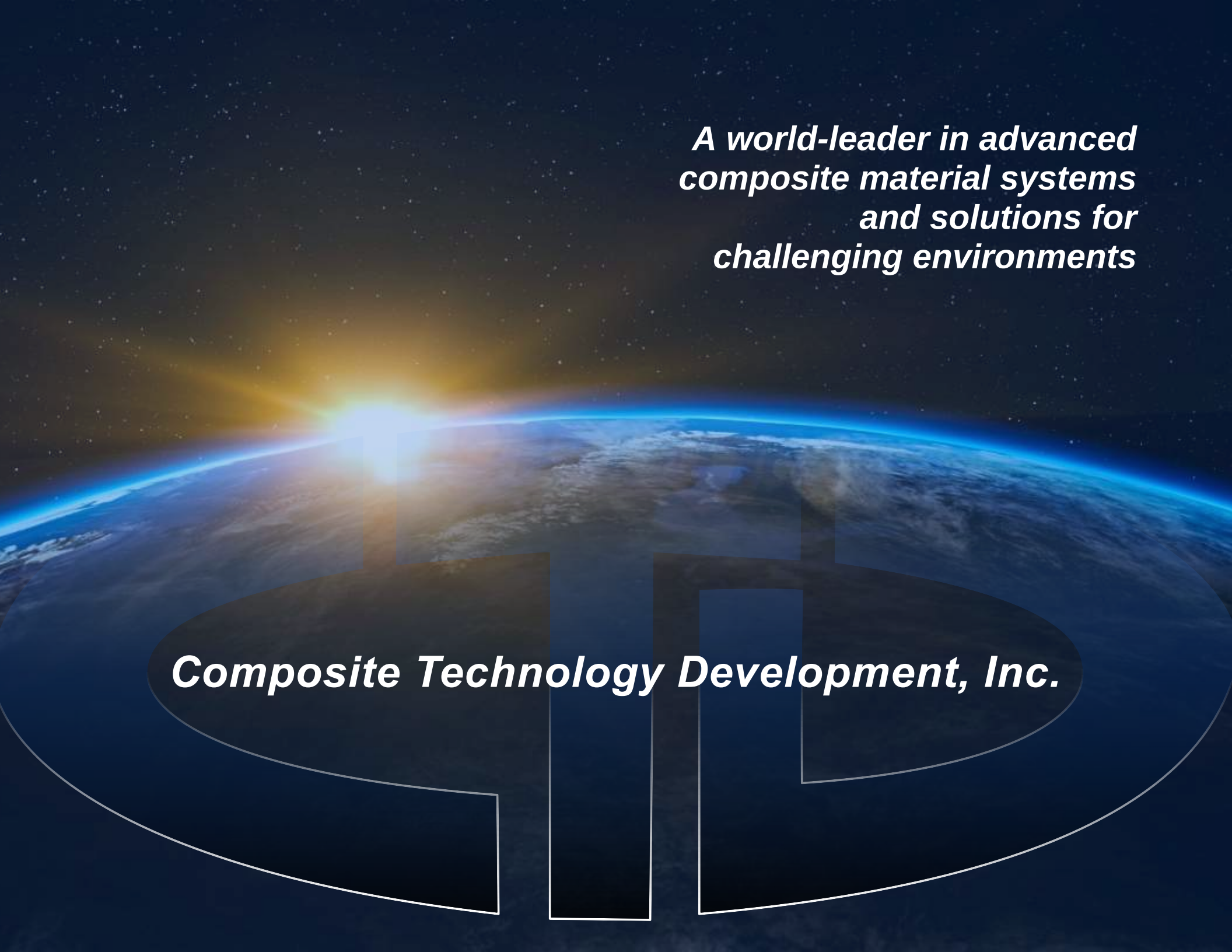

A world-leader in advanced
composite material systems
and solutions for
challenging environments
Composite Technology Development, Inc.

