



ΑΕΡΟ101

Συστήματα Διαστημικής

Διάλεξη 3, 24.10.22

Καθ. Β. Λάππας

ΣΧΟΛΗ ΘΕΤΙΚΩΝ ΕΠΙΣΤΗΜΩΝ

**ΤΜΗΜΑ ΑΕΡΟΔΙΑΣΤΗΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ ΚΑΙ
ΤΕΧΝΟΛΟΓΙΑΣ**



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

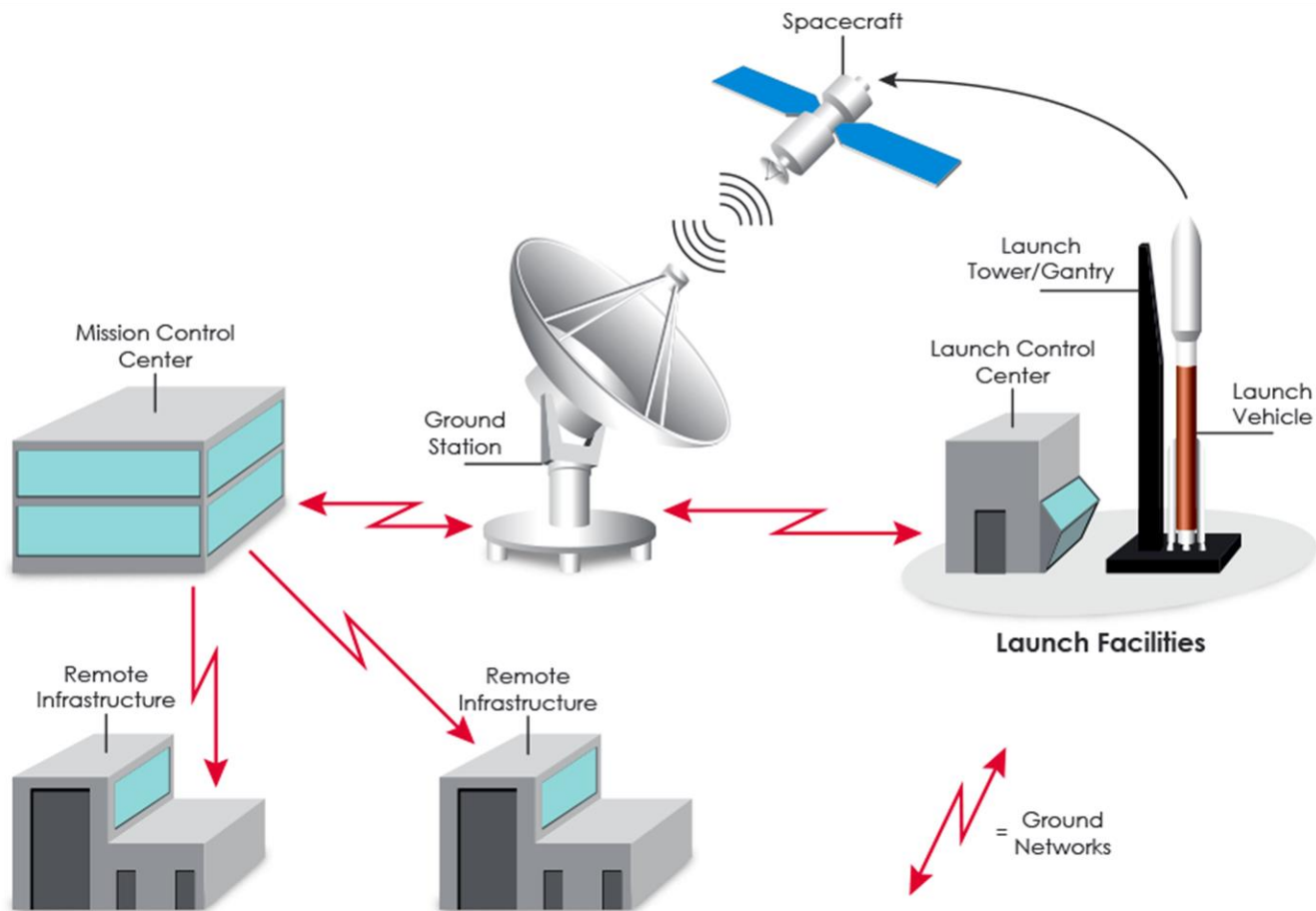
Εθνικόν και Καποδιστριακόν
Πανεπιστήμιον Αθηνών

— ΙΔΡΥΘΕΝ ΤΟ 1837 —



Συστήματα Διαστημικής

- Διαστημικός Τομέας (Δορυφόρος, Διαστημόπλοιο, ρομποτικό όχημα)
- Σταθμοί εδάφους, ελέγχου
- Τελικοί χρήστες του συστήματος (επιστήμονες, μηχανικοί...)





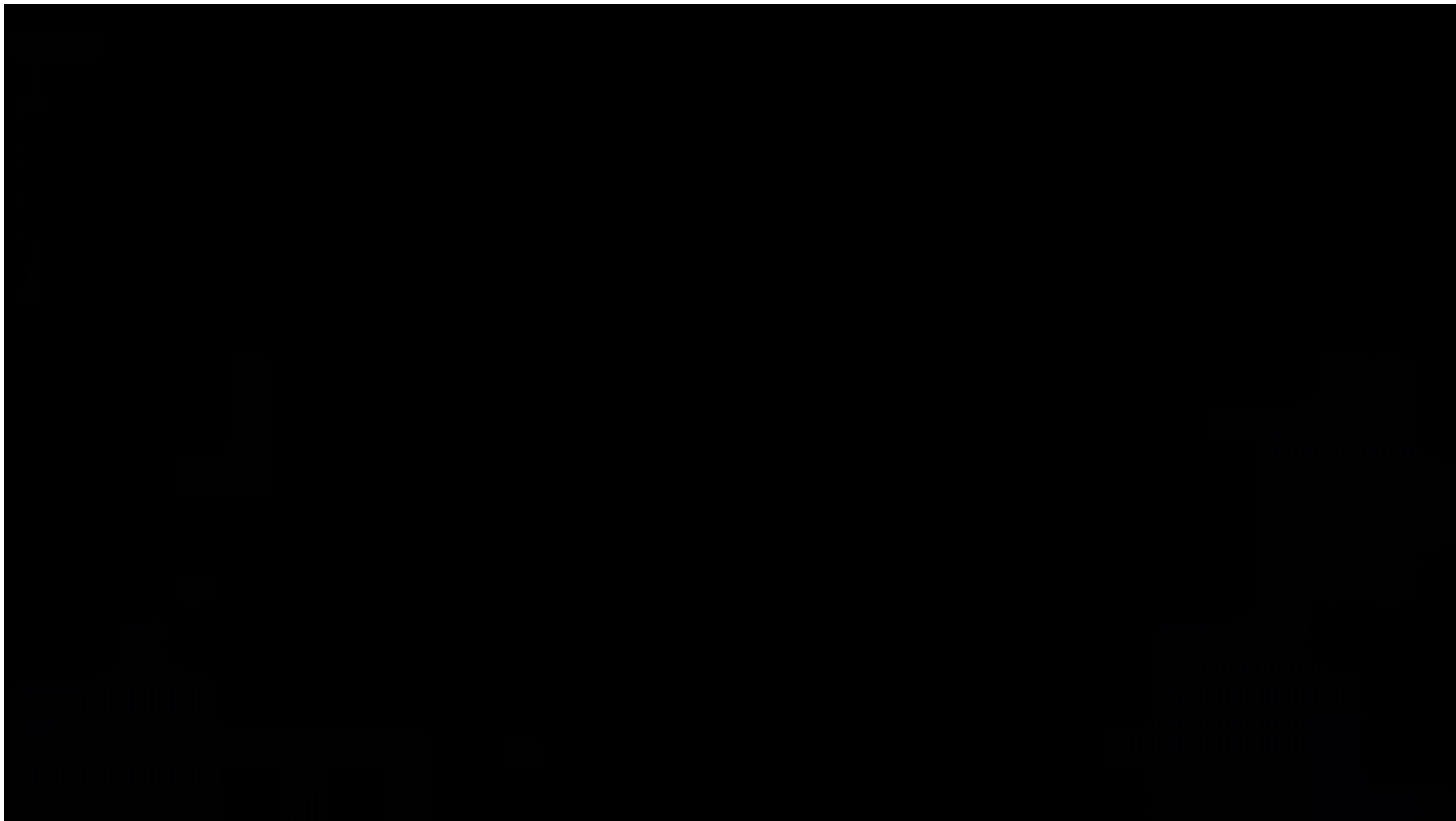
ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Εθνικό και Καποδιστριακό
Πανεπιστήμιο Αθηνών

