ESI MOTION™

Rugged Control and Power Conversion Systems

For Space & Defense Applications

Sales: 1-800-823-3235 | sales@esimotion.com | www.esimotion.com

Who We Are

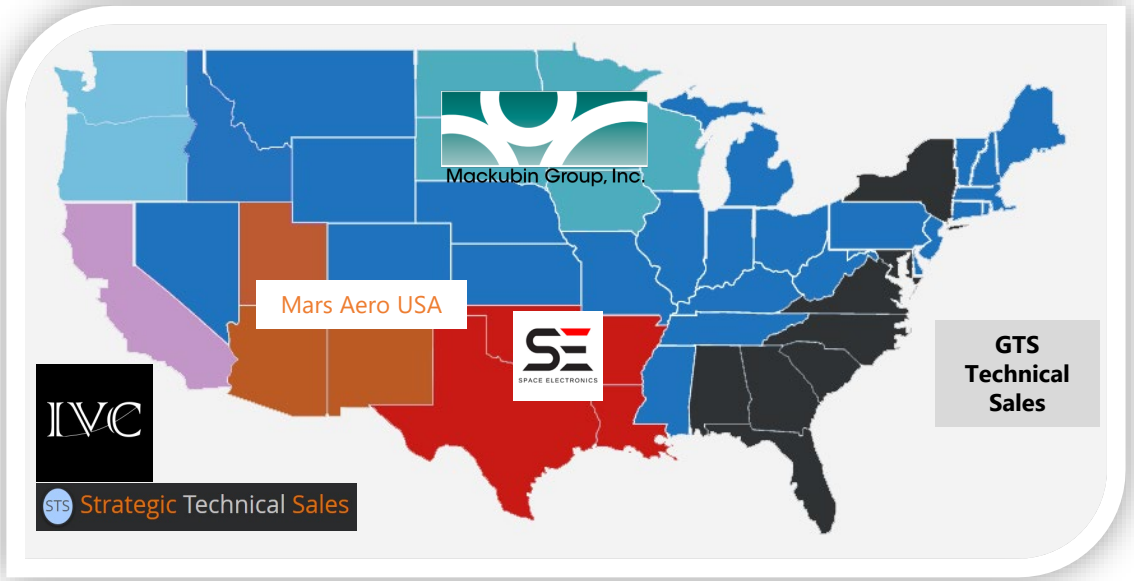
ESI is a Recognized Leader in ***Control and Power Conversion*** *Solutions for* ***Extreme Environments.***

- Founded in 2004 in Southern California, USA
- Servo Drive and Power Conversion Systems
- Engineering Analysis and Support Services
- Cutting-Edge Test and Production Facility
- AS9100D Certified
- Space, Defense, and Commercial Applications
- OEM and Top Tier Client Base

ESI Motion Headquarters
Simi Valley, CA

Where We Are

ESI is growing! We have reps in the USA and globally.



Countries where ESI has representation shown in blue.

Clients



SIERRA
SPACE

NORTHROP GRUMMAN

MDA

VERTICAL

BOEING

BLUE ORIGIN

LOCKHEED MARTIN

BAE SYSTEMS

L3HARRIS™


PARAGON
SPACE DEVELOPMENT CORPORATION

AIRBUS

JAXA

Raytheon

TEXTRON

REDWIRE

MOOG


RENAULT
SPORT

Virgin
ORBIT

U.S.ARMY

LOGISTICS
DEFENSE
AGENCY

DEPARTMENT OF THE NAVY
UNITED STATES MARINE CORPS

DEPARTMENT OF THE NAVY
UNITED STATES OF AMERICA

U.S. NAVAL
RESEARCH
LABORATORY

Esterline

ULA
United Launch Alliance


GALACTIC

SwRI
SOUTHWEST RESEARCH INSTITUTE

Dynetics
A Leidos Company

CUBIC

GATR
Technologies

TERRAN ORBITAL

Huntington
Ingalls
Industries

GENERAL ATOMICS

Astroscale


Honeywell

INTERGALACTIC

ASTROLAB
VENTURI

The ESI Advantage

High Performance
Revolutionary Products for Rugged Applications

Compact
Small, Light, Incredibly Powerful, Scalable

Reliable
Fielded on Space, Defense, and Commercial Applications

- Servo Drives and Control Systems
- Stabilization Systems
- Energy Recovery Systems
- Actuator Systems
- Power Conversion
- Obsolescence Management
- System-Level Integration
- Rapid-Prototyping

Space Servo Drive Systems

ESI Advantage

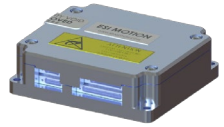
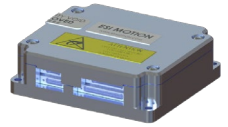
- 2-10x Higher Power Density than Competition
- Wide Temperature Range
- CAN and Full-Duplex RS-422
- ESI PC GUI Compatible
- DO-178 Compliance
- Single or Dual-Axis

Radiation Tolerance

- TID: 100 kRad
- SEL: 75 Let MeV (Non-Destructive)
- Custom Options are available for Polar and Interplanetary Missions. These may require a tailored testing procedure to ensure mission success.



