

Eguzki bela-ontziak

Argi-bidezko helgaldiak espazioan

Unai Aldasoro eta Mikel Antoñana



GIPUZKOAKO
INGENIARITZA
ESKOLA
ESCUOLA
DE INGENIERÍA
DE GIPUZKOA

Zientzia Astea 2021
Donostia
2021-11-05

Edukiak

- 1 Testuingura
- 2 Misioak
- 3 Baliagarritasuna eta mugak
- 4 Etorkizuna

Atala

1 Testuingura

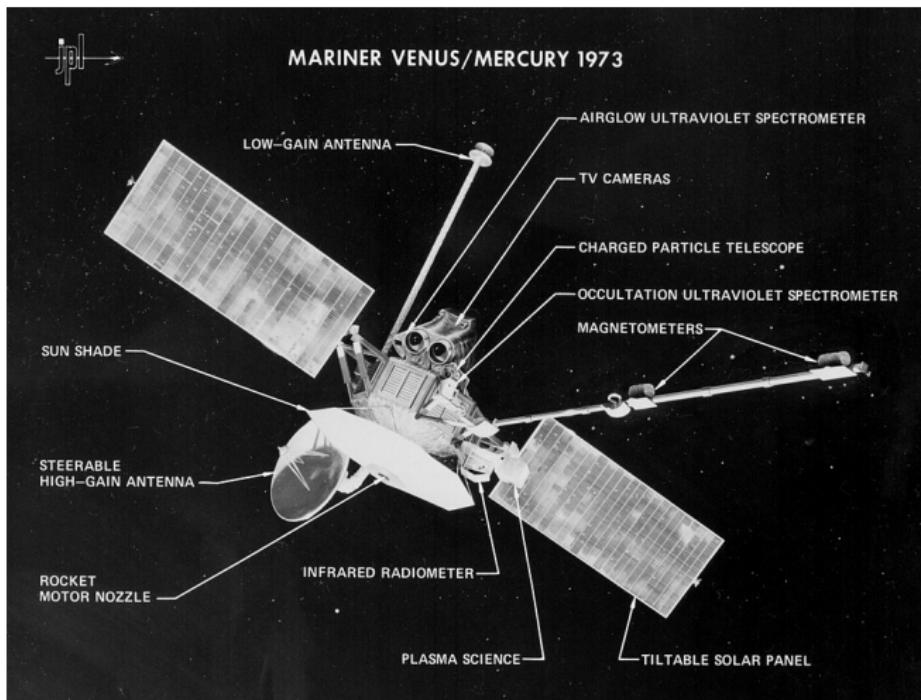
2 Misioak

3 Baliagarritasuna eta mugak

4 Etorkizuna

Mariner 10

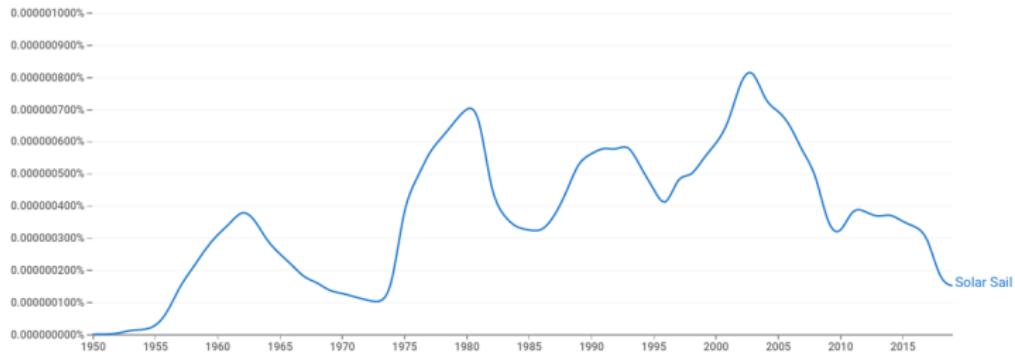
Bideoa (1:19min)



Arg: NASA / Jet Propulsion Laboratory

Google Books Ngram Viewer

● Sola Sail



Google Books Ngram Viewer

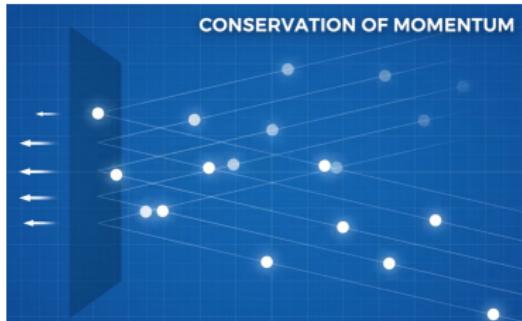
Fenomeno fisikoa

Zerk eragiten du mugimendua?