Ιστορία του Διαστήματος

<https://www.youtube.com/watch?v=NcylqG1ffO4>



Satellites: How do they work

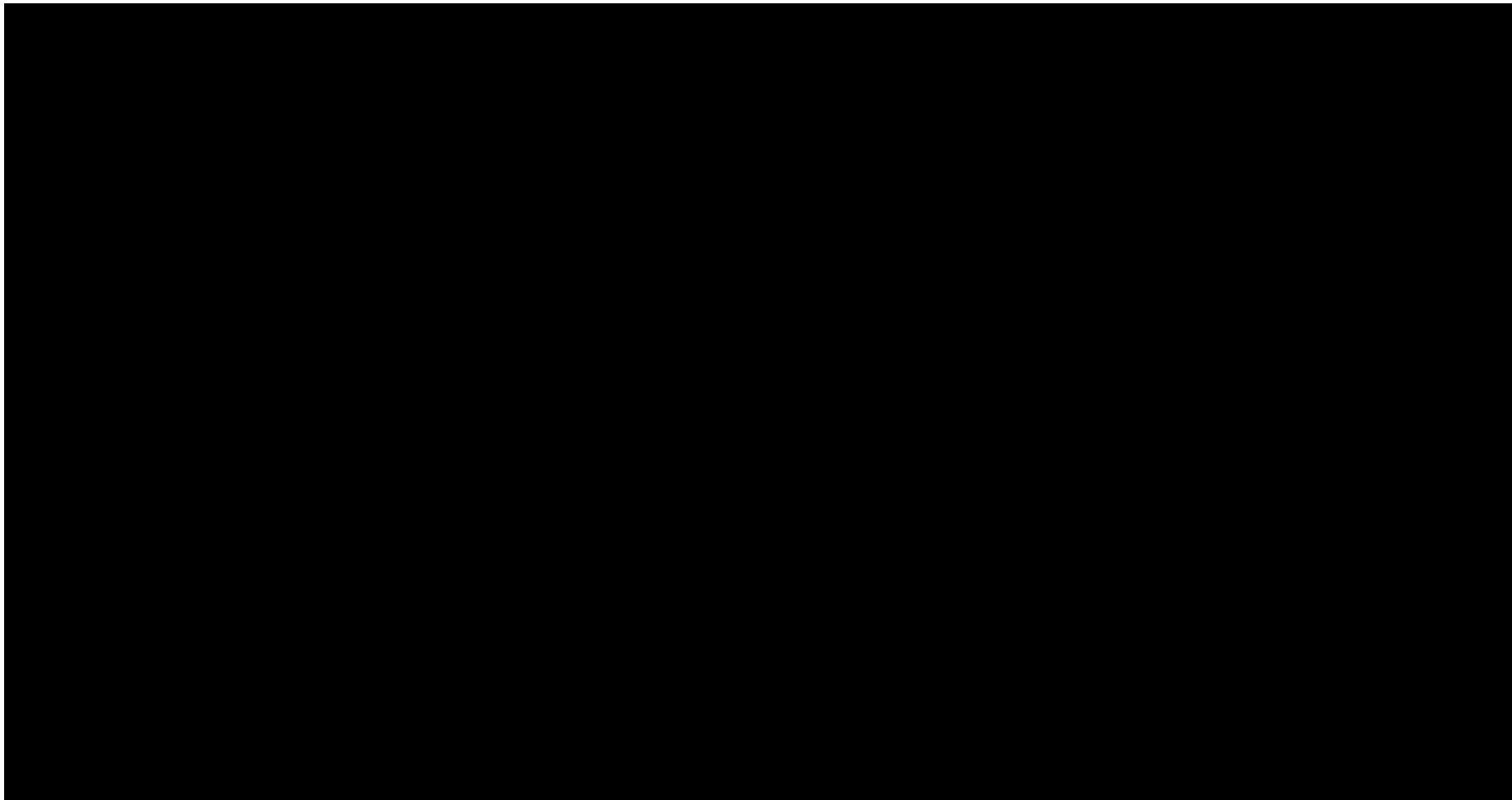


<https://www.youtube.com/watch?v=yxYzjHBKNcA>



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Εθνικό και Καποδιστριακό
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Hellasat-4



