BUILD ABOVE

Redwire LEO Solar Arrays – Evolution from DX Heritage to Commercial Proliferation

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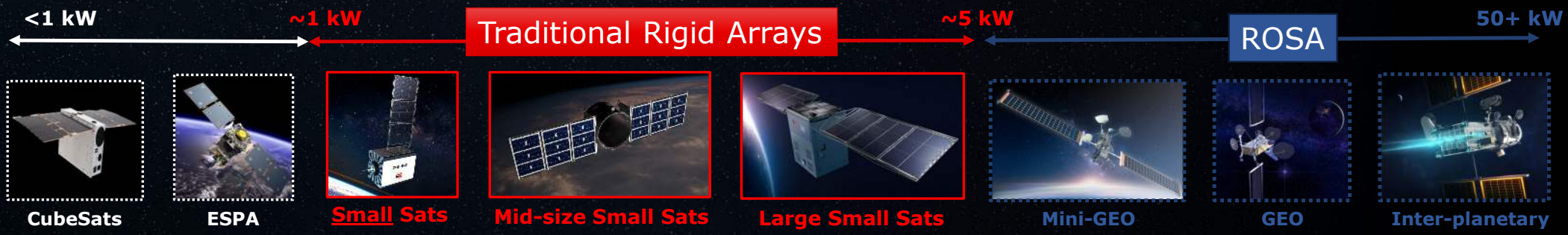
REDWIRE

LEO Market – Where We're Heading

- Definition of "Small Sat" continues to grow in size / power
- Many companies offer excellent solar array solutions for ESPA and below

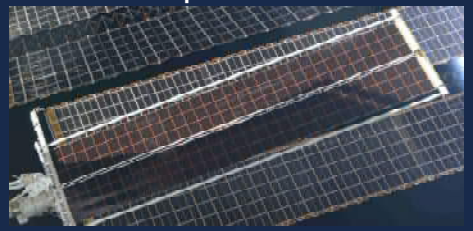


There was an apparent opportunity to apply RDW's flexible solar array solutions for the 1 – 5 kW power range

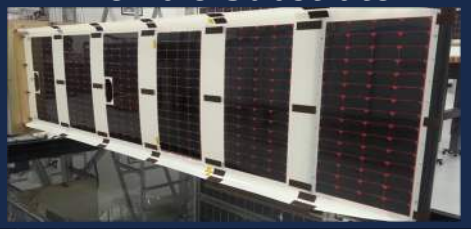
RDW's Evolution to a LEO Wing Design

IXPE
1st SmallSat Flight Unit

ROSA
Decoupled Blanket



Aladdin
Flexible Substrate



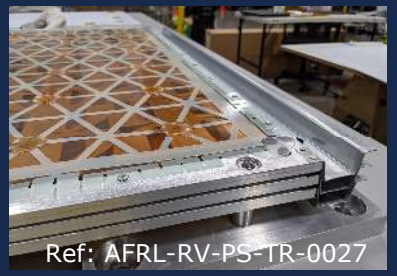
ELSA

HiPASS
Lenticular Hinges

NASA SBIR: CubeSat
Compact Stow

Ref: NASA SBIR 80NSSC20C0173

AFRL SBIR
Nested Frame EDU



Ref: AFRL-RV-PS-TR-0027

Introducing ELSA: Extensible Low-profile Solar Array

ELSA

Motivation: Why ELSA?