Arg: Crookes Radiometer (1873)

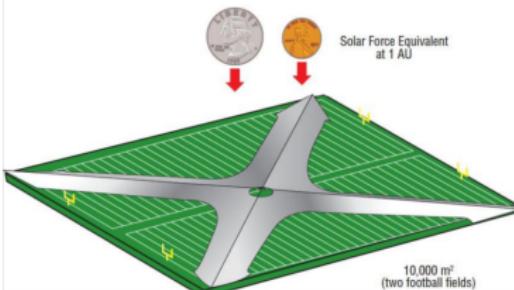
Fenomeno fisikoa

Inertzia momentua



Arg: How to sail on Starlight

- Force on a 100 m x 100 m square sail:



Arg: NASA

Atala

1 Testuingura

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IKAROS misioa (2010)



Arg: JAXA

LightSail 2 (2019)

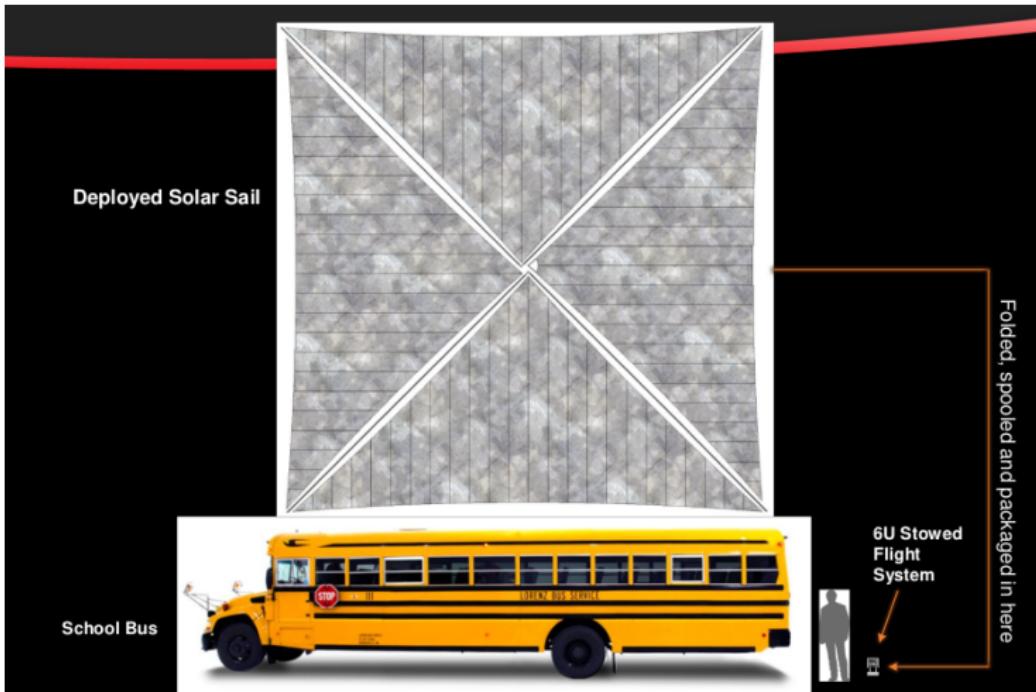
Bideoa 3:01min



Arg:The Planetary Society

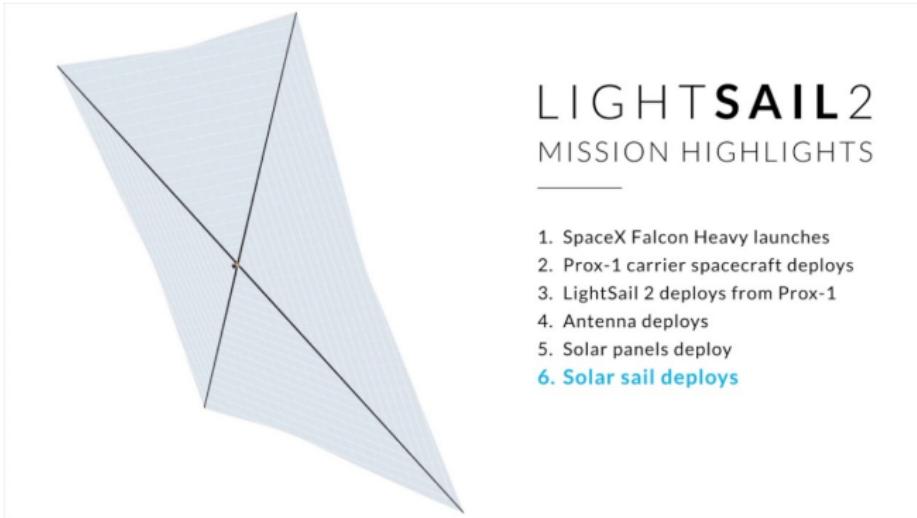
LightSail 2 (2019)

Materialak, tamaina, masa



LightSail 2 (2019)

Misioaren urratsak (animazioa 40seg)



The graphic features a large, semi-transparent blue and white striped sail on the left side. To the right, the text "LIGHTSAIL 2 MISSION HIGHLIGHTS" is displayed in a serif font, with a horizontal line separating it from the list below. A numbered list follows, with the final item in blue.

LIGHTSAIL 2
MISSION HIGHLIGHTS

1. SpaceX Falcon Heavy launches
2. Prox-1 carrier spacecraft deploys
3. LightSail 2 deploys from Prox-1
4. Antenna deploys
5. Solar panels deploy
6. Solar sail deploys

Arg:The Planetary Society

LightSail 2 (2019)

Non dago oraintxe bertan?

The image shows the Lightsail 2 Mission Control interface. At the top center is the Lightsail 2 logo, which is a shield-shaped emblem featuring a sailboat against a sunburst background, with the text "THE PLANETARY SOCIETY" at the top and "LIGHTSAIL 2" in the center. Below the logo, the text "LIGHTSAIL 2 MISSION CONTROL" is displayed in large white letters, followed by "LAST DATA RECEIVED: OCTOBER 23, 2021 @ 21:19:39 UTC". The interface is divided into several sections:

- ELAPSED MISSION TIME:** 845 days 12 hrs
- SAIL STATUS:** ✓ deployed
- BATTERY CHARGE:** 3.85 volts (MAX 4.2V)
- INTERNAL TEMPERATURE:** 52.5 °C | °F
- ROTATION RATES:** 0x -0.4y -0.4z (DEG/SEC)
- ATTITUDE CONTROL MODE:** Solar Sailing