COMPOSITE TECHNOLOGY DEVELOPMENT, INC.
2600 CAMPUS DRIVE, SUITE D
LAFAYETTE, COLORADO 80026
PHONE: 303-664-0394 | FAX: 303-664-0392
www.ctd-materials.com

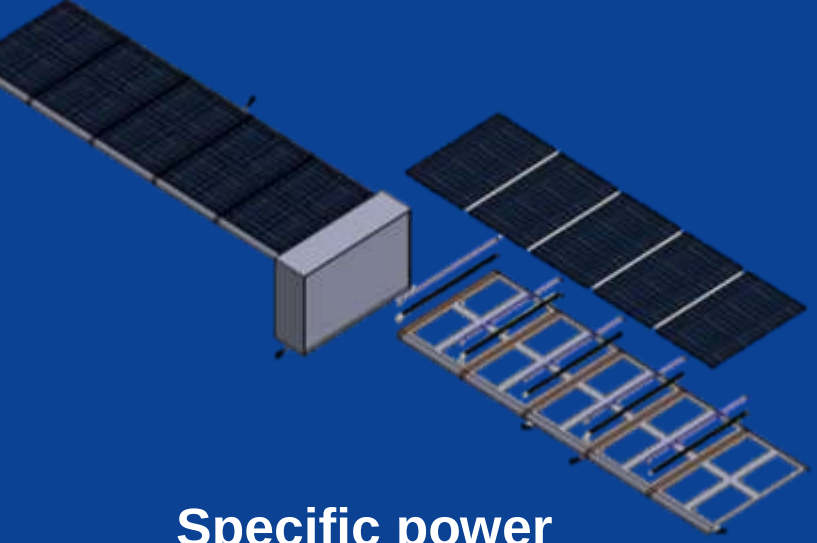
This guide is intended to apprise the aerospace community of the breadth and depth of material-enabled solutions available at Composite Technology Development (CTD).

Since 1988, CTD's materials and composite-enabled solutions deliver mission success in some of the most challenging and harsh environments including space exploration, superconducting and high-performance magnets, cryogenic devices, electrical motors, and other applications where high-strain and thermally stable materials provide an advantage over heritage systems.

In aerospace, CTD's materials set the mark for systems enabled by lightweight and high-strain composites. These materials exhibit high strain-to-failure, high radiation resistance, low coefficient of thermal expansion (CTE), microcrack resistance, and perform both at the extremes of cryogenic temperatures and the high-temperatures of aerospace and industrial environments.

All of our systems are tailorable to achieve the specific performance required by your demanding application. CTD's intimate knowledge of materials and composites enables our team to optimize a solution to address your need, whether as a raw material or an integrated system. We offer engineering design, analysis, and testing services for your material-enabled solution that will allow for the material properties to be fully exploited.

CTD looks forward to partnering with you to enable your mission success!