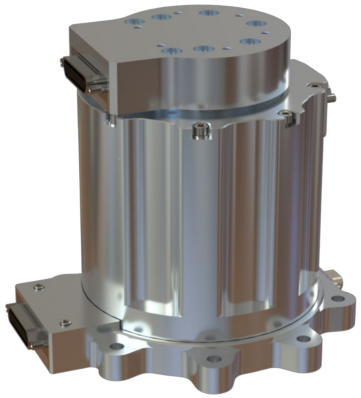


Specifications	SuperNova	Pulsar	Aurora	Comet	Cosmo	Astro
	Dual-Axis	Dual-Axis	Dual-Axis	Dual-Axis	Dual-Axis	Dual-Axis
Bus Voltage(DC)	28V	28V	120V	120V	28V	28V
Peak Motor Current	20A	20A	5A	5A	5A	5A
Output Power	200W per Axis	200W per Axis	600W per Axis	600W per Axis	140W per Axis	140W per Axis
Temperature	-40°C to 71°C	-40°C to 71°C	-40°C to 71°C	-40°C to 71°C	-40°C to 71°C	-40°C to 71°C
Motor Types	Permanent Magnet	Stepper	Permanent Magnet	Stepper	Permanent Magnet	Stepper
Weight	1.1 lb. (499g)	1.1 lb. (499g)	1.1 lb. (499g)	1.1 lb. (499g)	0.83 lb. (375g)	0.83 lb. (375g)
Size	6.5" W x 3.38" L x 0.9" H	6.5" W x 3.38" L x 0.9" H	6.5" W x 3.38" L x 0.9" H	6.5" W x 3.38" L x 0.9" H	3.15" W x 2.75" L x 1.00" H	3.15" W x 2.75" L x 1.00" H

Actuator Systems – Solar Array Drive Assemblies

Single-Axis Solaris

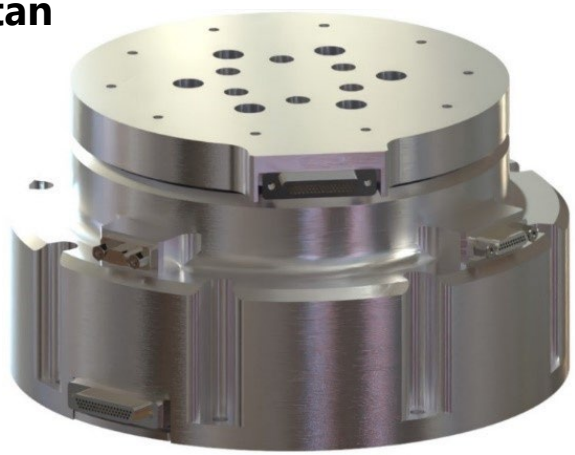


Dual-Axis Solaris

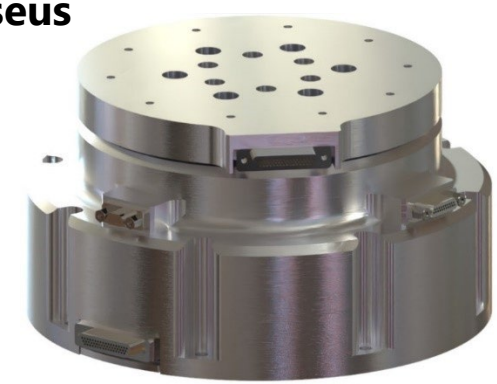
Specifications (COTS)	Solaris	
	Single-Axis	Dual-Axis
Motor Types	Stepper	Stepper
Output Torque	20 NM (180 in-lb.)	20 NM (180 in-lb.)
Speed (Max Load)	8 Deg/S	8 Deg/S per Axis
Load Capacity	800 N (180 lb.)	800 N (180 lb.)
Output Accuracy	0.1 Deg	0.1 Deg
Temperature	-40°C to 71°C	-40°C to 71°C
Size	4.4 in H; 3.4 in Dia	7.08 in H; 4.98 in Dia
Weight	4.4 lb. (2 kg)	11 lb. (5 kg)

Actuator Systems – Solar Array Drive Assemblies

Titan



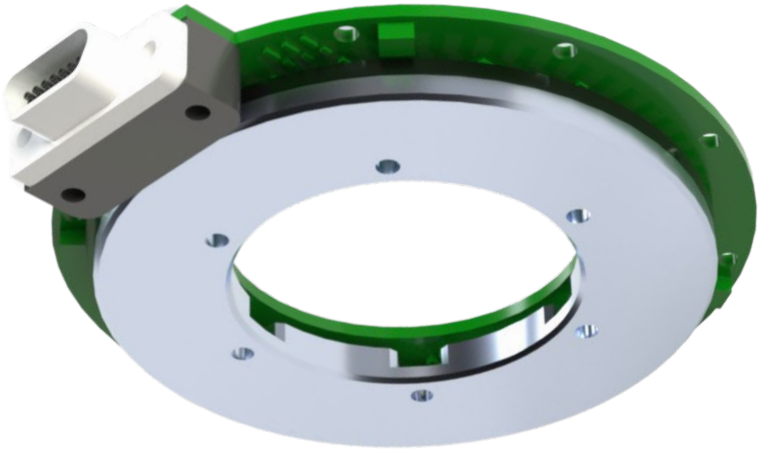
Perseus



Specifications (COTS)	Titan	Perseus
	Large Single-Axis	Direct Drive (Single)
Motor Types	Permanent Magnet	Permanent Magnet
Output Torque	226 NM (2,000 in-lb.)	226 NM (2,000 in-lb.)
Speed (Max Load)	10 Deg/S	60 Deg/S
Load Capacity	6,600 N (1,484 lb.)	6,600 N (1,484 lb.)
Output Accuracy	0.1 Deg	0.1 Deg
Temperature	-40°C to 71°C	-40°C to 71°C
Size	3.75 in H; 7 in Dia	3.29 in H; 7 in Dia
Weight	13.2 lb. (6 kg)	11 lb. (5 kg)