Atala

1 Testuingura

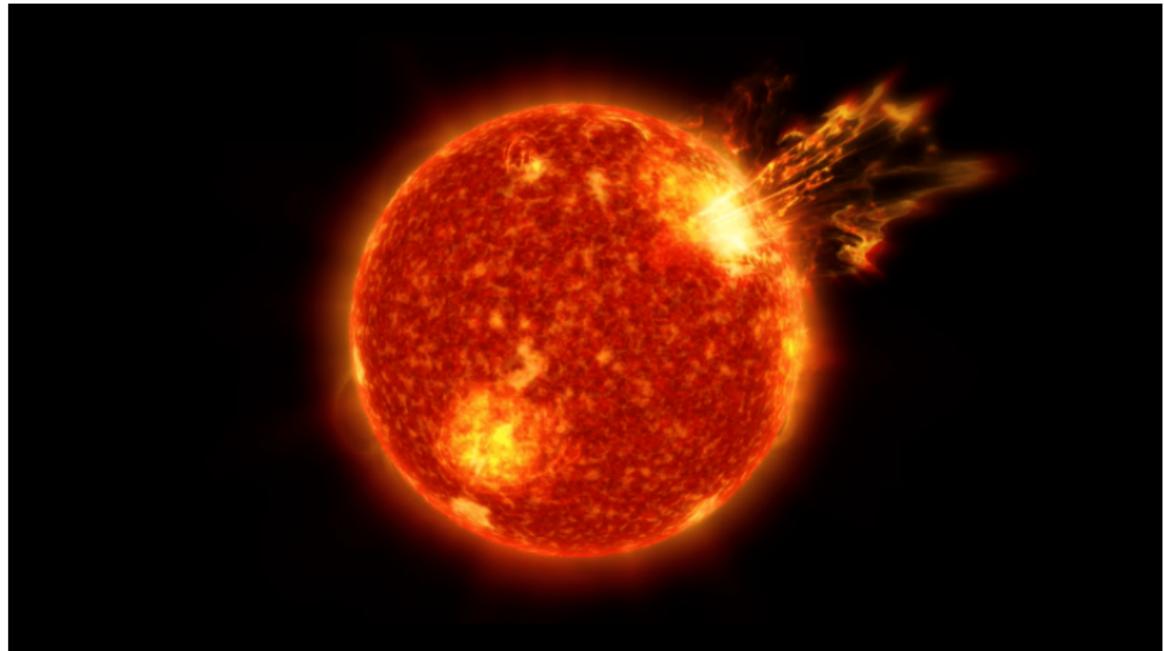
2 Misioak

3 Baliagarritasuna eta mugak

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Larrialdiak

Eguzki ekaitzak



Arg: NASA's Goddard Space Flight Center/Genna Duberstein

Larrialdiak

Asteroideen inpaktuak lurrean (kezkatu beharko genuke?)



→ RISK LIST

Last update: 2021-10-25 15:07 UTC

The Risk List
is a
catalogue of
all objects for
which a non-
zero impact
probability



Current number of NEAs in risk list:

1229

Arg: ESA

De-Orbit Aplikazio komertziala

- 20.000 objektu lurraren inguruan !!!
- De-Orbit System HPS GmbH (Bideoa 0:39seg)



Arg:ESA

Mugak

Pertsonen garraioa



Ag: NASA Dominio público: HAM txinpanzea (1961)

