DEVELOPING AN INFLATABLE SOLAR ARRAY

Patrick K. Malone, L'Garde, Inc.

Dr. Francis J. Jankowski, USAF Phillips Laboratory/VTPN

Geoffery T. Williams, L'Garde, Inc.

Dr. George J. Vendura, Jr., SUMM Associates

Presented By: Patrick K. Malone
October 6, 1992
NASA/DOD Flight Experiments Interchange Meeting
DEVELOPING AN INFLATABLE SOLAR ARRAY
ITSAT Design Goals

- 90 - 100 W/Kg Array System (200 W Wing)
- Design Orbit: 600 - 800 Km (Worst Case Inclination)
- 3 Year Life (200 W EOL)
- Scalability of design to 1000 Watt Wing
- Low Recurring Costs
DEPLOYMENT COMPARISON
ITSAT vs Bi-Stem vs Astromast DSCS III
(DOL/GEO/Crystal-Si)

1. L'Garde ITSAT with crystalline silicon cells on flexible blanket.
2. Rigid panel design.
3. ITSAT based on aluminum laminate.
4. ITSAT based on U-V cured resin structure.
DEVELOPING AN INFLATABLE SOLAR ARRAY
Program Phases

• Three Phases

• Phase 1 Feasibility and Proof of Concept

• Phase 2 Update Ph 1 Design and Fabricate a Flight Qualified System

• Phase 3 Refurbish Ph 2 System and Conduct a flight test

(Program status: approximately mid-term of phase 2)
PROTO TYPE UNIT
EOL POWER DENSITY vs DEPLOYED ARRAY POWER
APSA-Type Flexible Blanket/Torus Deployed

3 Year LEO

Power Density, W/kg

EOL Array Power, Watts

Crystal-Si
GaAs/Ge
Cellof GaAs
CIS

VU-92-GW-0220
DEVELOPING AN INFLATABLE SOLAR ARRAY

Major Sub-Systems

- Housing/Cover
- Tube Booms
- Inflation System
- Solar Blanket Assembly
ITSAT SOLAR ARRAY
PH2 Design

1. Solar array in packaged canister.

2. Canister lid releases. Tubes are inflated, pulling the array out of the canister. Note that the canister lid forms one end of the structure.

3. Tubes inflated to the rigidizing pressure. Array fully extended.

VU-02-GW-022g
DEVELOPING AN INFLATABLE SOLAR ARRAY

Rigidizable Tube Design

- 3-ply Kapton-Aluminum-Kapton Laminate
- 4.0 inch Diameter
- Compression Loading Requirements 12 lbs
- Rigidization Pressure 22 psi
- Current Design Margin is Approximately 2.5

This data is from actual test results.
ITSAT SOLAR ARRAY

Typical Blanket Segment

Solar Cells W/Coverglass

Blanket Substrate

Hinges

Wiring Harness
DEVELOPING AN INFLATABLE SOLAR ARRAY

Program Summary

- Current W/Kg estimates are well above State-of-the-art
- A variety of cell types can be used
- Modular design to adapt to a variety of satellites
- Recurring costs are anticipated to be low
Deployment Comparison: ITSAT vs Bi-Stem vs Astromast vs DSCS III (BOL/GEO/Crystal-Si)

1. L'Garde ITSAT with crystalline silicon cells on flexible blanket.
2. Rigid panel design.
3. ITSAT based on aluminum-kepton laminate.
4. ITSAT based on U-V cured resin structure.