<https://www.hellas-sat.net/>



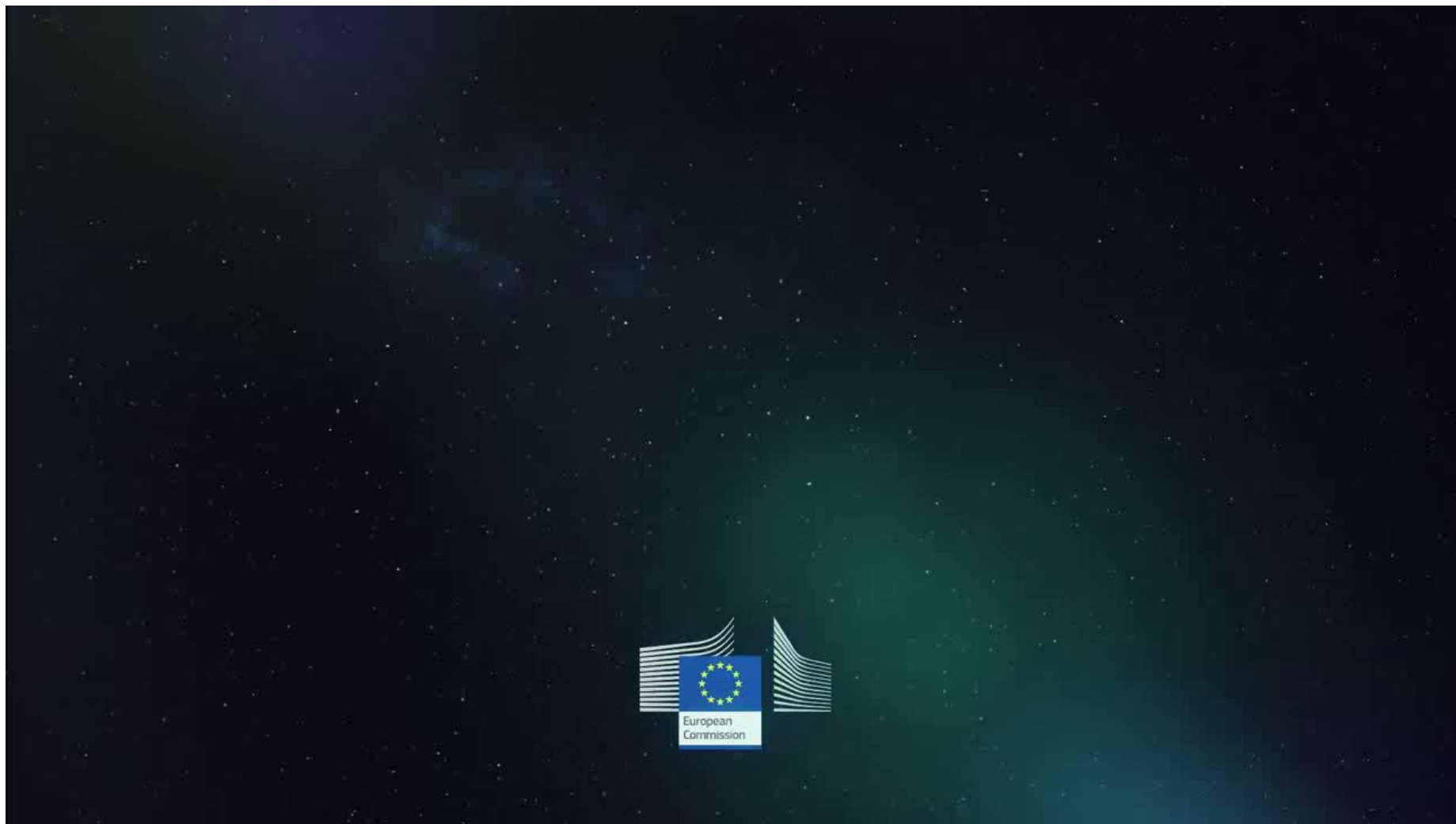
Mega Constellations - Broadband



<https://futuorology.earthone.io/our-videos>



Copernicus – Protecting Earth



<https://www.youtube.com/watch?v=MGJss4IDaBo>



Επανδρωμένες Πτήσεις

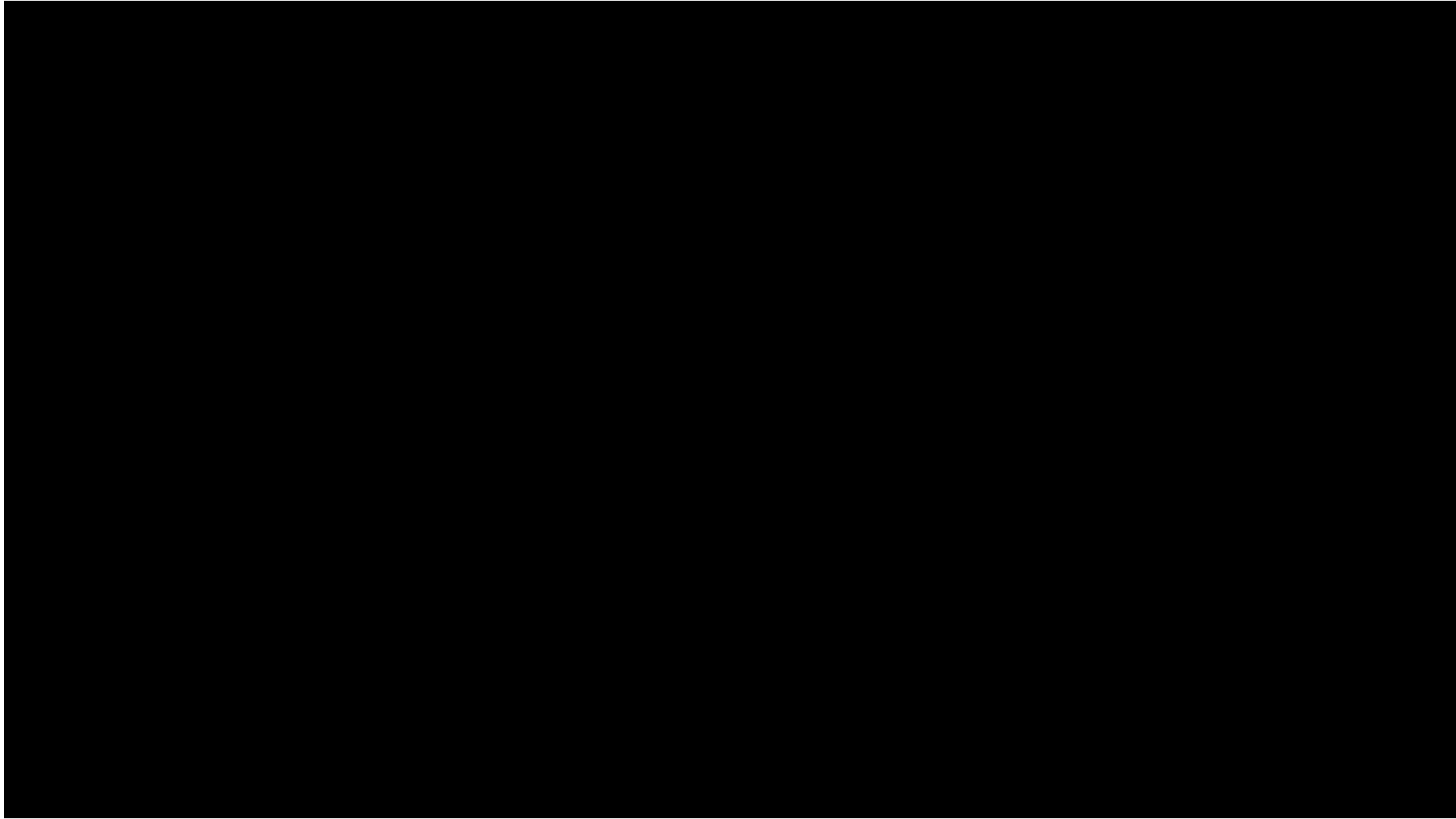


https://www.youtube.com/watch?v=oLrOnEmy_GA&t=393s



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Εθνικό και Καποδιστριακό
Πανεπιστήμιο Αθηνών