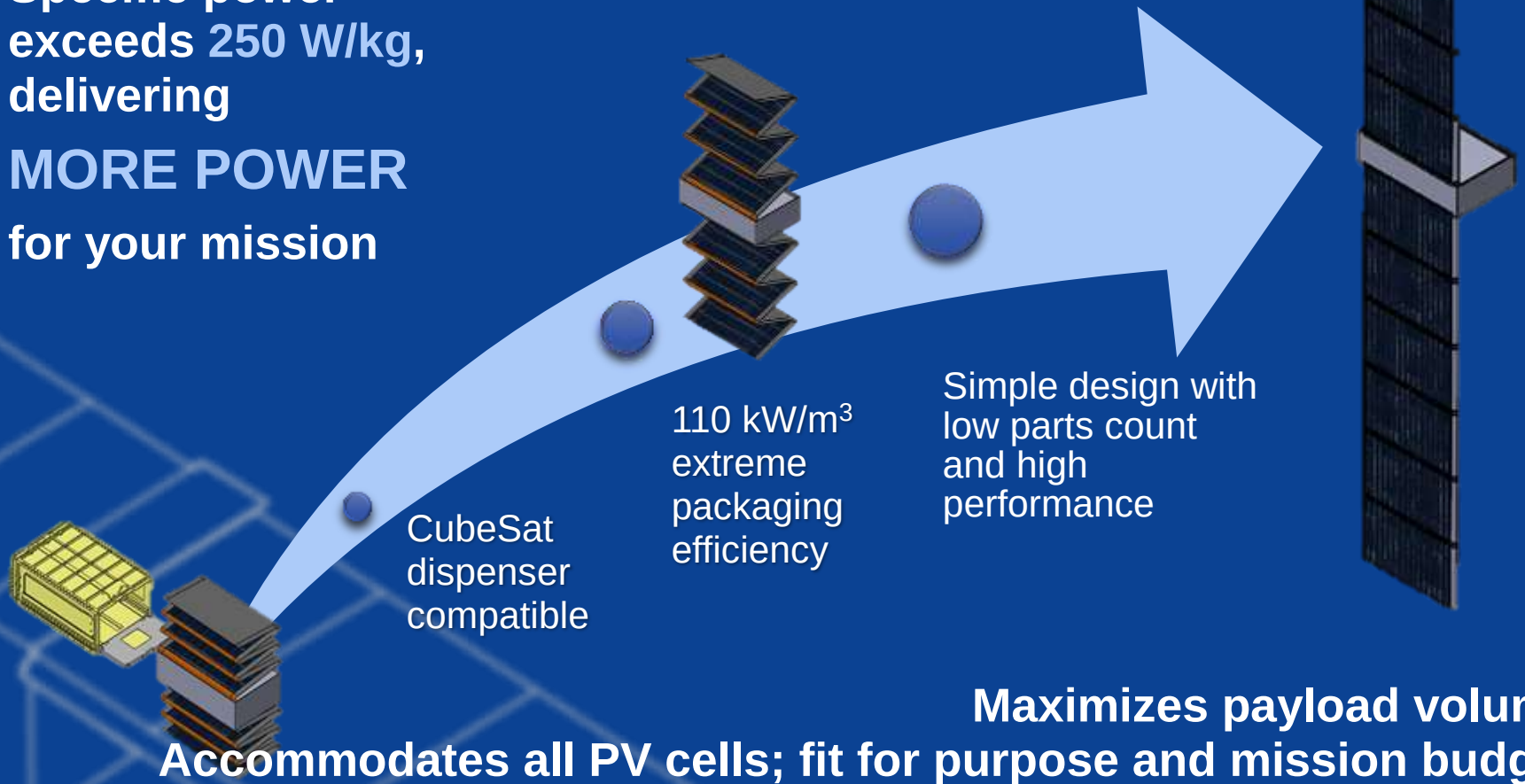


The most efficient packaging and deployment performance architecture for spacecraft solar power generation

Specific power exceeds 250 W/kg, delivering

MORE POWER

for your mission



CubeSat dispenser compatible

110 kW/m^3 extreme packaging efficiency

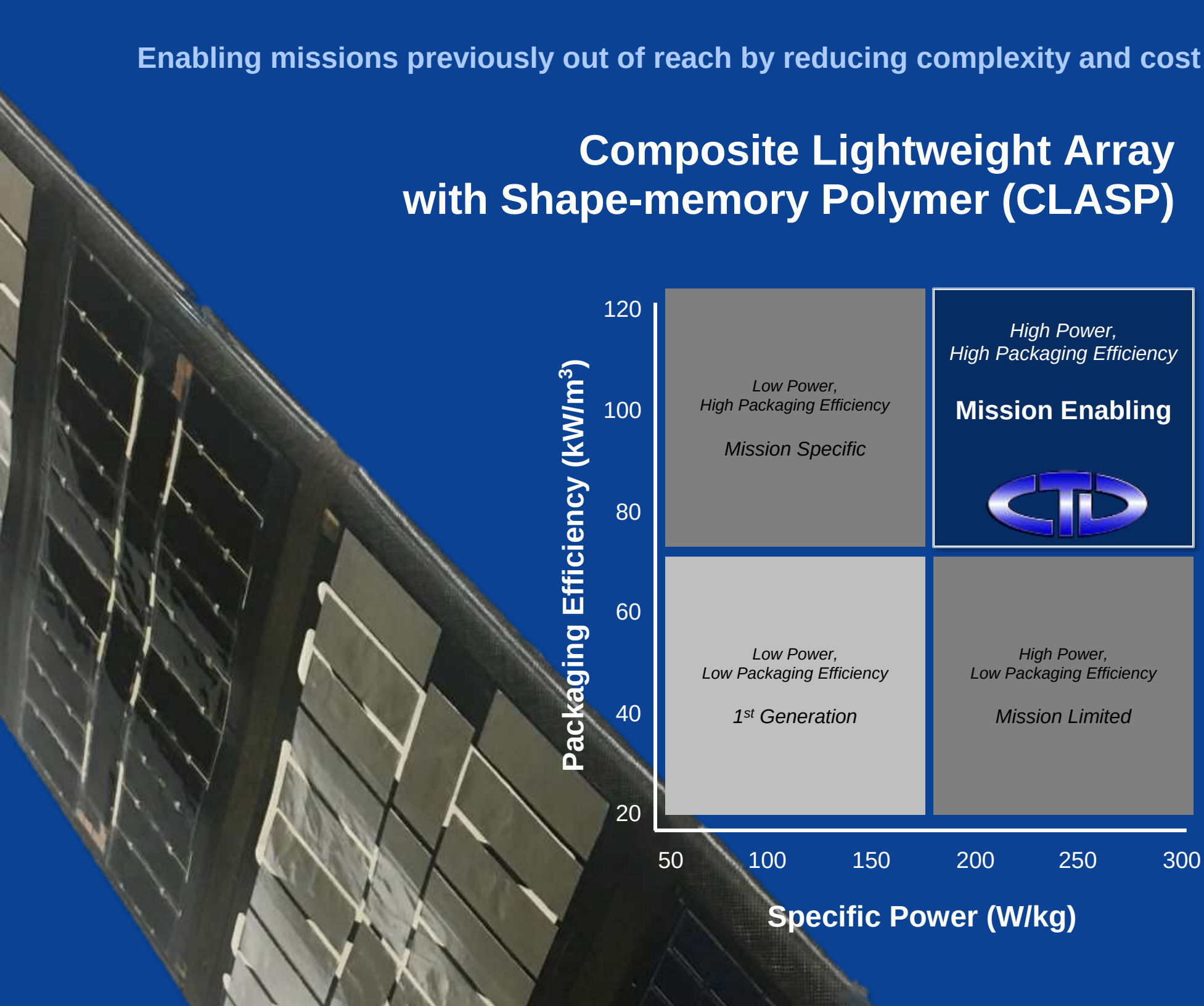
Simple design with low parts count and high performance