MODULARITY

- ✓ No fixed geometry
- ✓ Easily scaled

REDUCED LEAD TIME

- ✓ < 12 months from PO
- ✓ Bulk-stocked materials
- ✓ Parallel workflows

VERSATILITY

- ✓ PV agnostic
- ✓ Universal interface

REDUCED COST

- ✓ Simple design
- ✓ Simple manufacturing

PERFORMANCE

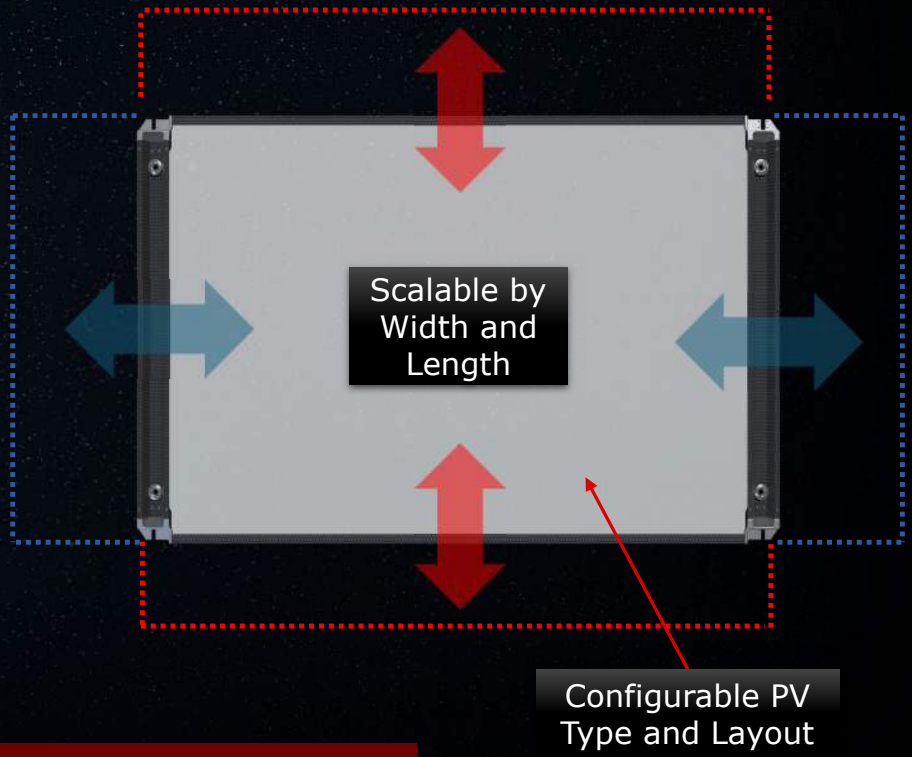
- ✓ More power, less volume
- ✓ Up to 5 kW per wing

HERITAGE

- ✓ Design elements inherited from rigid and ROSA arrays

ELSA's Modular Frame Design

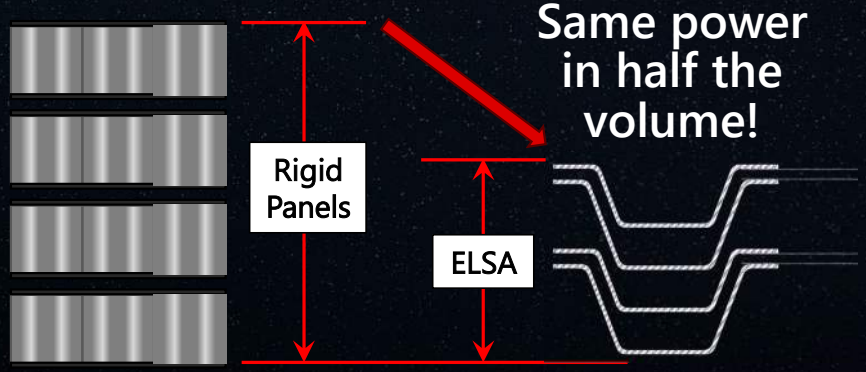
- Simple composite frame
- Flexible substrate