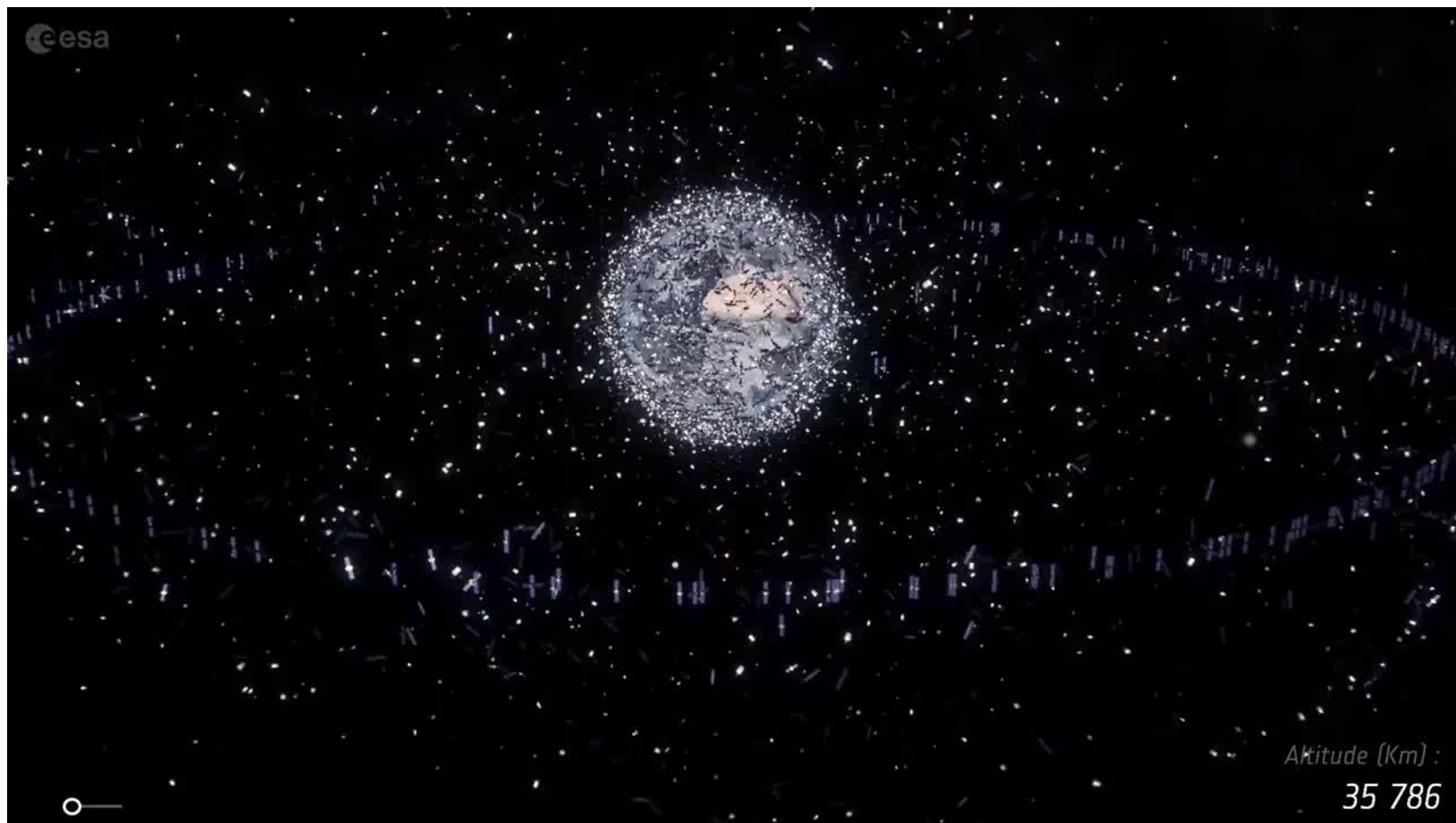
Space X Spaceship: Destination Mars



SpaceX: <https://www.youtube.com/watch?v=-aGISgOB6n0&t=105s>



Space Debris – Διαστημικά Απόβλητα



<https://www.youtube.com/watch?v=HVov8o9x0yl&t=2s>

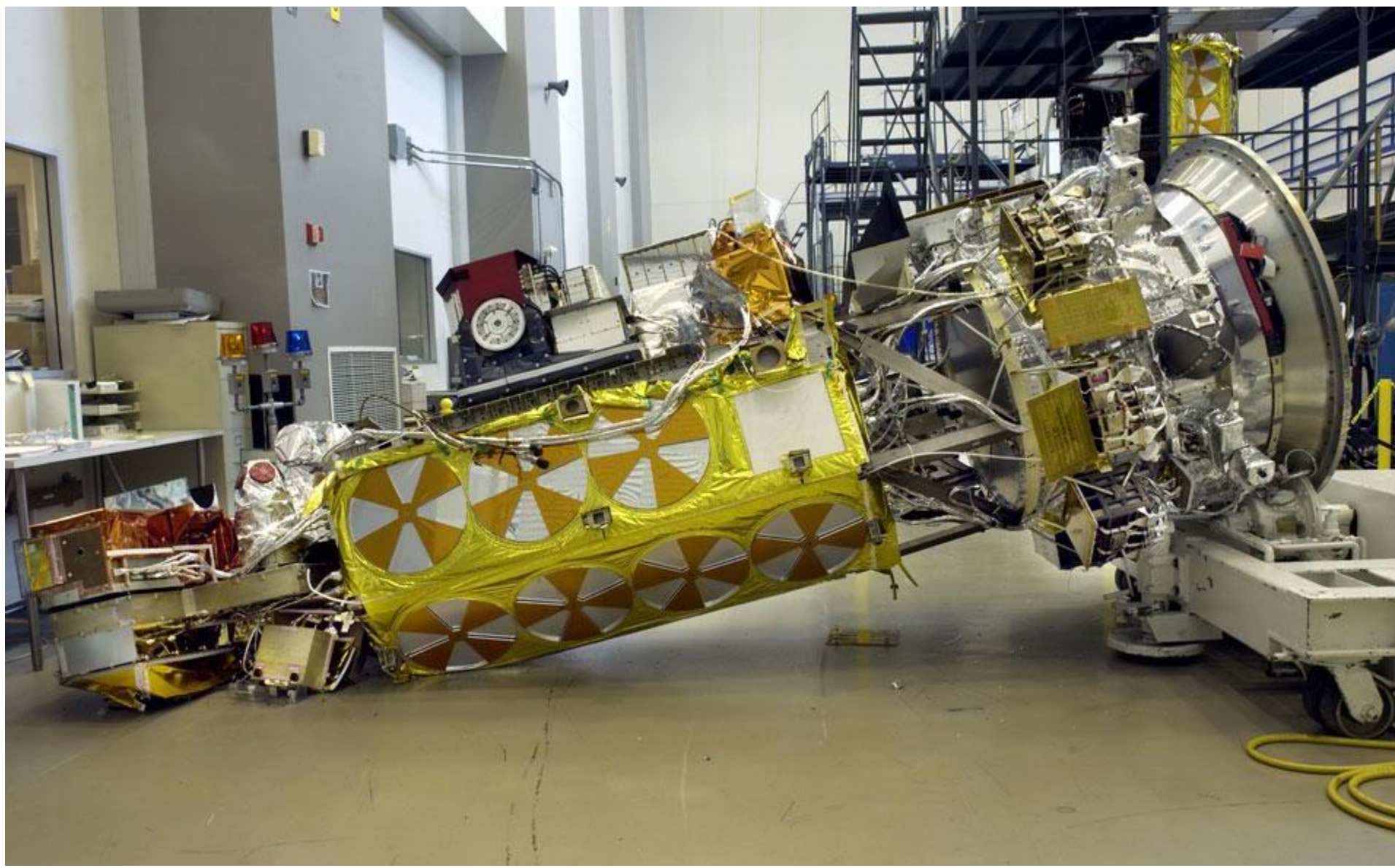


Διαστημικές Τεχνολογίες/Πλατφόρμες





NOAA-19 (2003)