Maximizes payload volume

Accommodates all PV cells; fit for purpose and mission budget

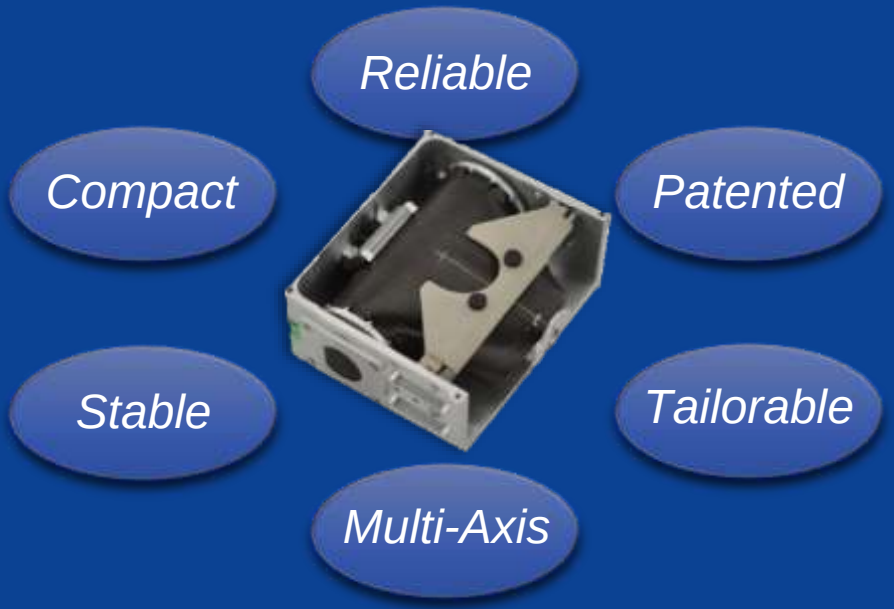
Enabling missions previously out of reach by reducing complexity and cost

Composite Lightweight Array with Shape-memory Polymer (CLASP)