Space-Rated Encoders

Nebula Encoder



PARAMETER	34mm	42mm	64mm	85mm
Approximate Read Head Dimensions	43 mm x 38 mm x 5.5 mm (1.69 in x 1.49 in x 0.22 in)	55 mm x 50 mm x 5.5 mm (2.17 in x 1.97 in x 0.22 in)	73.5 mm x 85 mm x 5.5 mm (2.89 in x 3.35 in x 0.22 in)	100 mm x 95 mm x 5.5 mm (3.94 in x 3.74 in x 0.22 in)
Encoder Target	34 mm x 34 mm x 4.5 mm (1.34 in x 1.34 in x 0.18 in)	42 mm x 42 mm x 4.5 mm (1.65 in x1.65 in x 0.18 in)	64mm x 64mm x 4.5mm (2.52 in x 2.52 in x 0.18 in)	85 mm x 85 mm x 4.5 mm (3.35 in x 3.35 in x 0.18 in)
Assembly Height	43 mm x 38 mm x 11 mm (1.69 in x 1.49 in x 0.43 in)	55 mm x 50 mm x 11 mm (2.17 in x 1.97 in x 0.43 in)	73.5 mm x 85 mm x 11 mm (2.89 in x 3.35 in x 0.43 in)	100 mm x 95mm x 11 mm (3.94 in x 3.74 in x 0.43 in)
Max Shaft/ throughbore Diameter	8 mm (0.31 in)	20 mm (0.79 in)	34 mm (1.33 in)	50 mm (1.97 in)
Unit Mass	0.07 kg (0.15 lb)	0.07 kg (0.15 lb)	0.07 kg (0.15 lb)	0.1kg (0.22 lb)
Connector	Flying Leads / M83513/03-A03N	Flying Leads / M83513/03-A03N	Flying Leads / M83513/03-A03N	Flying Leads / M83513/03-A03N
Recommended NEMA stepper motor pairing	NEMA 17	NEMA 23	NEMA 34	Large frameless motors

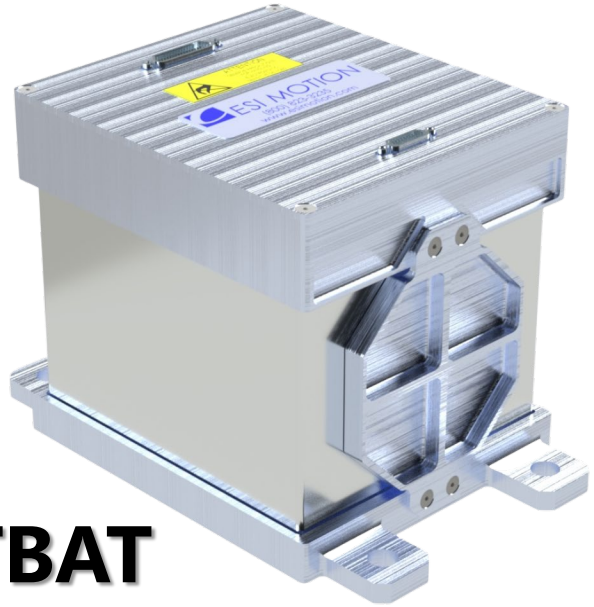
Specifications:

- Accuracy: 0.1 deg
- Resolution: 20 bits
- Max Speed (operating): 5,000 RPM
- Communication Frequency: 5 kHz
- Input Voltage: 5 VDC
- Temperature limits, Operation: -40°C to 85°C
- Temperature limits, Survival: -50°C to 125°C

Radiation Tolerance

- TID: 50 kRad
- SEL: 75 Let MeV (Non-Destructive)

Space-Rated Battery



SATBAT

- **Half the Weight as Li-Ion batteries**
- Optimized for High Cycle life in LEO orbit
- Up to 100% DoD per Cycle Without Degradation
- **98% Capacity Remaining after 4-Year Leo Mission**
- Charge/Discharge at -30C Without Damage
- Integrated Battery Management System

PARAMETER	208WH12V	250WH14V	416WH24V	500WH28V	1000WH28V	1000WH56V
Capacity (Whr)	208	250	416	500	1000	1000
Capacity (Ahr)	18	18	18	18	36	18
Useable Capacity [1] (%)	100%	100%	100%	100%	100%	100%
Useable Capacity at 90% DoD (Whr)	188	225	375	450	900	900
Nominal Voltage	11.5	13.8	23	27.6	27.6	55.2
High Operating Voltage	12.5	15	25	30	30	60
Low Operating Voltage	10	12	20	24	24	48
Max Voltage	13.5	16.2	27	32.4	32.4	64.8
Min Voltage	7.5	9	15	18	18	36
Max Cont. Discharge Rate (A)	100	100	100	100	200	100
Typical Charge Rate (A)	40	40	40	40	80	40
Heater Power @ 28VDC (W)	30	30	60	60	120	120
Max Operating Range [1] °C	-30°C to 60°C					

Defense Servo Drive Systems

ESI Advantage

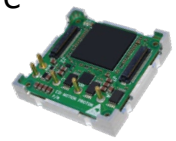
- 2-10x Higher Power Density than Competition
- Wide Temperature Range
- CAN and Full-Duplex RS-422
- ESI PC GUI Compatible
- DO-178 Compliance
- Single or Dual-Axis