TIROS Mechanical Interfaces

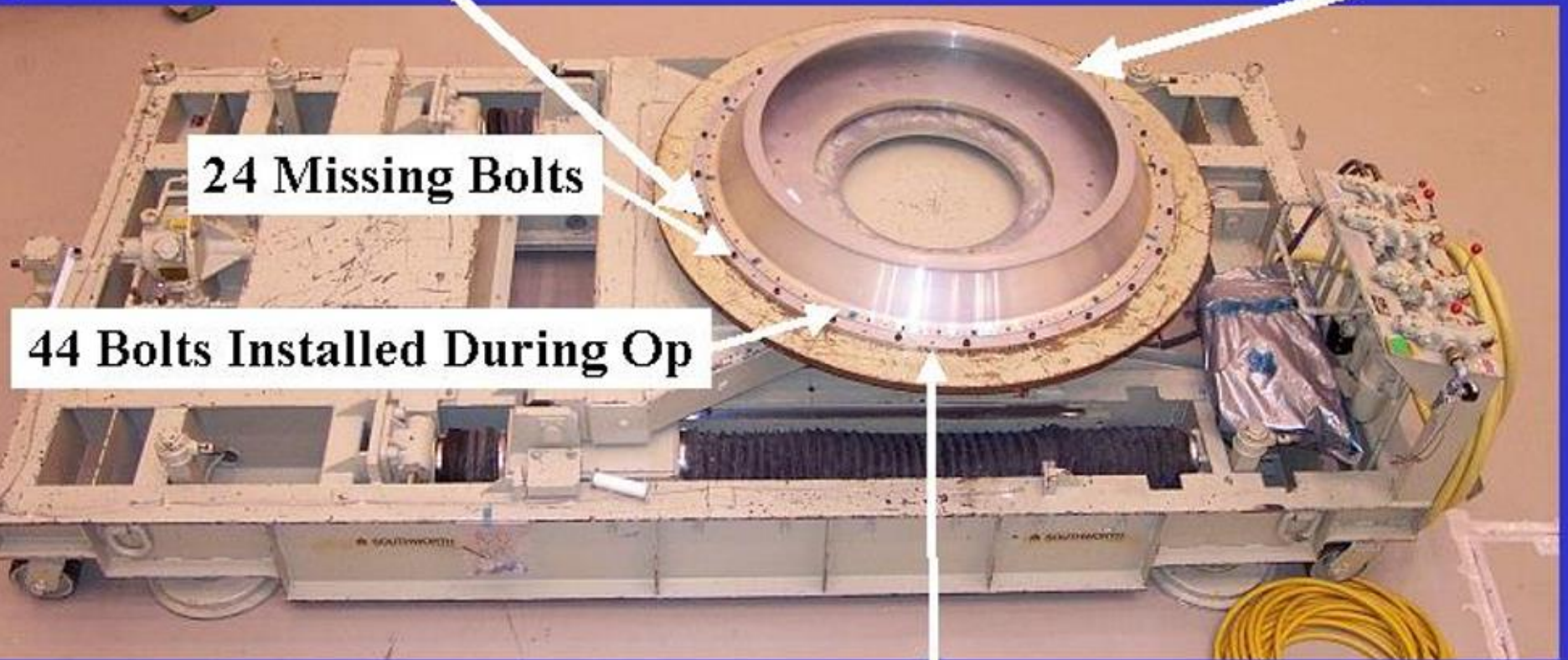
Adapter Plate Mounting Hardware

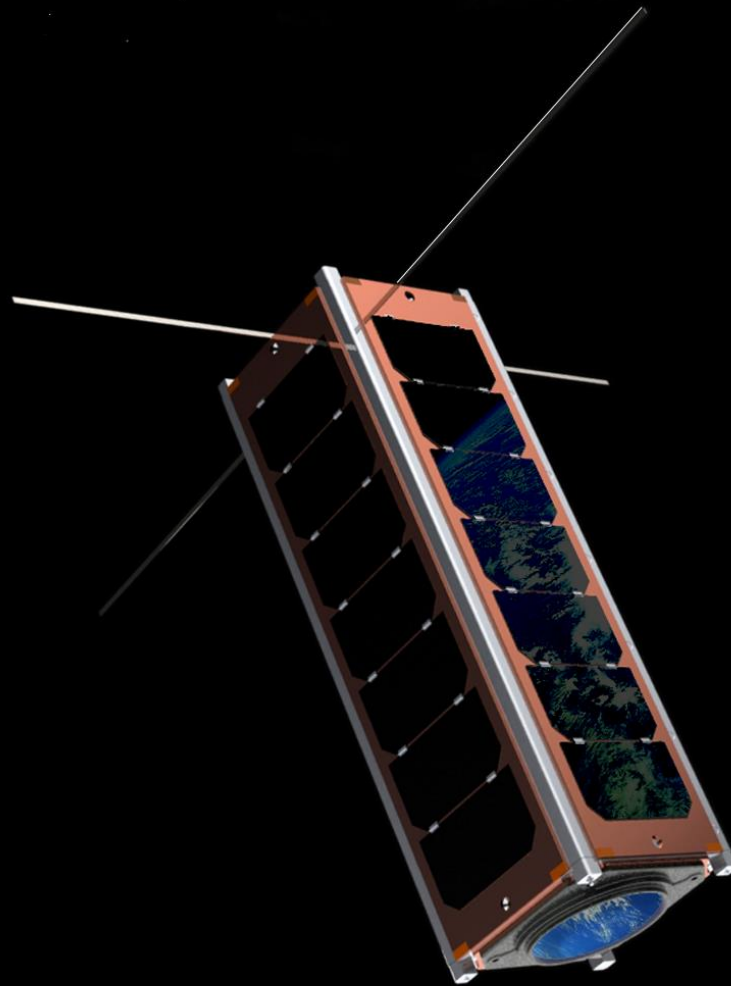
TIROS Payload Adapter

24 Missing Bolts

44 Bolts Installed During Op

Turnover Cart Adapter Plate





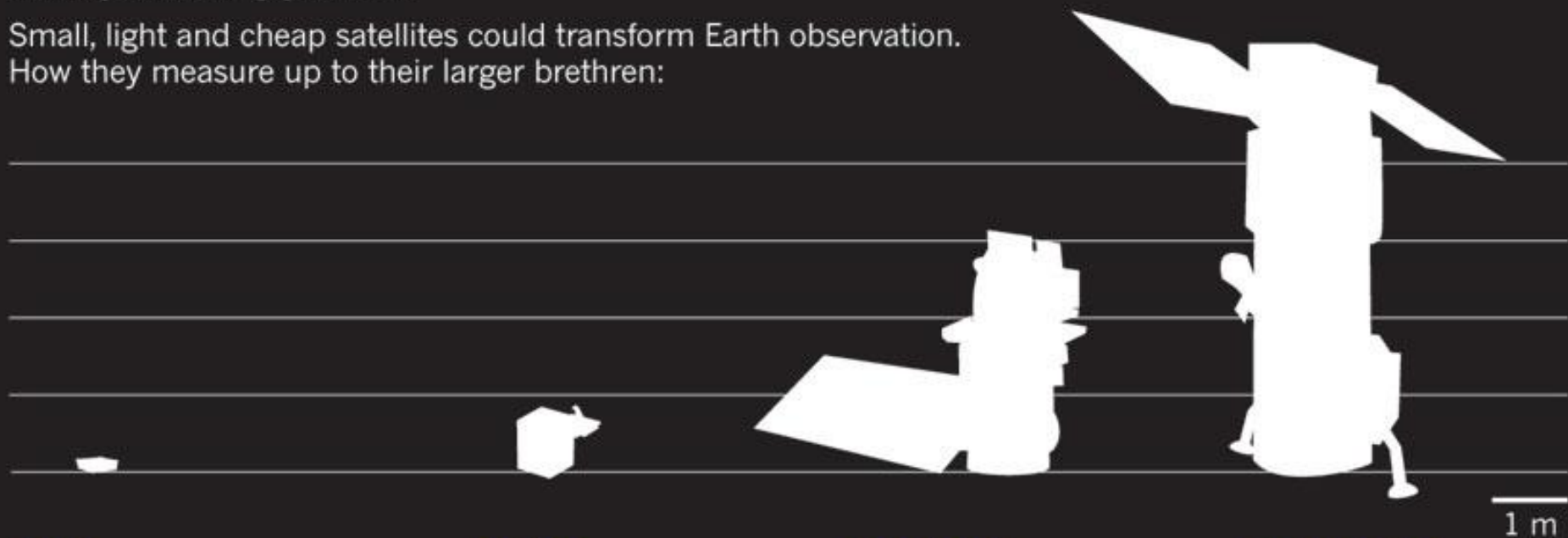
Small Satellites – Μικροδορυφόροι



Μικρο/Νάνο-δορυφόροι

THE SWARM COMETH

Small, light and cheap satellites could transform Earth observation.
How they measure up to their larger brethren:



DOVE

Operator: Planet Labs
Number of satellites*: 32
Weight: ~5 kg
Instruments: Optical and near-infrared spectral bands