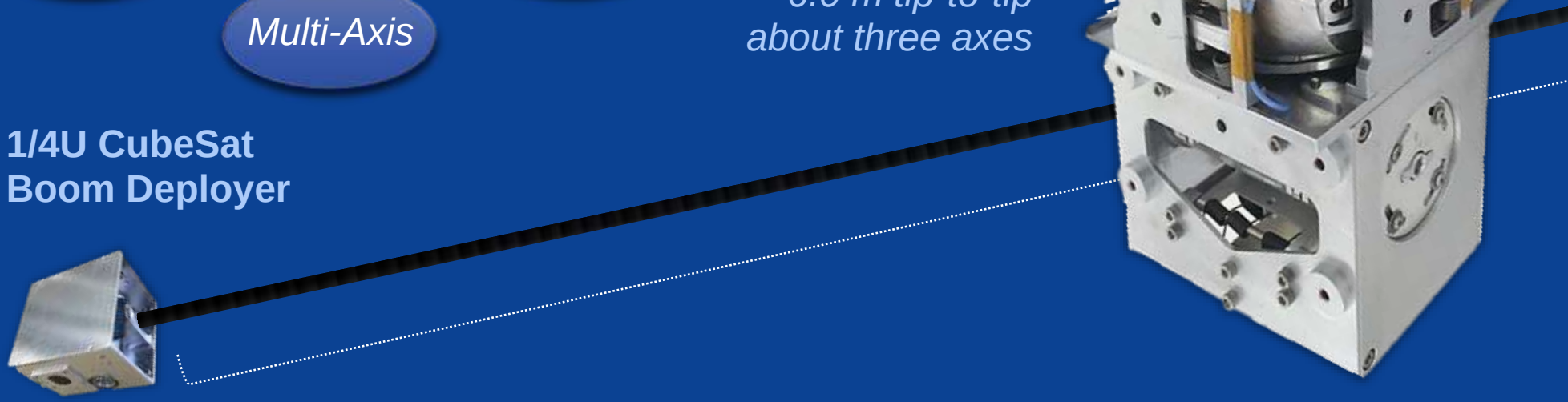
Smallest deployers on the market

Composite Booms and CubeSat Boom Deployers

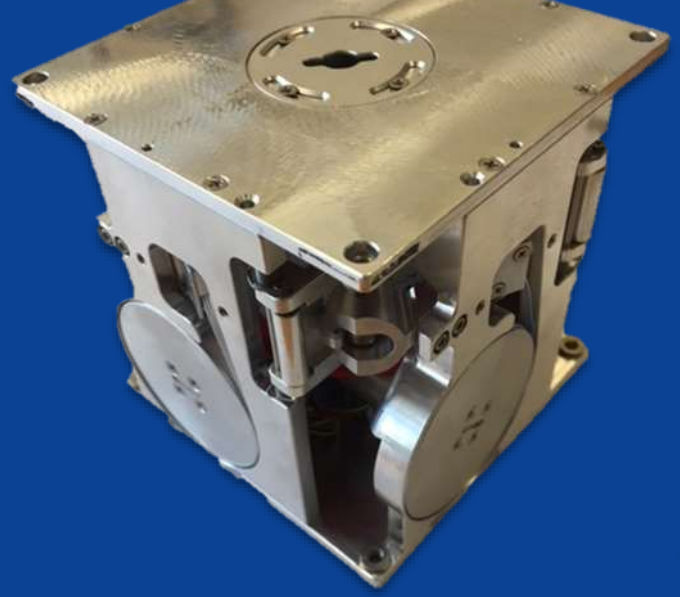


Six-axis CubeSat Boom Deployer
Deployed span: 6.0 m tip-to-tip about three axes

1/4U CubeSat Boom Deployer

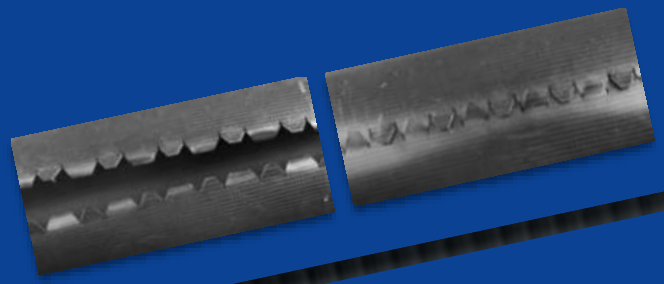


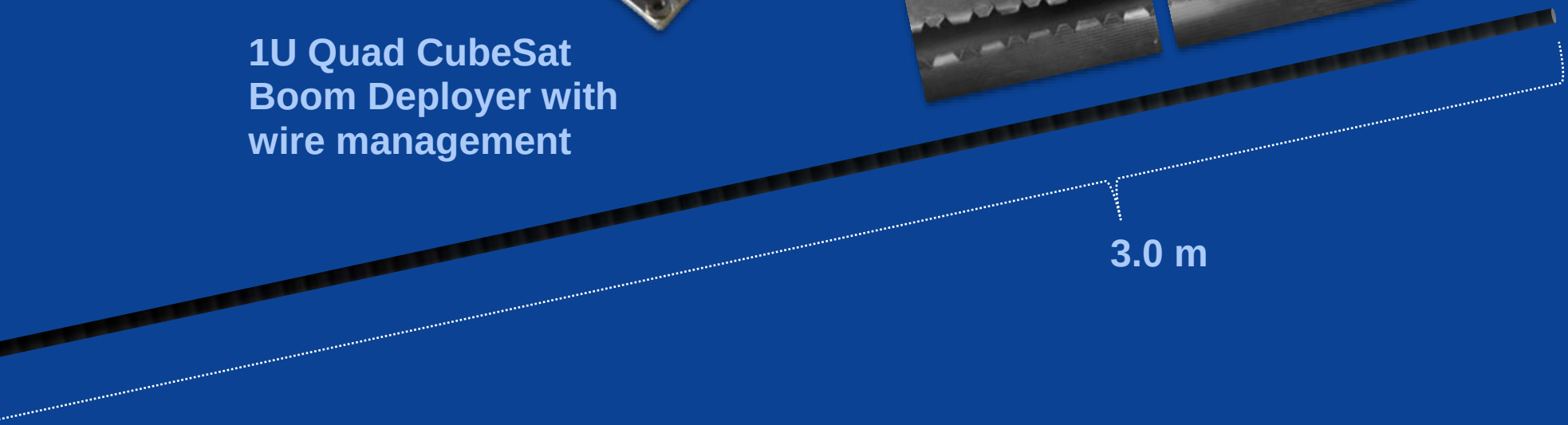
Engineered for maximum, efficient stowage



1U Quad CubeSat Boom Deployer with wire management

Overlapping slit-tube booms, or patented Slit-Lock™ for maximum payload stability

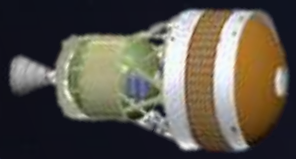




Boom materials tailored to the mission

Carbon fiber composite (ultimate stiffness and thermal stability)
Fiberglass (RF transparency)
Hybrid metal-composite (antenna elements)

CryoCoat® 620T insulation
on every Delta IV
Cryogenic Second Stage



TEMBO® hinges validated on ISS
TEMBO® materials on MISSE 2 & 6

CTD Founded
(Boulder, CO)

CryoCoat®, NANUQ® and
TEMBO® materials
qualified for space

TEMBO® EMC Hinges,
Shape Memory Products,
and KIBOKO® Pressure
Vessels attain flight
heritage

1988

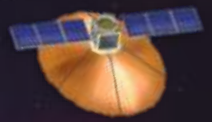
2000 – 2005

2005 – 2010

6-axis boom deployer

All-composite upper stage propellant tanks

All-composite launch vehicles, structures, and tanks



Stowable SAR Reflector

Expanded flight heritage with TEMBO® enabled Booms and Deployers

Continued success with CryoCoat® insulations and adhesives

CTD composite-enabled materials and solutions for strategic partners

- Advanced Fiber Placement materials
- Cryogenic Insulation
- Composite Structures

