoders: Optical/Mechanical
    - Potentiometers
    - Diode and Resistor Arrays
    - Enclosures and Mounting Plates
    - LED Fluorescent/Electro-luminescent/LCD Displays
    - Micro-controller control of annunciator actuation and panel/annunciator dimming utilizing PWM
    - Power Supplies, Connectors & Wiring
    - Bus interfaces to panels using discrete/serial/parallel data including RS232, RS422, Ethernet, etc.





# Other Engineered Solutions Products

## *Broad-based Specialized Products*



Radio Frequency Products  
Millimeter Wave  
Components & Microwave  
Switch Products

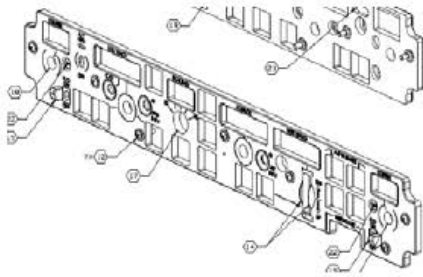


Motion Control Devices  
Motors, Resolvers,  
Actuators, &  
Mechanisms

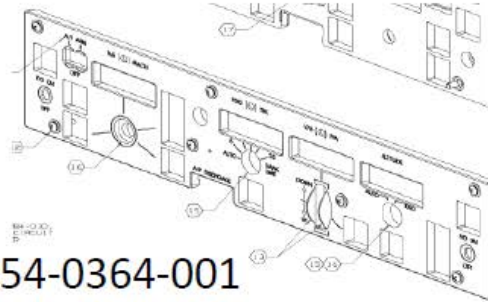
*Engineered Solutions products are value-added services with the full capability to design, test and manufacture custom and standard solutions*



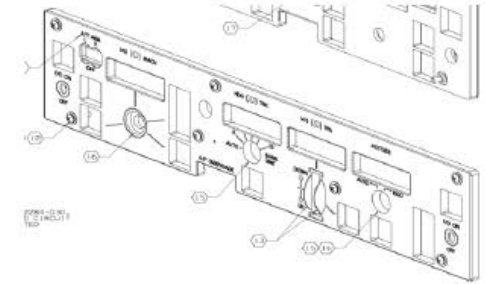
# Boeing Commercial 737, 757, 767, 777



754-0370-002 (B737)



754-0364-001  
(B757/767)  
822-1492-102  
S241T100-232

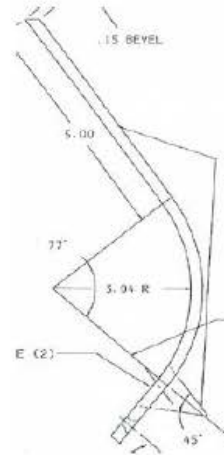
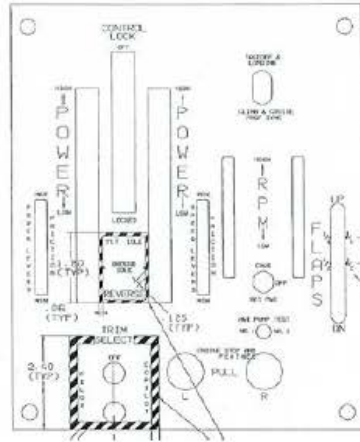


754-0365-001 (B777)

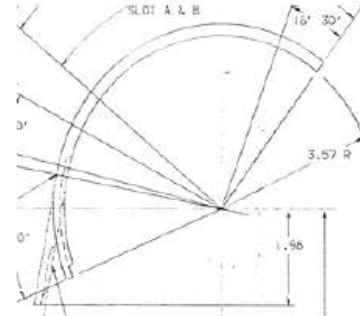
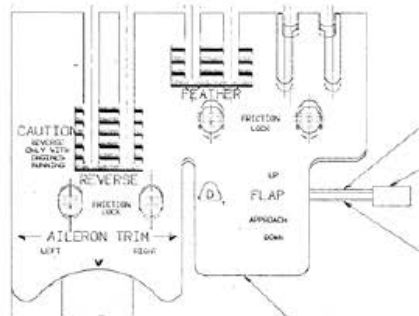