Spatial resolution: 3–5 m

SKYSAT

Operator: Skybox Imaging
Number of satellites*: 24
Weight: ~100 kg
Instruments: Optical and near-infrared spectral bands
Spatial resolution: ~1 m

LANDSAT 8

Operator: NASA
Number of satellites*: N/A
Weight: 2,071 kg[†]
Instruments: Multiple spectral bands
Spatial resolution: 15–100 m[‡]

WORLDVIEW-3

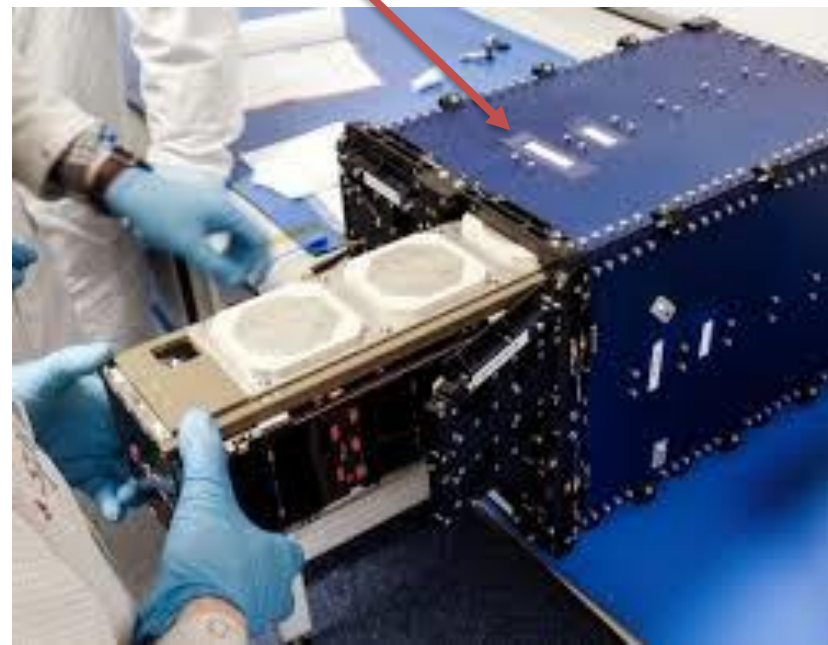
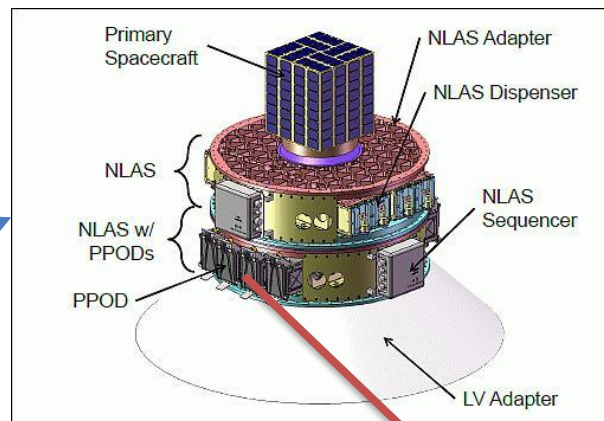
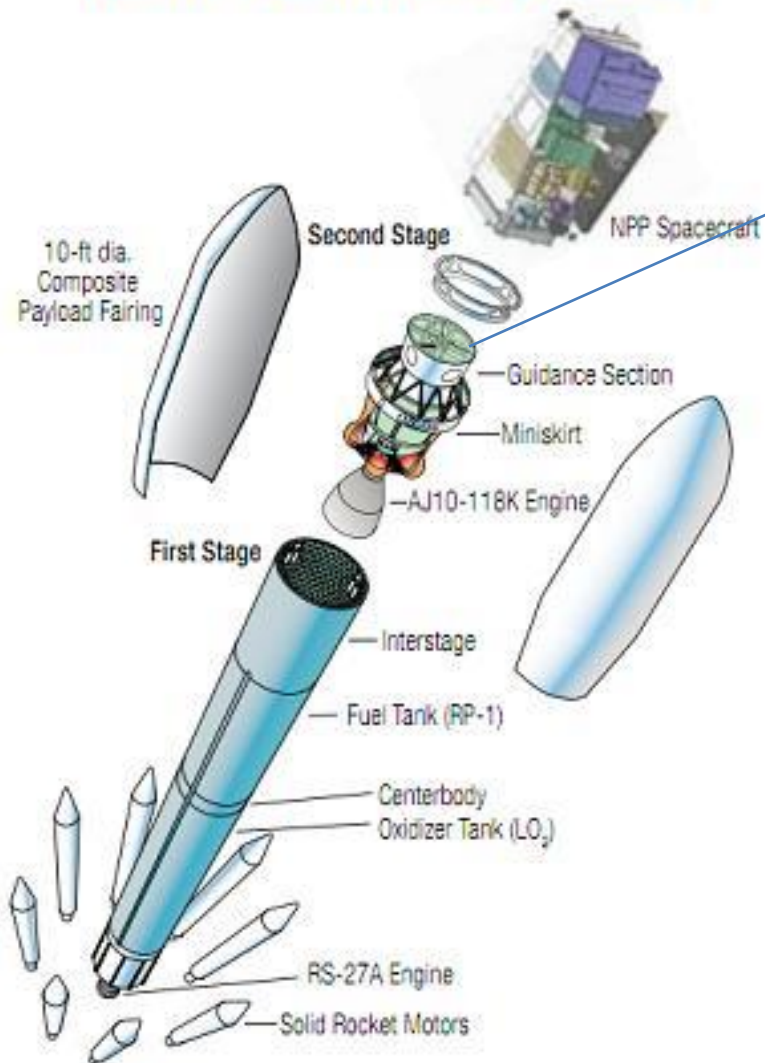
Operator: DigitalGlobe
Number of satellites*: N/A
Weight: 2,800 kg
Instruments: Multiple spectral bands
Spatial resolution: 0.3–30 m[‡]

