IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

SOLAR ARRAY FOR A ROTATABLE OBJECT

IITM Technology Available for Licensing

PROBLEM STATEMENT

- Most deployable **solar arrays for spacecraft use crystalline solar cells** mounted to **rigid honeycomb panels.**
- **Flexible solar arrays are limited** to crystalline solar cell arrays packaged in a long roll or pleated stack.
- **Solar cells are typically disposed on a solar array**, which is typically **used on satellites**.
- Solar arrays consist of one or more **solar panels electrically attached to each other** and to the satellite.
- Each solar panel in a solar array includes numerous individual solar cells, **connected together electrically at their adjacent edges**.
- Solar arrays also include an **underlying structure for deployment** of a substantial number of individual solar cells from the satellite body.
- The goal is to **minimize the volume of the stowed package of the solar array** while **maximizing the available solar cell area that can be packaged** when stowed and subsequently deployed.

TECHNOLOGY CATEGORY/ MARKET

Technology: Solar Array for Rotatable Objects
Category: Aerospace & Defense Technologies
Industry: Aerospace & space
Application: Solar with Satellite
Market: The global market size **USD 156.16 billion in 2023,** which is estimated to be at **USD 167.41 billion in 2024** and projected to reach, growing at a **CAGR of 8.05%** from **2024 to 2031**.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2428 ,Patent No: IN 546920

TRL (Technology Readiness Level)

TRL-6, Technology validated in relevant environment (Industrially relevant enabling technologies);

Research Lab

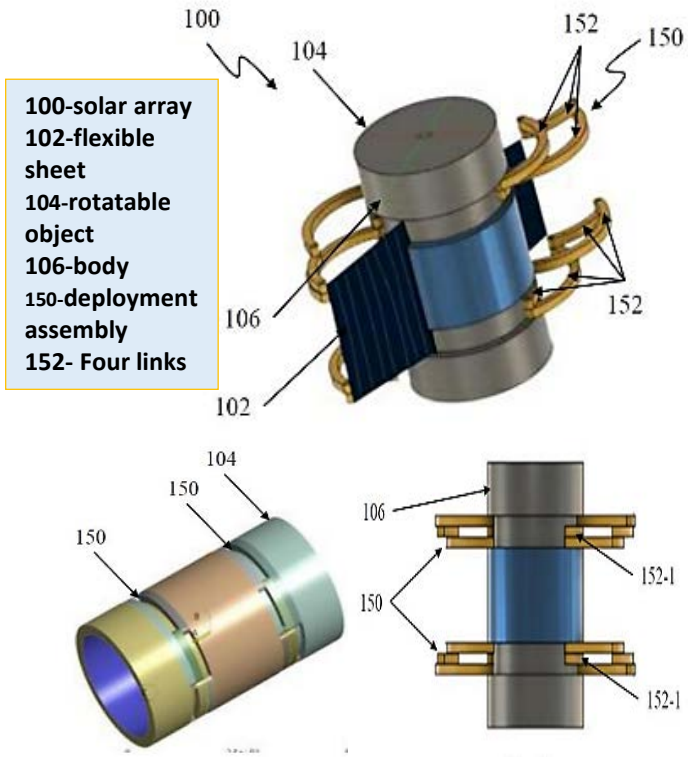
Prof. Jayaganthan,
Dept. of Engineering Design

TECHNOLOGY

Solar Array for Rotatable Objects

- **Composed of a flexible sheet with solar cells on its surface.**
- **Deployment assembly includes links with distal and proximal ends.**
- **Fixed link ends fixed to the rotatable object.**
- **Distal end of movable link coupled with adjacent link's proximal end via pivot joint.**
- **Flexible sheet's periphery coupled with movable link's distal end.**
- **Deployment assembly allows pivotal rotation of movable link to deploy sheet due to centrifugal force.**

Various representations of a solar array for a rotatable object, such as a satellite



100-solar array
102-flexible sheet
104-rotatable object
106-body
150-deployment assembly
152- Four links