FLEXIBLE BY DESIGN

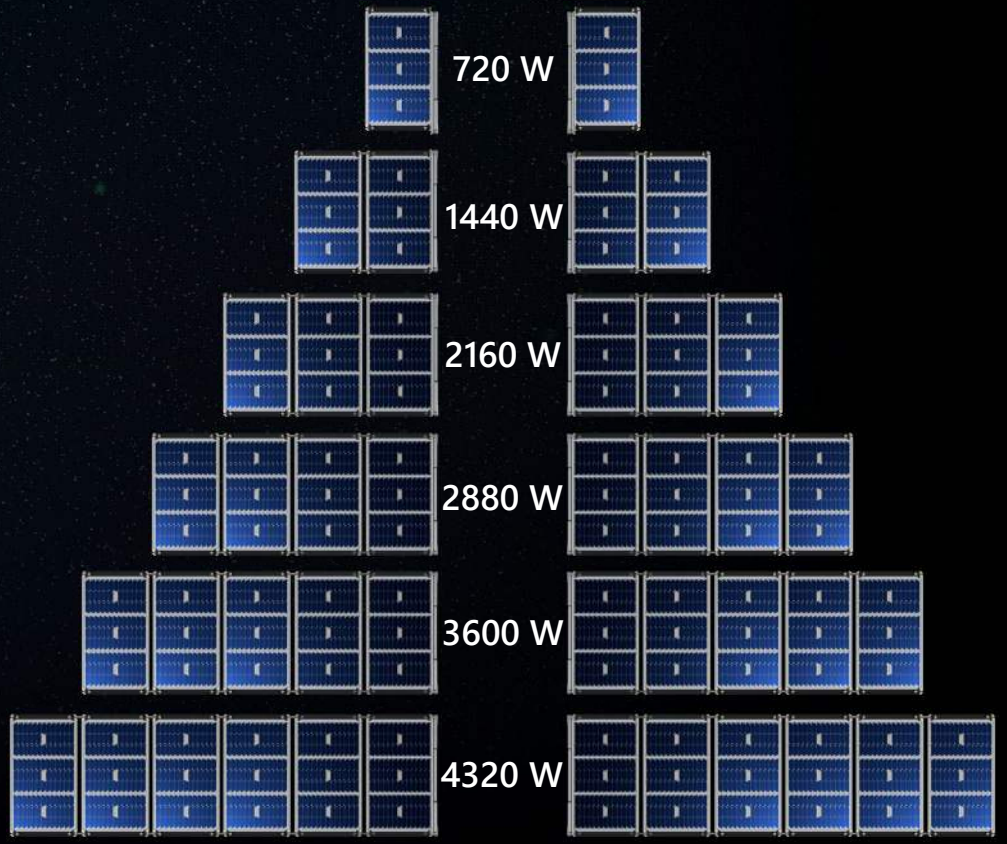
ELSA's Performance

- Nesting frames
- Up to 5 kW per wing



BUS POWER

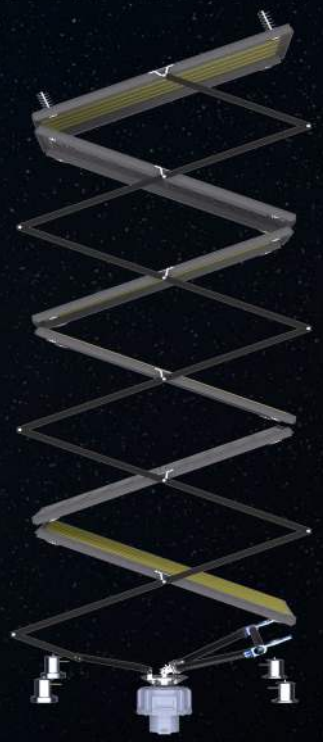
Example frame size: 1m long X 1.5m wide
Pmp, BOL, AM0 28°C, III-V technology



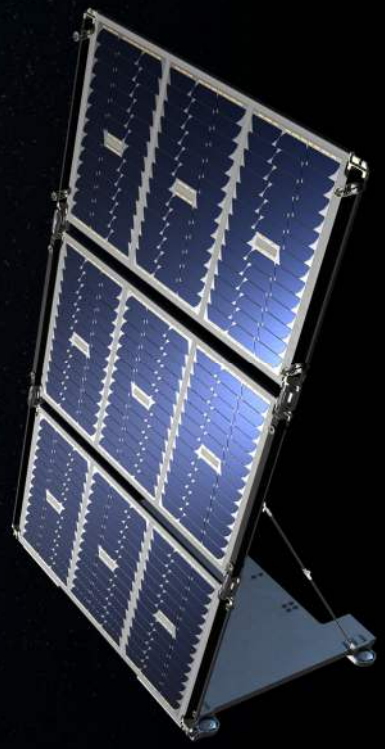
PATENT PENDING

ELSA's Versatility

- PV Agnostic
- Variable string length → compatible with any bus voltage!
- Configurable features:
  - Root interface
  - Synchronized/Damped deployments
  - Increased deployed stiffness