# Curved Panels



Fairchild Metroliner



Beechcraft King Air



# Boeing Military F-15 & F/A-18



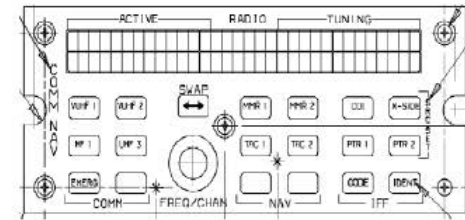
## F-15 Eagle

F/A-18E/F Super Hornet

*with integrated lighted assemblies, panels, APG- 79 radar rack and microwave switches*

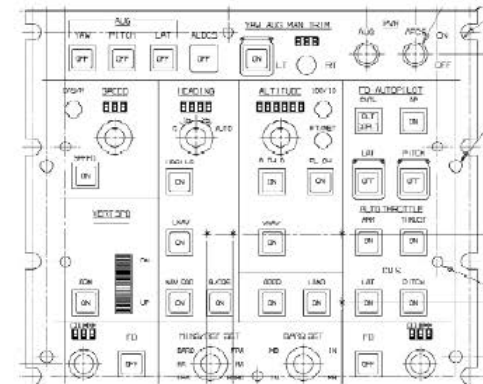


# C-5 Galaxy



Integrated Communication Navigation Panel  
(CNP)

PN: 4V91083



## Integrated Automatic Flight Control System (AFCS)

PN: 4V91084



# Custom Panel & Integrated Display

Auto Flight Panel



Overhead Panel



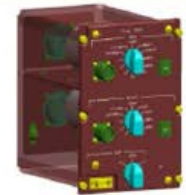
Audio Mgmt Panel



Boeing C-130 Avionics  
Modernization Program



INU / Radar  
Control Panel



Secure Fill  
Port Panel



AUX  
Switch  
Panels



Equipment  
Cooling  
Control Panel



Hydraulic  
Panel



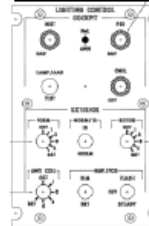
Flight Engineer  
MFD Control Panel



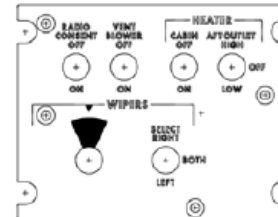
# Helicopter UH-1

- Lighted Panels (NVIS)

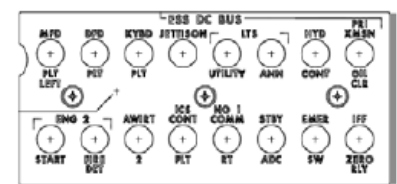
Part Number	Description
1-0726	Lighting Control
1-0730	Utility Panel
1-0841	RH Overhead Console, Fwd
1-0843	RH Overhead Console, Center
1-0844	Auxiliary Overhead Console, Center
1-0852	LH Overhead Console, Center
1-0863	LH Overhead Console, Fwd



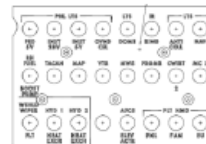
1-0726



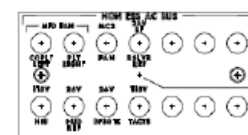
1-0730



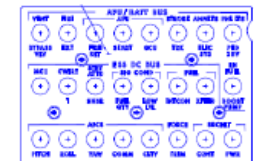
1-0841



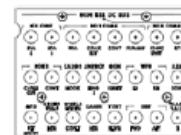
1-0843



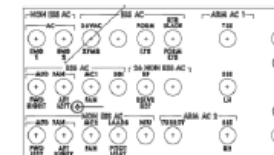
1-0844



1-0852



1-0863



1-0863



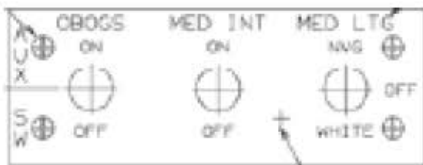
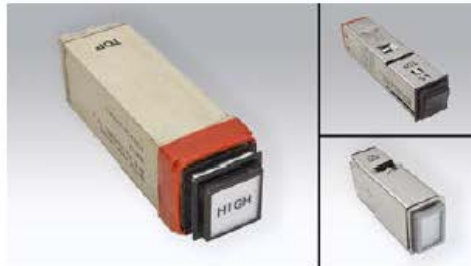
# UH60 and CH47