*When fully operational † Without instruments ‡ Depending on spectral frequency



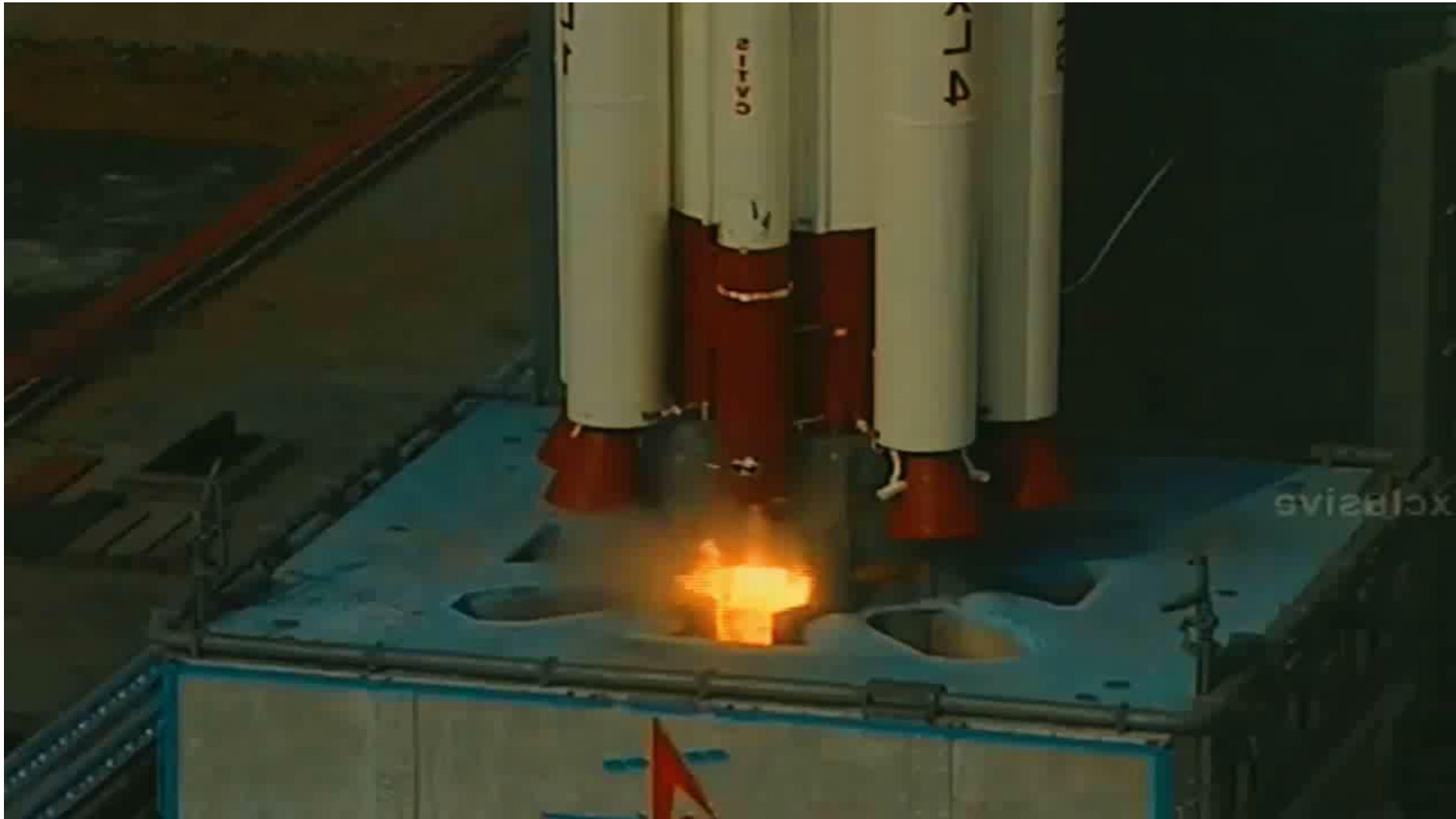
Εκτόξευση νάνο-δορυφόρων

DELTA II 7920-10C LAUNCH VEHICLE





PSLV Nanosat deployment (2017)