Specifications	Draco	Dragon	Zeus	Rogue	Wolverine
	Light-Weight	Versatile	High-Power	Compact Rugger	Configurable
Bus Voltage(DC)	300V, 600V	24V - 610V	48V - 600V	28V	Variable
Peak Motor Current	Up to 120A	Up to 80A	Up to 180A	20A	Variable
Output Power	36kW	12kW	75kW	500W	Variable
Temperature	-40°C to 71°C -55° C to 100 C (Optional Extended)	-40°C to 71°C	-40°C to 71°C	-40°C to 71°C -55° C to 100 C (Optional Extended)	Variable
Electrical Speed	Up to 75,000 RPM	Up to 75,000 RPM	Up to 75,000RPM	Up to 75,000 RPM	Variable
Weight	6.02 lbs. (2.73 kg)	From 6.4 lbs. (2.9 kg)	25 lbs. (11.34 kg)	2.9 lbs. (1315g)	Variable
Size	9.38" L x 7.01" W x 2.6"H	11.3" L x 7.0" W x 2.7" H	9.56" L x 9.86" W x 5.08"H	5.86" L x 4.86" W x 2.725" H	8.8" L x 6.3" W x 2.4" H

Servo Drive Module Product Lines

ESI Advantage

- Wider Temperature Range
- 2-8x Higher Power Density than Competition
- Dual-Axis Configurations
- CAN and Full-Duplex RS-422
- ESI PC GIU Compatible
- DO-178 Compliance



Specifications	Proton	Atom	Mite	Mite	Scorpion	Beetle
	Single-Axis	Dual-Axis	Single-Axis	Dual-Axis	Single-Axis	Single-Axis
Bus Voltage(DC)	8V - 80V	8V - 80V	10V - 170V	10V - 170V	24V - 610V	22V - 300V
Peak Motor Current	Up to 50A	Up to 100A	Up to 40A	Up to 80A	Up to 80A	Up to 20A
Output Power	3850W	7700W	2kW	2kW	24kW	6kW
Temperature	'-55°C to 100°C Aerospace '-40°C to 85°C Industrial '-30°C to 60°C Commercial	'-55°C to 100°C Aerospace '-40°C to 85°C Industrial '-30°C to 60°C Commercial	'-40°C to 71°C '-55° to 100°C (Extended)	'-40°C to 71°C '-55° to 100°C (Extended)	-40°C to 71°C	-40°C to 71°C
Electrical Speed	Up to 75,000RPM	Up to 75,000RPM	Up to 75,000RPM	Up to 75,000RPM	Up to 75,000RPM	Up to 75,000RPM
Weight	0.58 oz (16.4g)	1.9 oz (53.9g)	1.9 oz (53.9g)	3.7 oz (105g)	1 lb. (453g)	6.4 oz (181.4g)
Size	1.46" L x 1.46" W x 0.73" H	1.8" L x 1.3" W x 0.3" H	2.0" L x 1.8" W x 0.8" H	2.0" L x 3.0" W x 0.6" H	2.6" L x 4.0" W x 1.8" H	3.8" L x 1.99"W x 1.0" H

Legacy Servo Drive Systems

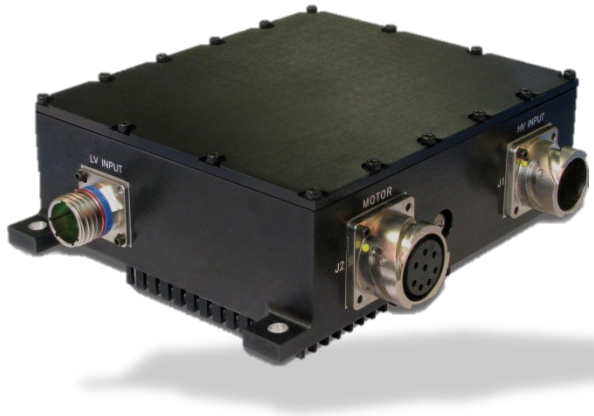
ESI Advantage

- 2-10x Higher Power Density than Competition
- Shock and Vibration
- Wide Temperature Range
- EMI Filtering

Specifications	Roadwind High-Speed	Hydra High-Power	Vulcan High-Temp	Hyperion High-Power
Bus Voltage(DC)	12V - 150V	48V - 600V	24V - 610V	400V - 800V
Peak Motor Current	Up to 200A	Up to 50A	Up to 65A	125A - 250A
Output Power	15kW	20kW	12kW	100kW
Temperature	-40°C to 71°C	-40°C to 85°C (Optional 105°C)	-40°C to 121°C	-40°C to 75°C
Electrical Speed	Up to 300,000 RPM	Up to 75,000RPM	Up to 75,000 RPM	Up to 240,000RPM
Weight	8.1 lbs. (3.7 kg)	15.5 lbs. (7 kg)	11.5 lbs. (5.2kg)	9.8 lbs. (4.5kg)
Size	13.8" L x 7.0" W x 3.1" H	9.5" L x 5.8" W x 4.4" H	16.3" W x 6.3" L x 3.0" H	10.3" L x 5.9" W x 4.0" H