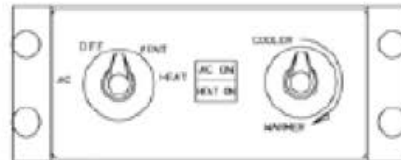
- 190 Push button switches for UH/SH - 60
  - 10410 Series
  - 10530 Series
  - 10620 Series
  - 10800 Series
  - 30367 Series



- 73 Push button switches for CH-47
  - 10620 Series
  - 10648 Series
  - 10732 Series
  - 30268 Series



Auxiliary Switch Panel



ECS Control Panel





# Other Aerospace Platforms

- UH-60 Blackhawk
- Regional Jets
  - Embraer
  - Bombardier
- Hawker Beechcraft
- Space Shuttle, Space Station
- F-16, F-117
- Apache Helicopter
- Eurocopter

Mirage 2000



CRJ 900



Apache



Blackhawk/Seahawk



B-2 Bomber



Bell H-1



Space Shuttle & Station



F-117 Night Hawk



Airbus 330-200

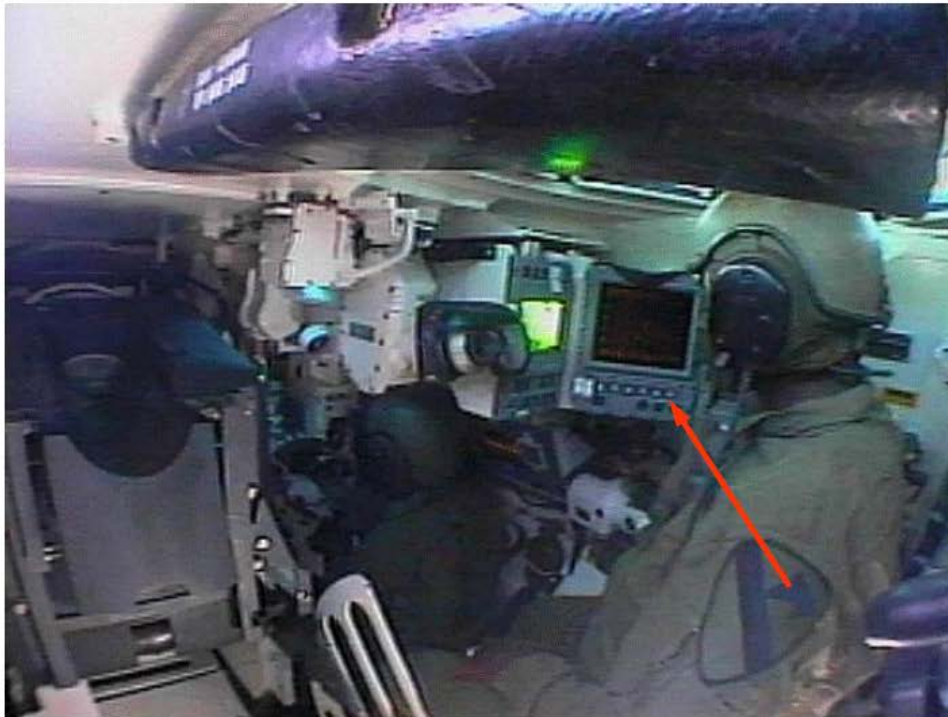


F-16 Falcon





# M1A2 Abrams Main Battle Tank

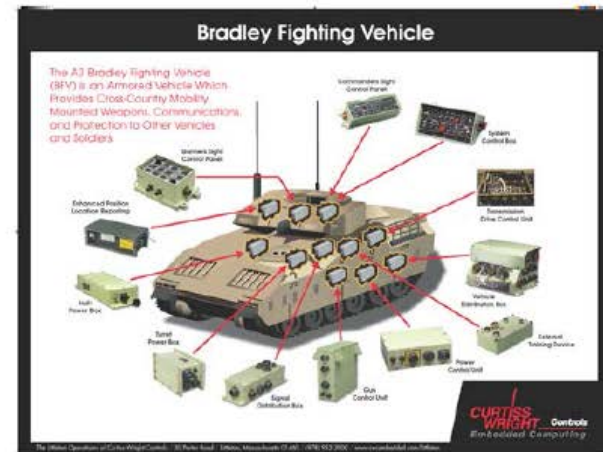


**GENERAL DYNAMICS**  
*Strength On Your Side®*

\*Integrated display assembly  
consisting LCD display and  
bezels



# Bradley Fighting Vehicle



799 Commander's Sight Control Panel

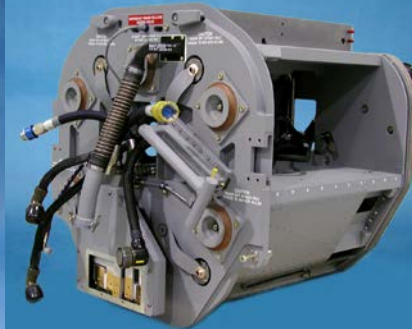


800 Gunner's Sight Control Panel



798 System Control Panel





# Electronic Integrated Solutions

## *Integrated Systems*

*Tod Brindlinger, VP & GM*

*Greg Raczynski, Plant Mgr*



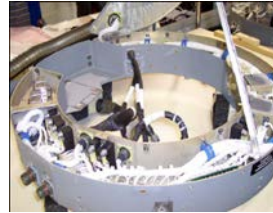