Synchronized Wing with SADA & Yoke

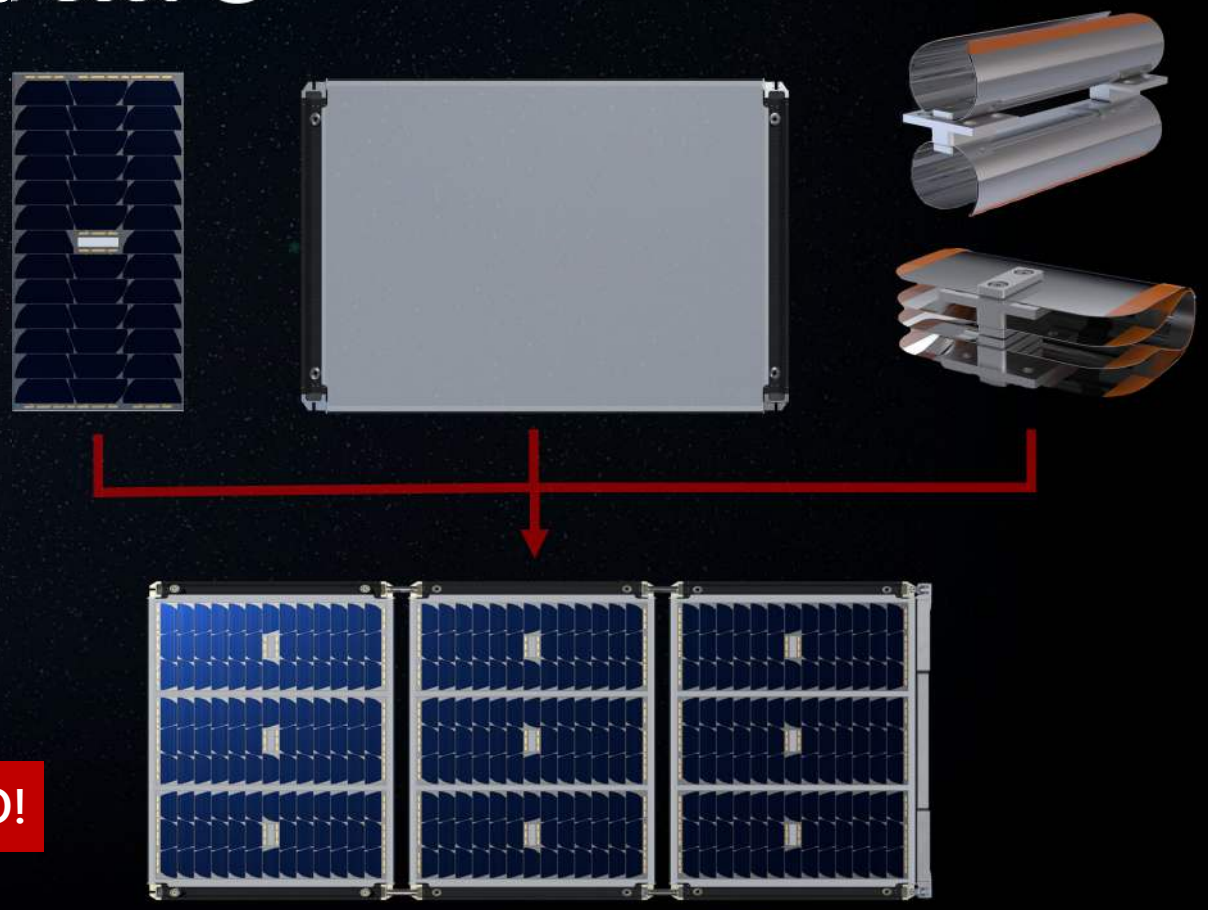


Fixed Wing with Stiffening Strut

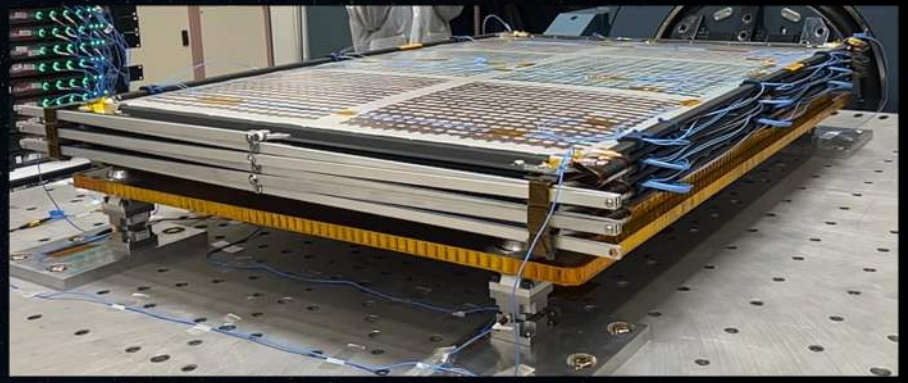
Reducing Lead Time and Cost

- Built for manufacturability
  - Bulk-stocked materials
  - Parallel processes
  - Minimized adhesives
- Lenticular hinges
- Minimized NRE

Delivery in < 12 months from PO!