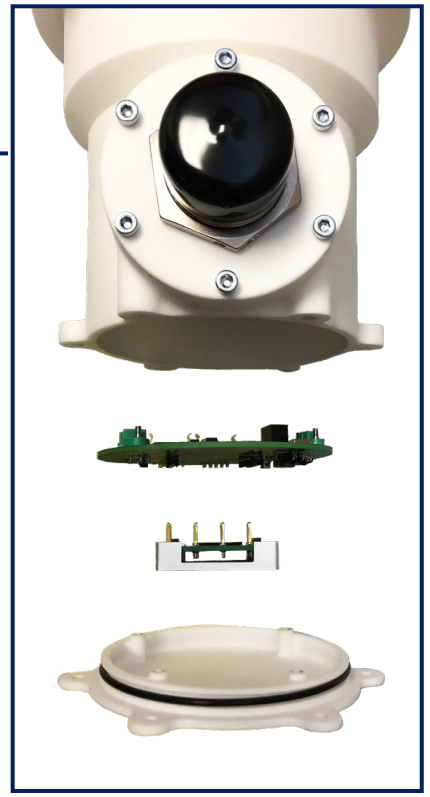
Cooling Options

Air, Fan & Liquid Cooled Options



Integrated Solutions

- Smart Fan (Integrated Controller)
- Smart Motor (Integrated Controller)
- Smart Actuator (Integrated Controller)



Upcoming Products

- **Additional Space Actuators**
- **Space Power Distribution Units**

Engineering Services & Analysis

Requirements Development
Design Reviews

Radiation Testing
Modifications
DO-178 DAL A

Thermal Analysis & Storage Temp
Vibration & Shock Analysis

Product Qualification
System Level Integration
Rapid Prototyping

EMI Conductive
EMI Susceptibility
MTBF – Mean-Time-Between-Failure

On-Site Support
DFAR/FAR Compliance
Test Asset Development

Derating, Outgassing
Humidity, Altitude
Salt Water, Fog & Fungus

Engineering Capabilities

Dependable Software

- Development & Quality Plans
- Software & Interface Requirement Specifications
- I/O Communication Configuration
- Test Plans, Description & Report
- User Manuals and Protocols Available on Website
- DO-178 Compliance
- Configurable for All Motors and Applications

Requirement Validation

- Requirements Validation Matrix
- Specification Development
- Acceptance Test Procedure (ATP)
- Qualification Test Procedures (QTP)
- Test Data Package (TDP)

System Integration & Onsite Support

- Sensorless Control Configuration
- System Integration with Client Test Asset at ESI facility
- System Integration at Client Site
- System-Level Debugging and Defect Management
- System-Level Architecture Support

ESI MOTION™

Standards Compliance

MIL-STD-461

MIL-STD-464

MIL-STD-810

MIL-STD-1472

MIL-C-5015

MIL-C-5541

DO-160

DO-178

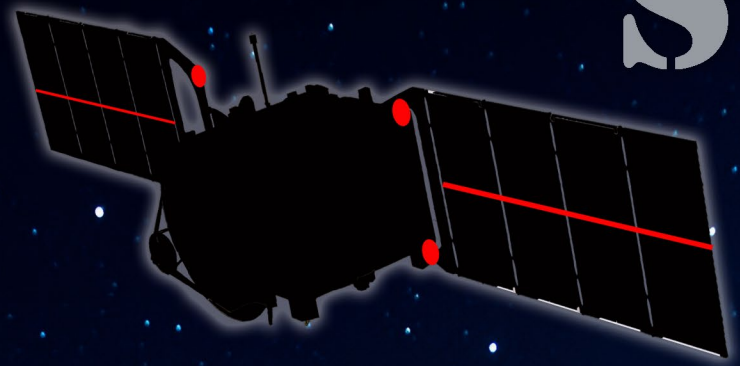
DO-330

DO-254

SPACE

Lunar Vehicle
SUPERNOVA

Solar Array Deployment “SADE”
PULSAR



Satellite Positioning System
NOVA
SUPERNOVA

Escape Engine Thrust Control
SCORPION (DO-178)

Space-Rated Robotic Arm
SUPERNOVA

Turbine Value Controller
SUPERNOVA

Space Vehicle
Wing Control
NOVA (DO-178)

Space Vehicle
7-Axis Actuation Control Unit
NOVA (DO-178)