6-axis Boom Deployer first flight

CEFI first flight

CLASP Flight Qualified

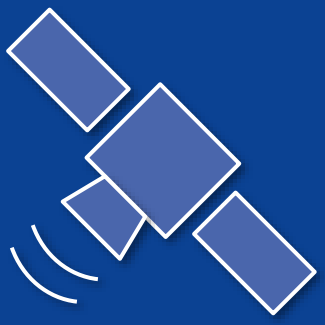
2010 – 2015

2015 – 2020+

KIBOKO® All-Composite Linerless Pressure Vessels

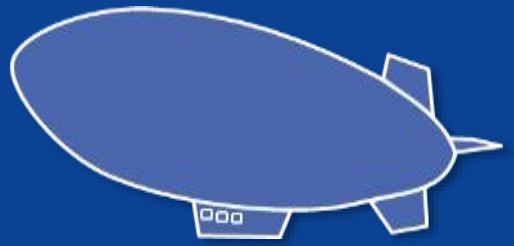
extend the mission

benign leak before burst

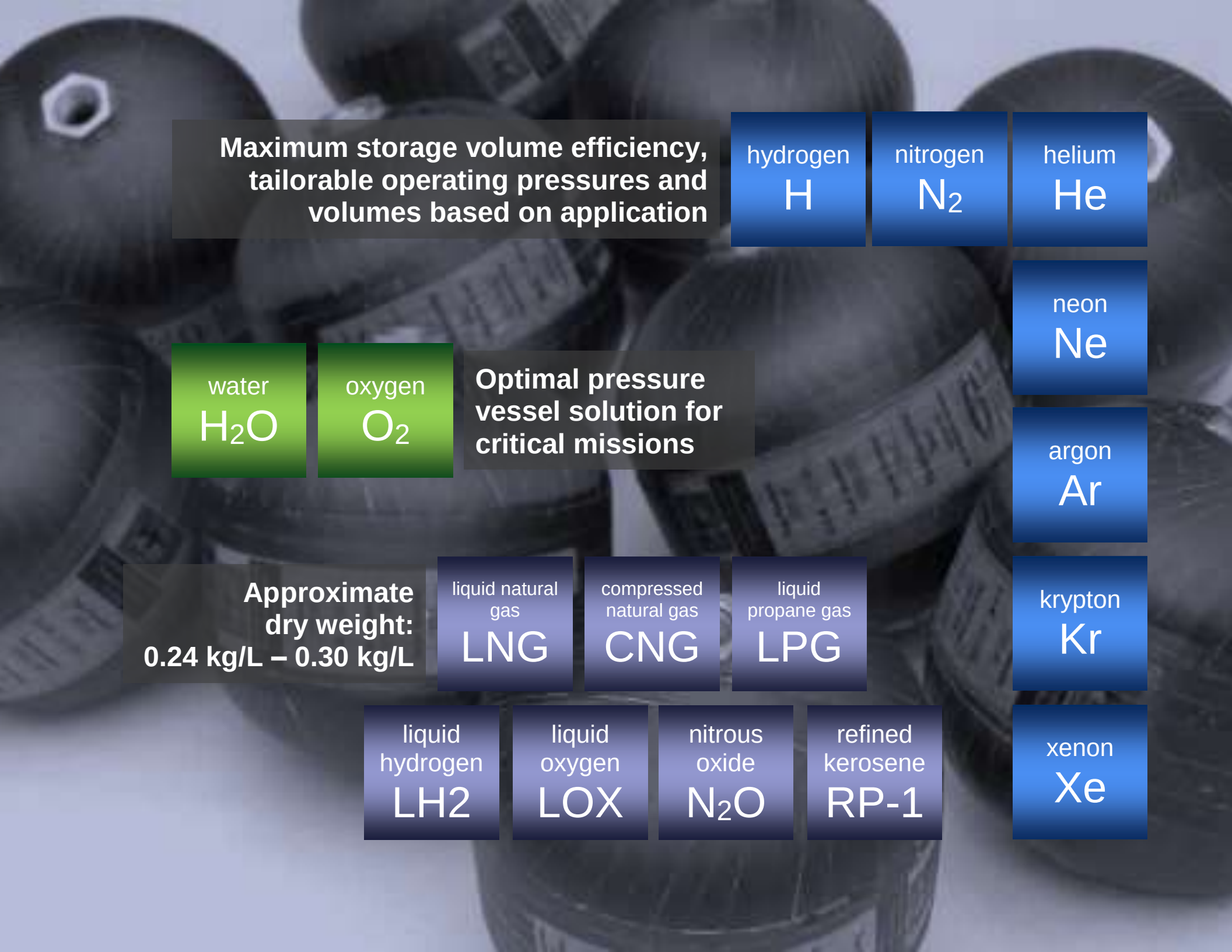


enables larger payload

maximizes lift to weight ratio



Low thermal mismatch, structural integrity maintained at cryo-temps


Maximum storage volume efficiency, tailorable operating pressures and volumes based on application
hydrogen H
nitrogen N_2
helium He
neon Ne
water H_2O
oxygen O_2
Optimal pressure vessel solution for critical missions
argon Ar
Approximate dry weight: 0.24 kg/L – 0.30 kg/L
liquid natural gas LNG
compressed natural gas CNG
liquid propane gas LPG
krypton Kr
liquid hydrogen LH2
liquid oxygen LOX
nitrous oxide N_2O
refined kerosene RP-1
xenon Xe

CTD DELIVERS…

the most efficient packaging,
more power in a smaller footprint,
& unmatched performance resulting in

BETTER DATA!