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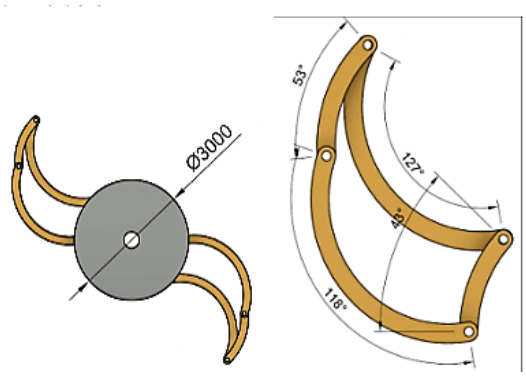
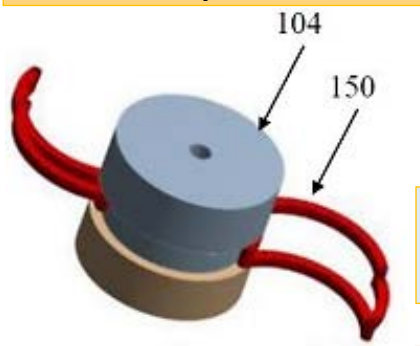
Deployment assembly of the solar array

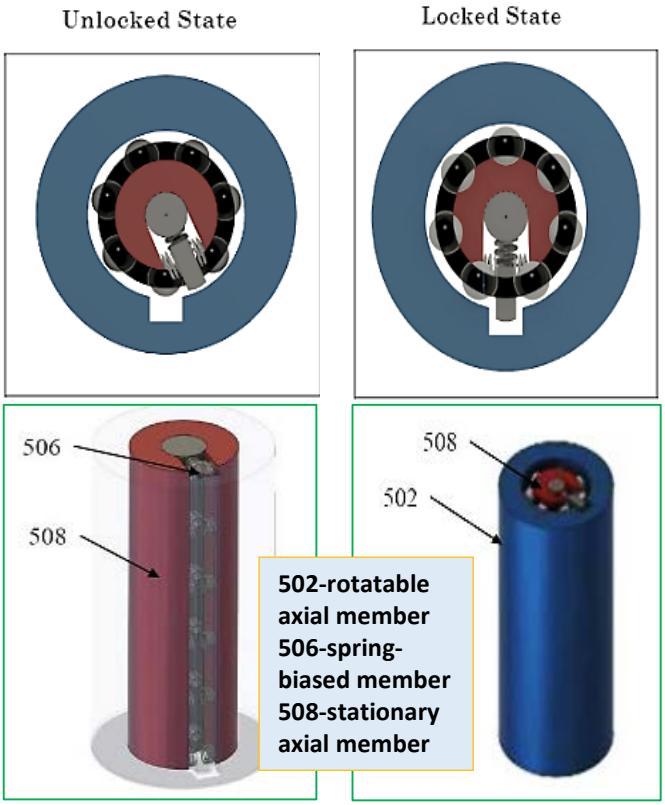


Perspective view of structural simulation of the solar array



104 - satellite
150- deployment assembly

Various representations of a locking assembly of the solar array



502-rotatable axial member
506-spring-biased member
508-stationary axial member

Key Features / Value Proposition

Object:

- Provide a solar array for a rotatable object like a satellite that **minimizes stowed package** volume while maximizing power production.

Features:

- Lightweight,
- stiff, strong, and stable,
- **uniform exposure from individual solar panels without external energy**.
- Minimizes disturbance loads during rotation of the rotatable object.
- Includes simple, efficient, and cost-effective mechanisms for deployment of the individual solar panels.
- **Can be easily retrofitted to conventional satellites**.

Advantages:

- Includes flexible sheet with solar cells and deployment assembly.
- Allows pivotal rotation of at least one movable link to deploy the flexible sheet.
- Includes at least four links, damping member, and locking assembly.
- **Locking assembly includes rotatable axial member and spring-biased member**.
- Spring-biased member moves into internal groove after predetermined angular displacement, locking movement of at least one movable link when the flexible sheet is fully deployed.

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