Light Launch Rocket
Valve Control
NOVA

ESI MOTION™

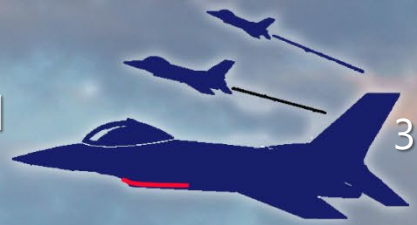
ESI MOTION™

AIR

Military Aircraft
Antenna Motor Drive System
MITE

Hypersonic Missile Launch Platform
DRAGON

Pod Pump
BEETLE



Military Aircraft
3-Axis Gimbal Positioner
MITE
ROGUE

Strut Control
DRAGON

Door Control
ROGUE
DRACO

Fan Control
ZEUS

VTOL Aircraft
Actuator Tilt Rotor Control
DRACO

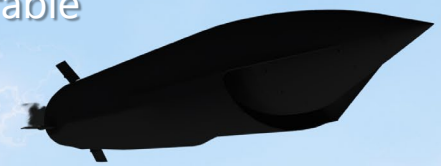
Drones
Motion Control
ATOM or Proton

Helicopter Winch System
SCORPION

ESI MOTION™

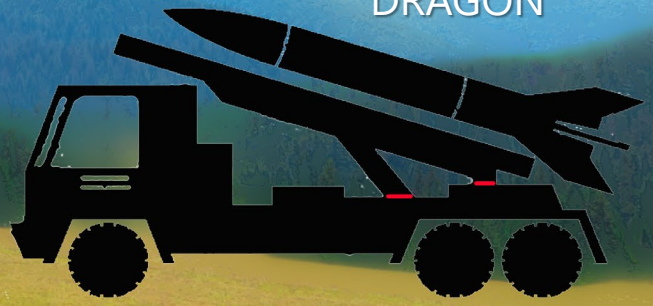
LAND

Long Range Maneuverable
Fires Missile
ROGUE

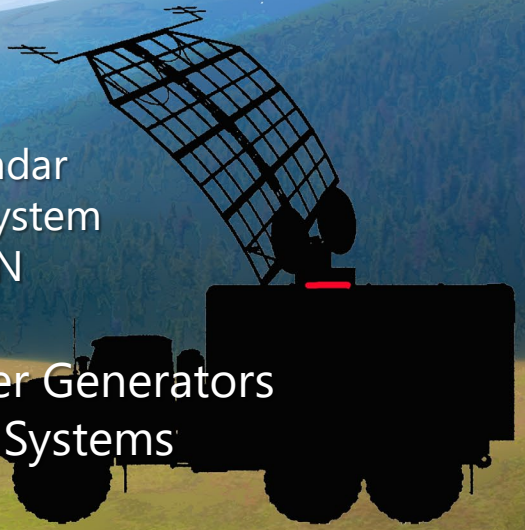


Target Acquisition System
DRAGON

Counter Battery System
DRAGON



Military Radar
Positioner System
DRAGON



Integrated Starter Generators
Sight Head Systems

Humvee
Antenna Control
ATOM

Tank
Air Conditioning Control
DRAGON

Turret Stabilization Systems
Braking and Steering

Portable Antenna System
MITE

Portable Launch
System
DRACO

ESI MOTION™

Sonar Deployment Actuation Control
DRAGON

Sonar Deployment Winch Motor Control
DRAGON

Winch Applications

Gun Control
ZEUS

Hatch Release
DRAGON

SEA

Unmanned
Pump & Mast Control
WOLVERINE

SUB-SEA

Unmanned
Motor Control
DRACO

Manned Sub
Pump
DRACO

Sonar/Glider Motion Control
MITE

Armament Handling Equipment
UUV Applications
BEETLE

ESI MOTION™

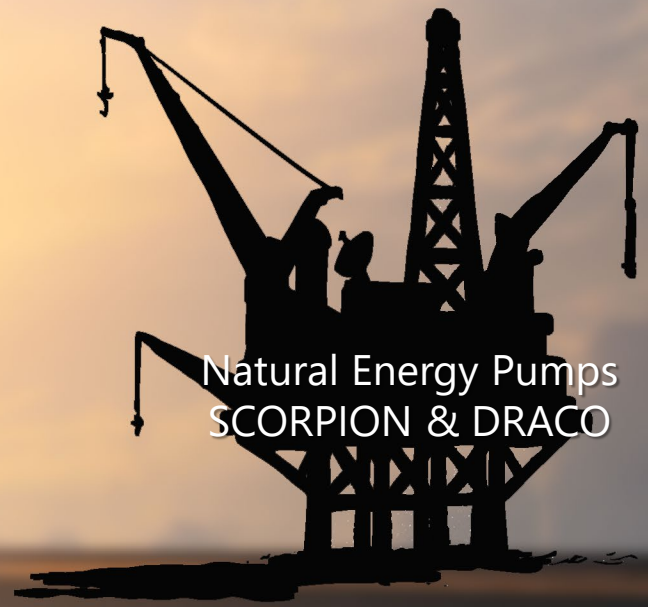
COMMERCIAL & INDUSTRIAL

Commercial Drones
ATOM & PROTON

Alternate Energy
DRACO & SCORPION

Nuclear Energy
DRACO & SCORPION

Natural Energy Pumps
SCORPION & DRACO



Mineral Detection
ATOM

Animatronics
ATOM & PROTON

Energy Recovery
HYPERION

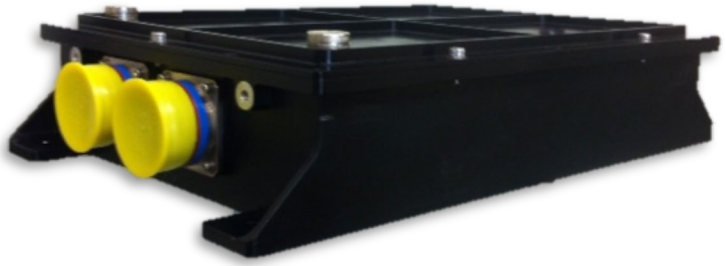
Program Highlight – Fly by Wire

ESI saved Major NASA Dream Chaser Program with Successful Drop Test!

Flight Surface Actuator Control System

- Servo Drives for **7 Flight Critical** Wing Flap Actuators
- *Delivered 9 Production Units in 3 Months to Save Program Launch Date*
- Instrumental in Supporting Program Flight-Worthiness
- Low Earth Orbit (LEO) Application

Dream Chaser



Program Highlight – Energy Recovery

Led Teams to Success in Formula One Racing

Formula One Energy Recovery System:

- Recovers Exhaust Waste Energy Electronically
- Operates at Up 100,000W and 120,000 RPM
- Smaller than a Shoebox
- Record Breaking Size and Weight Power Density Levels
- Applicable to All Turbo Engines