Which pays for the mission,
over, and over, and over…

TEMBO®
Elastic Memory Composites (EMC) and Deployables

Reduces part count

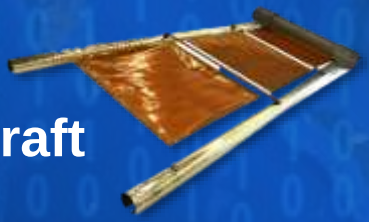
Creep resistant

Lowest mass solution

Enables smaller spacecraft

Most efficient package

Reliable, predictable deployment



Minimizes risk

Collect better data

Lower launch cost

Bigger constellations

Effective spacecraft

Eliminate redundancy

Engineered Material Solutions

CryoCoat™ and CryoBond™ are epoxy-based systems for cryogenic insulation and adhesion, compatible with various substrates (metals, composites, and ceramics) delivering maximum performance at cryogenic temperatures. Ideal for retrofit or refurbish applications while delivering long-lasting performance. These tough materials withstand numerous thermal cycles, are UV and impact resistant, and are non-sparking and self-extinguishing in LOX environments.

Alpha Magnetic Spectrometer 2 (AMS-02) coated with 3mm of CryoCoat™ UL79

The high strain-to-failure capability and bond strength across a wide temperature range makes it especially well-suited to space applications.

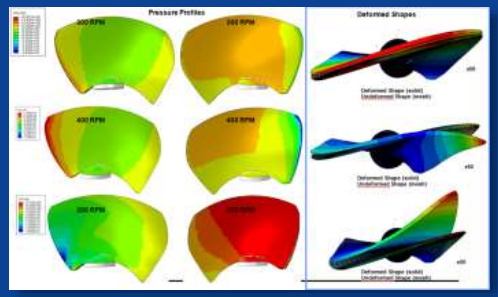
The KIBOKO® family of high-performance, microcrack-resistant structural resins are suitable for a wide range of composite systems, including pressure vessels, flight surfaces, booms, deployers, and solar wings. Ideally suited for filament winding and infusion processes these systems are also available as adhesives and prepregs to facilitate manufacturing processes such as Automated Fiber Placement (AFP) and complex structural applications.

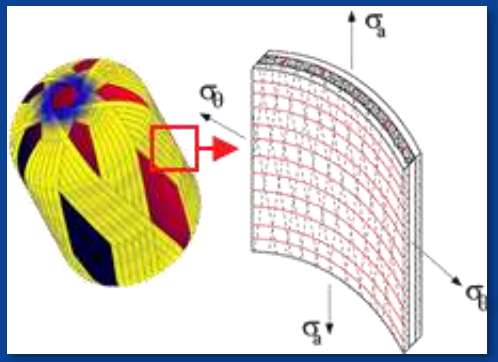
With unparalleled strain-to-failure and compatibility with a wide-range of cryogenic fluids, these resins are the only choice for applications that demand the highest levels of performance. Whether propelling an all-composite rocket or enabling future space missions such as the commercial lunar lander services vehicles.

Engineering Services

CTD’s decades of experience and insight allows you to fully leverage composite material capabilities to maximize the application’s impact. When utilized in aerospace, mission success results from exploiting the unique challenges of tailored composite materials and designs.

CTD’s team is ready to provide high-quality solutions that will make the impossible a reality. CTD will partner with you to deliver the enabling capability for your mission critical hardware!





Testing Services

Cryogenic testing services

CTD specializes in scaled-composite material sample testing in or after exposure to harsh environments, such as space. Testing capabilities include NASA Cryoflex test, custom cryogenic temperature windows, elevated temperatures, vacuum of space, and radiation. These tests enable risk-reduction and increased confidence for flight hardware.

CTD offers standard ASTM and SACMA tests, as well as custom tests developed to provide unique information to our customers.


Where Failure is Not an Option