ELSA Engineering Development Unit (EDU)



- Si, III-V, and CIGS PV
- TRL 6

ELSA EDU – Thermal Deployments

HOT DEPLOY

COLD DEPLOY

ELSA Qualification Status

COMPLETED EDU TESTING

- ✓ Vibration – Sine & Random
- ✓ Hot/Cold Deployment ±65°C
- ✓ Deployed Survival Temps ±120°C
- ✓ Stowed Thermal Cycling ±65°C - 6x Cycles
- ✓ Wing-Level Stiffness
- ✓ Grounding

SM1

Q3 QUALIFICATION TESTS

- ➢ Life Cycle Coupon – 5k cycles to ±120°C
- ➢ TVAC Coupon
- ➢ Acoustic
- ➢ Vibration
- ➢ ESD and Plasma

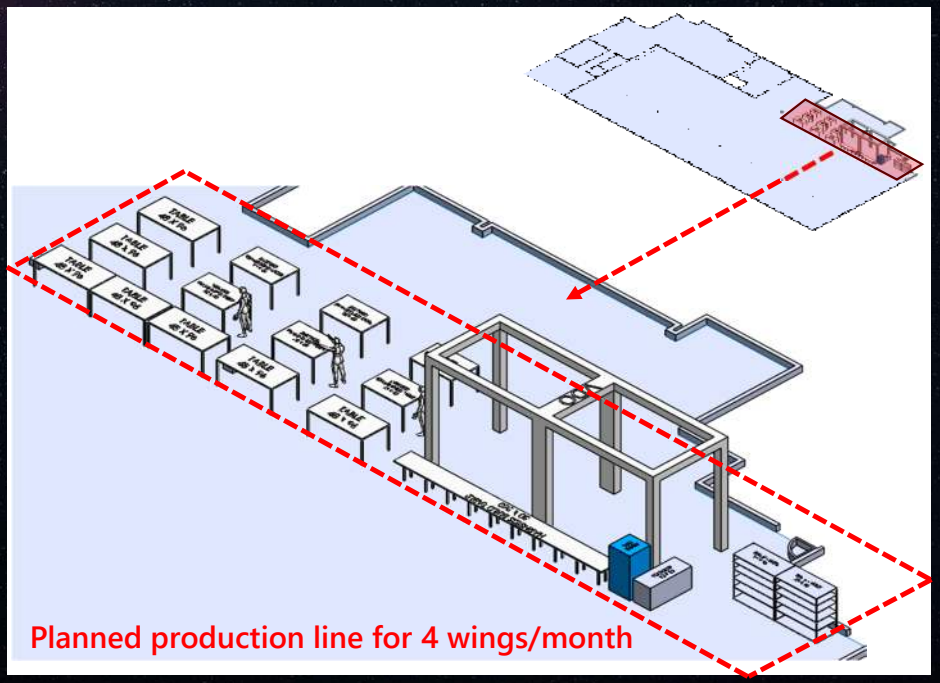
Q4 QUALIFICATION TESTS

- ➢ Flight Wing ATP

ELSA on Moog's METEOR Bus

- 1100 Watts per wing BOL @28C
- ~0.8 Hz deployed 1st mode
- 8 wings
- First delivery in Q1 2027

ELSA Industrialization: Cellular Manufacturing Environment (CME)



- Parallel assembly flow optimization
- Insulation from supply chain variation
- Modular offloaders and tooling
- Scalable Work Cells
- Production plan based on labor studies

ELSA is designed for volume manufacturing

In Summary

- Simple & modular design
- Up to 5 kW in LEO
- Nesting frames: more power, less volume
- <12-month turnaround
- Compatible with any PV type
- Built for high-volume production

DX heritage evolved for proliferated LEO

ELSA

REDWIRE


REDWIRE
Thank You!
MOOG
NASA
idemitsu
mPower TECHNOLOGY
AZUR SPACE ENABLING TECHNOLOGIES
solestial
SOURCE
dhv technology
SPECTROLAB A Boeing Company
DEEPSAT
MicroLink Devices, Inc.
SOLAERO BY ROCKET LAB


REDWIRE
If you need a LEO solar array, just….


Let it Stow