# Provider of Innovative Integrated Solutions

## Integrated Electro-Mechanical Assemblies, Consoles, Cabinets



### Assembly

- Complex, large rack and cabinet expertise
- Integrated Electro-Mechanical solution provider



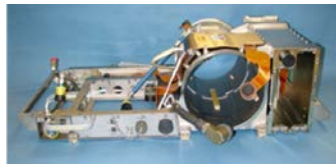
### HALT/HASS Testing

- ICT
- Functional
- Environmental
  - Vibration
  - Temperature cycling



### Flexibility

- All sizes and complexities
- Ruggedized for harsh environments
- Robust test capabilities



### Engineering

### Solutions/Sustaining

- Design Engineering – DFx
- Design Analysis
- Reverse Engineering/Product Transitions

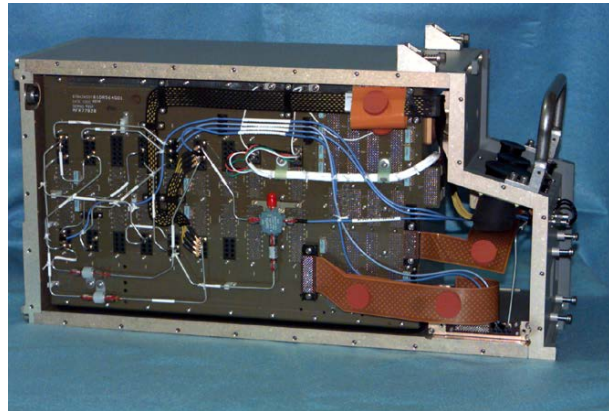
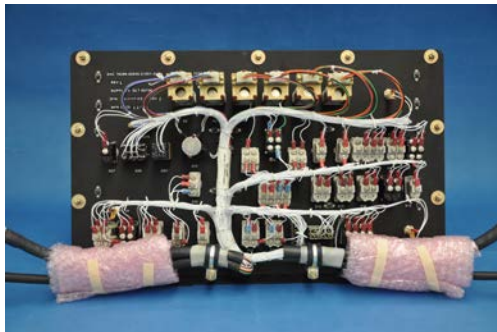
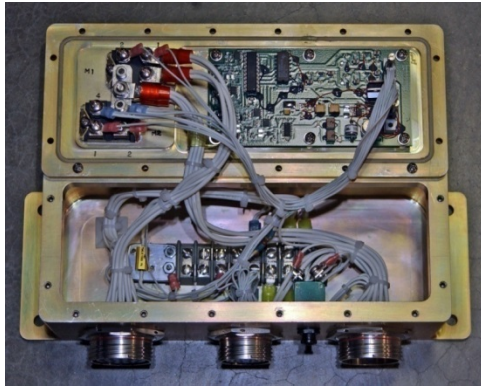




# Core Competencies

## Electromechanical Services

- Complex subassemblies, mechanical assemblies, cabinets, enclosures & integrated electromechanical assemblies requiring a high degree of test including ESS





# Additional Core Competencies

- **Strong Engineering**
- **High Quality Standards**
- **Streamlined Supply Chain**
  - Internal cable/harness design/manufacture
  - Internal circuit card assembly manufacture (including conformal coat)
- **Fabrication**
  - Sheet Metal Assembly
  - Prototype Machining
  - Precision Integration
  - NADCAP Chem-Film Process
  - Bonding / Welding
  - Painting & Silk Screening

