Space Elevator
Advanced Construction Process

Utilization of Space Debris for SE Counterweight Mass Increase

2014
Step 1. Space Debris Large Fragments Collection
Step 2. Collected Fragments of Space Debris

Collected space debris in GEO (CSDG)

Collected space debris in LEO (CSDL)

Geostationary Earth Orbit
Step 3. Space Elevator Launch Mission to LEO

Multiple launches and SE spacecraft assembly in LEO
Step 4. SE Spacecraft And CSDL Docking. 
Sailing to GEO
Step 5. SE Spacecraft With CSDL And CSDG Docking. Space Elevator Deployment
Step 6. Deployed Space Elevator
Benefits Of The Counterweight Mass Increase By Means Of Space Debris Utilization

Clean Near-Earth Space
- Increase of Space Elevator’s safety at all project phases
- Decrease of risks connected with deorbiting of space debris into the Earth’s atmosphere
- Cleanup of GEO positions

Decrease of Space Elevator Length
- Decrease of tether length and mass
- Decrease of tether production time
- Decrease of total Space Elevator project cost and construction time
Counterweight Mass Estimation

Dependency of Counterweight mass on its altitude

Counterweight Mass, tons

Counterweight Altitude, km

Space Debris Mass Distribution:

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<tr>
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<th>LEO</th>
<th>GEO and MEO</th>
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<tr>
<td>~2500</td>
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Estimation Of Propellant Mass Needed For Space Debris Uplift From LEO to GEO

Chemical liquid propulsion engine

Propellant Mass, tons

Electric propulsion engine

Propellant Mass, tons

Collected Debris Mass, tons

Counterweight Altitude, km

Collected Debris Mass, tons

Counterweight Altitude, km
Conclusions

The most efficient way to increase the Counterweight mass is to use collected space debris from GEO.

Usage of Space debris collected from LEO is more expensive but it will lead to near-Earth space cleanup that can increase the safety of SE and other space missions.
Thanks for Attention!