Atala

1 Testuingura

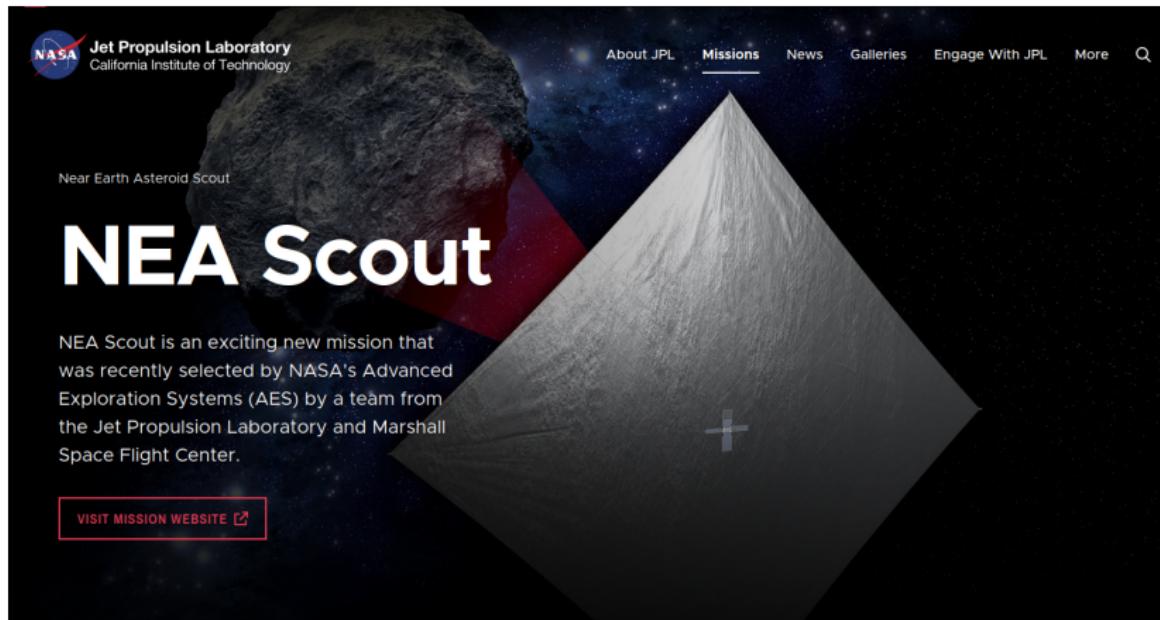
2 Misioak

3 Baliagarritasuna eta mugak

4 Etorkizuna

Etorkizun hurbilean

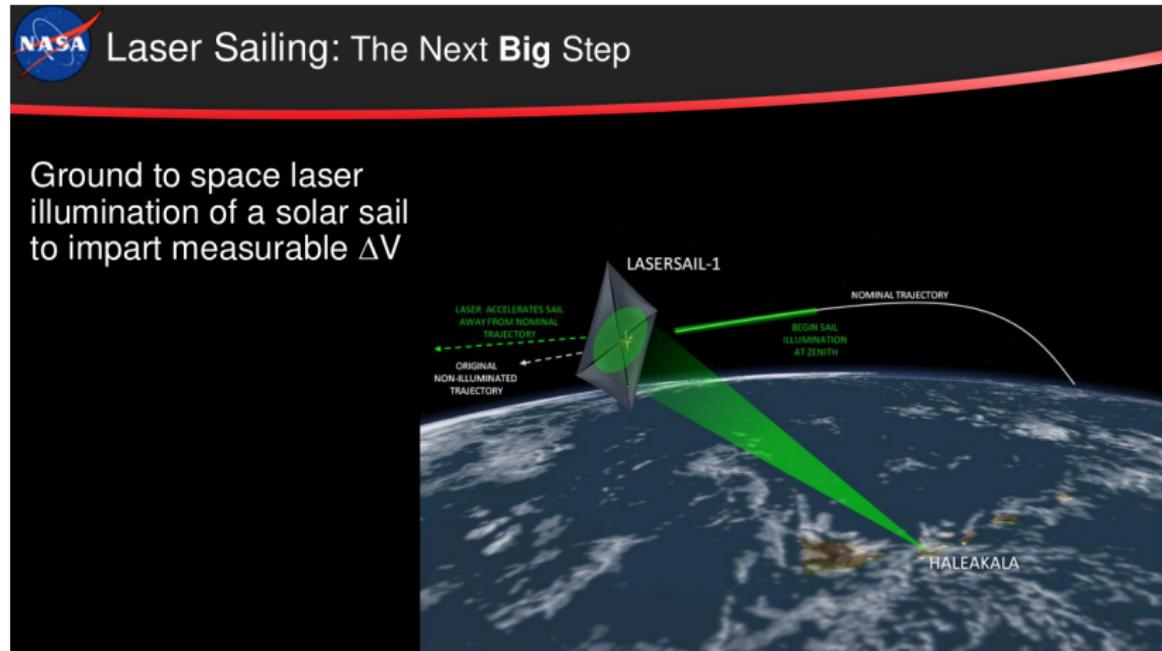
Ilargirako Artemis-I misioan (Otsaila 2022)



Arg NASA

Etorkizun luzean

Zientzia-fikzio?



Arg: NASA

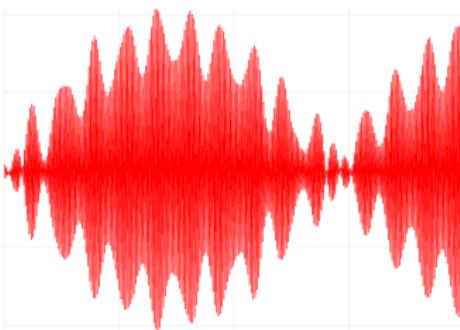
Erreferentzi interesgarriak

● Artikuluak

- 1) **Eguzki-bela (wikipedia)** Euskarazko erreferentzia !!!
- 2) **Solar Sailing - Technology, Dynamics and Missions Applications**, Colin R. McInnes- Springer (2004)
- 3) **Solar sail technology—A state of the art review**, Bo Fu, Evan Sperber, Fidelis Eke- Progress in Aerospace Sciences (2016)
- 4) **Solar Sailing – Mission Opportunities and Innovative Technology Demonstration**, C.R. McInnes et al. ESA bulletin 108 (2001)
- 5) **The LightSail 2 solar sailing technology demonstration**, David A. Spencer et al. - Advances in Space Research (2021)
- 6) **The Planetary Society** erakundearren webgunea
- 7) **Maketa: LightSail 2 full-scale paper model**

● Bideoak

- 1) Bill Nye Explains the Science Behind Solar Sails
- 2) How to sail on Starlight
- 3) How Solar Sails Are Remaking Space Exploration



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Aurkezpena helbide honetan eskuragarria:

- <https://github.com/mikelehu/Zientzia-Astea-2021>