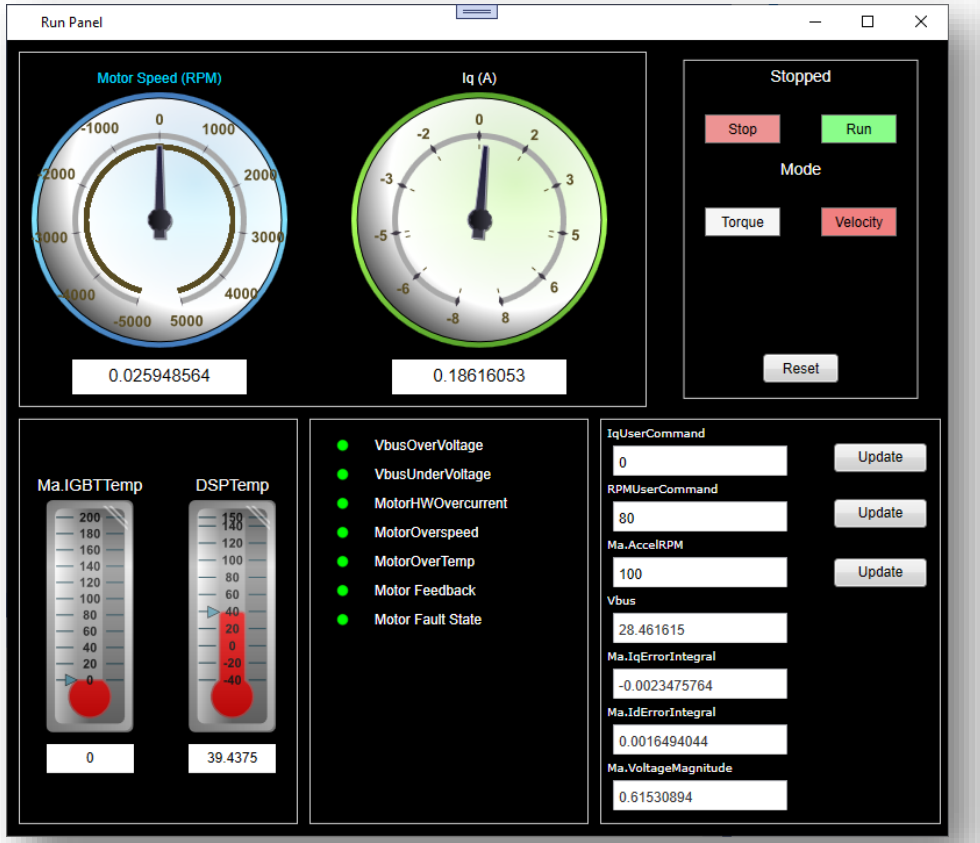
Program Highlight – FLIP it Fast

Fast, Space-Quality Deliveries with ESI's COTS, Space-Ready Products

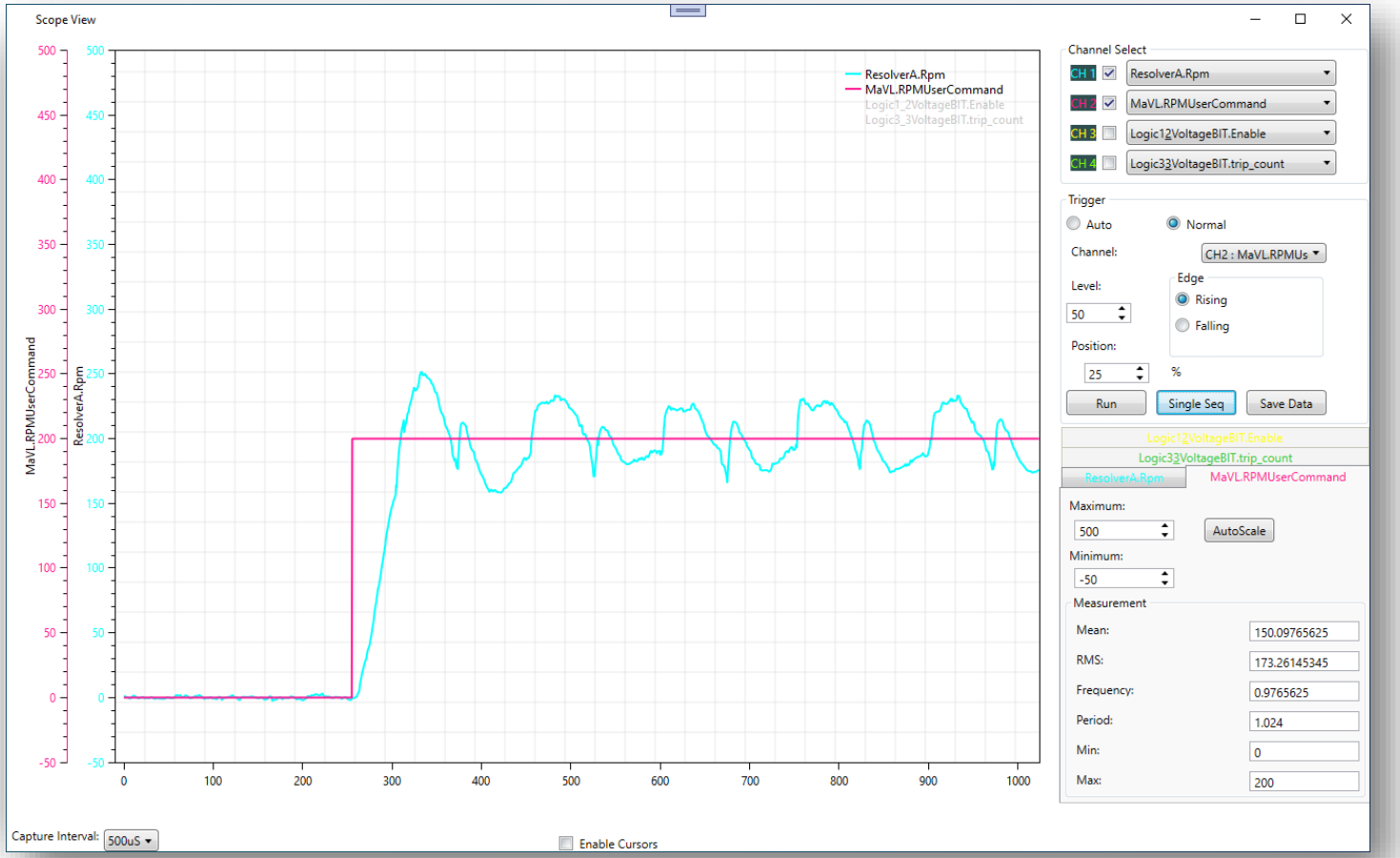
Flight Lunar Surface Control System

- COTS SuperNova controls wheels and panels.
- *EDUs in less than a month*
- *Flight units in less than 3 months*
- Lunar Application set to land on the Moon December 2025

PC Interface w/Integrated Oscilloscope Feature

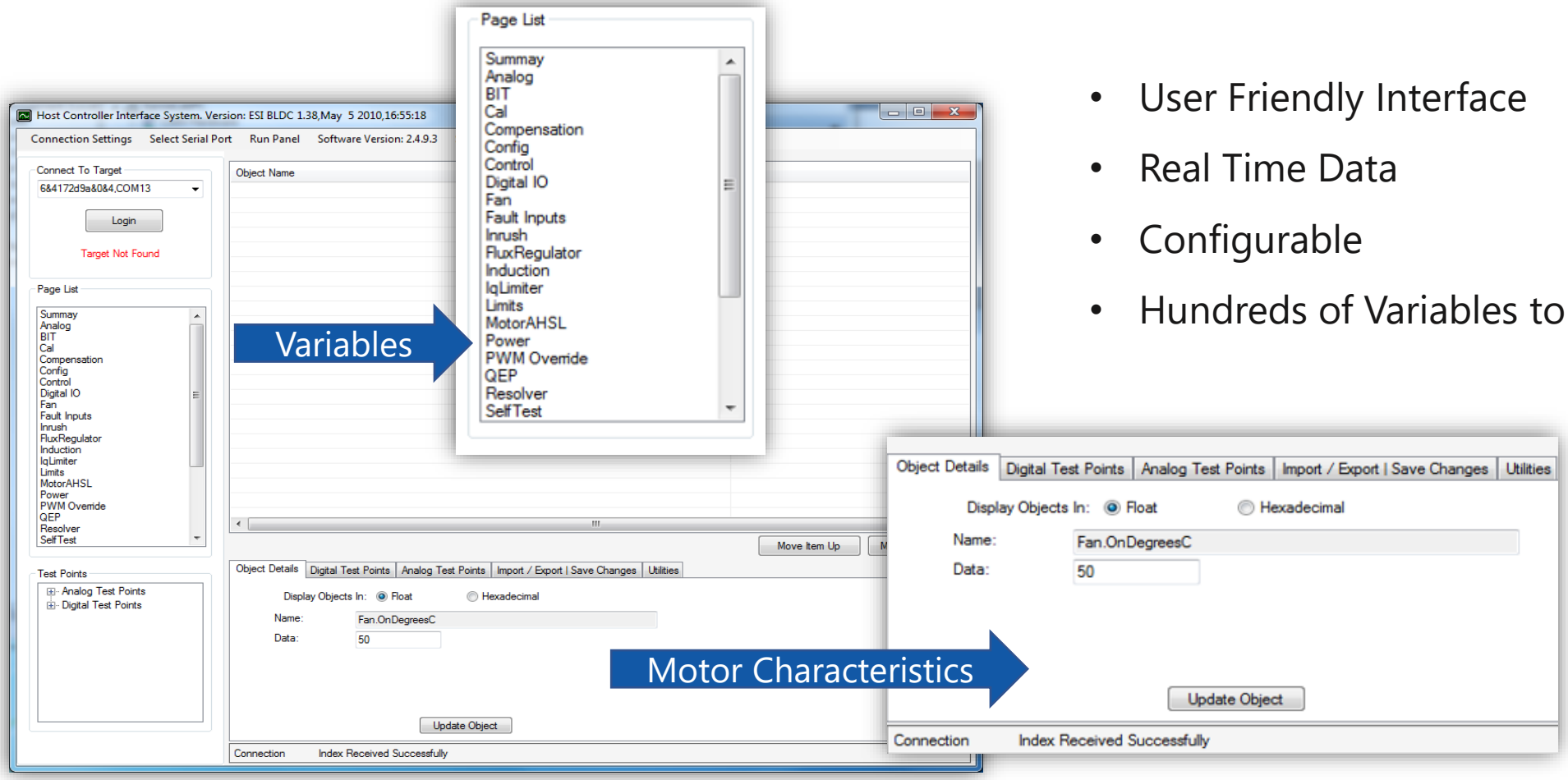


Insight User Configurable Run Panel



Insight Oscilloscope Data Capture

Revolutionary System Visibility Simplifies Testing System Integration



- User Friendly Interface
- Real Time Data
- Configurable
- Hundreds of Variables to Choose From

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