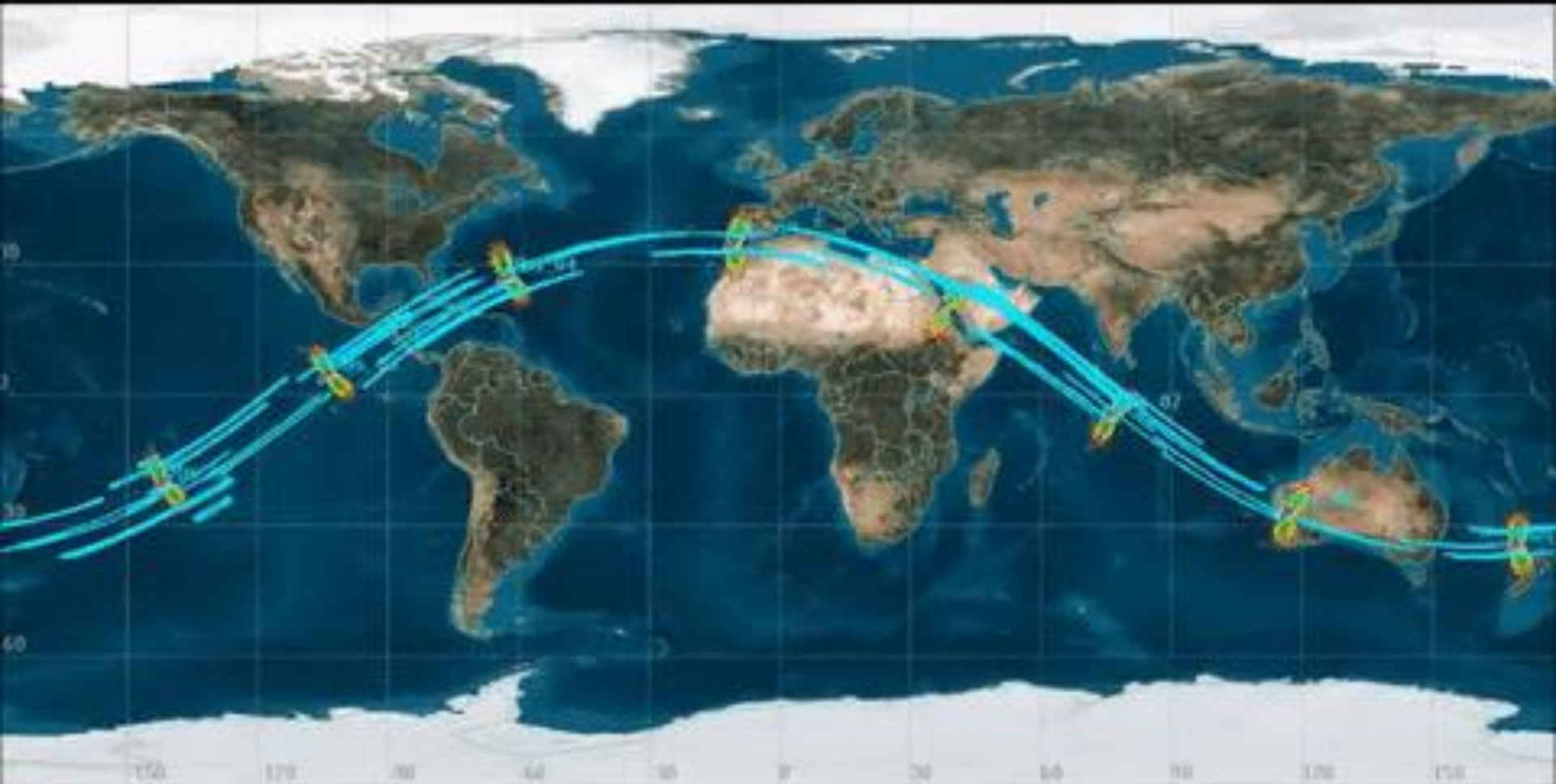


<https://www.youtube.com/watch?v=c0BpjPUT5FE>



Small Satellite Constellation

More data/high revisit time





OneWEB: A Revolution in Space



<https://www.youtube.com/watch?v=Ylrlt0R47Z8>



Earth-I (UK) Constellation HD Video from Space (1-m res)

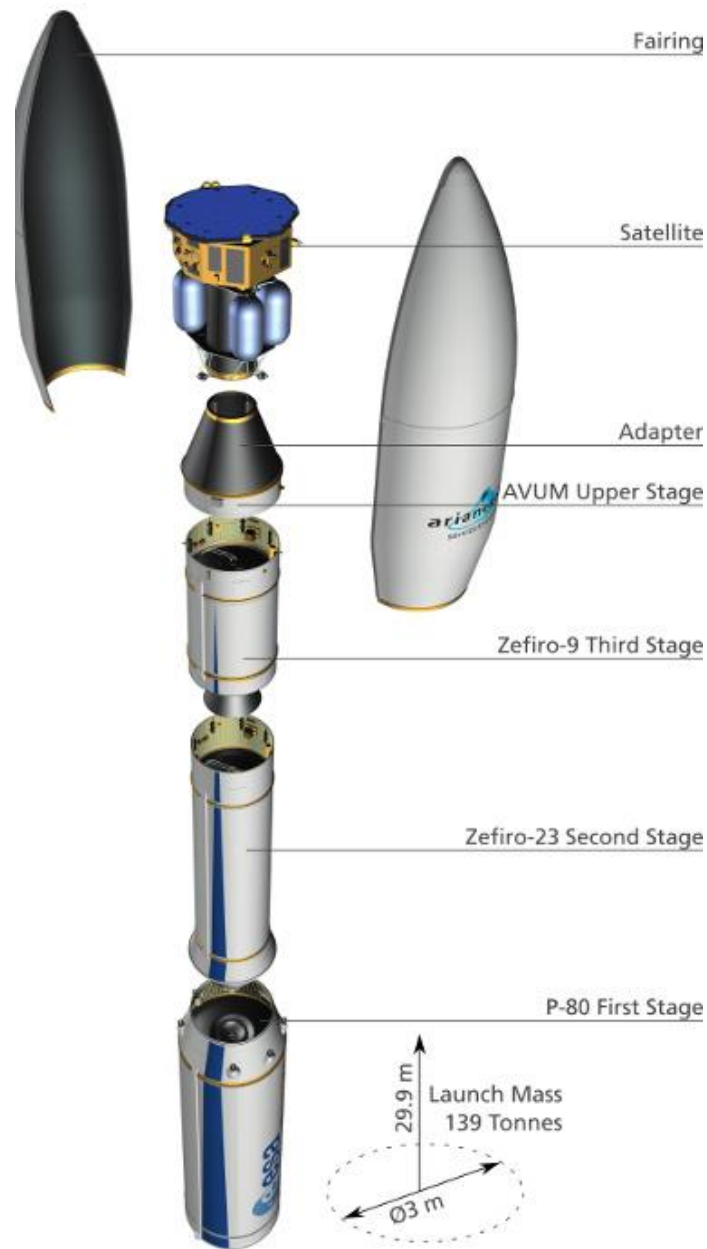
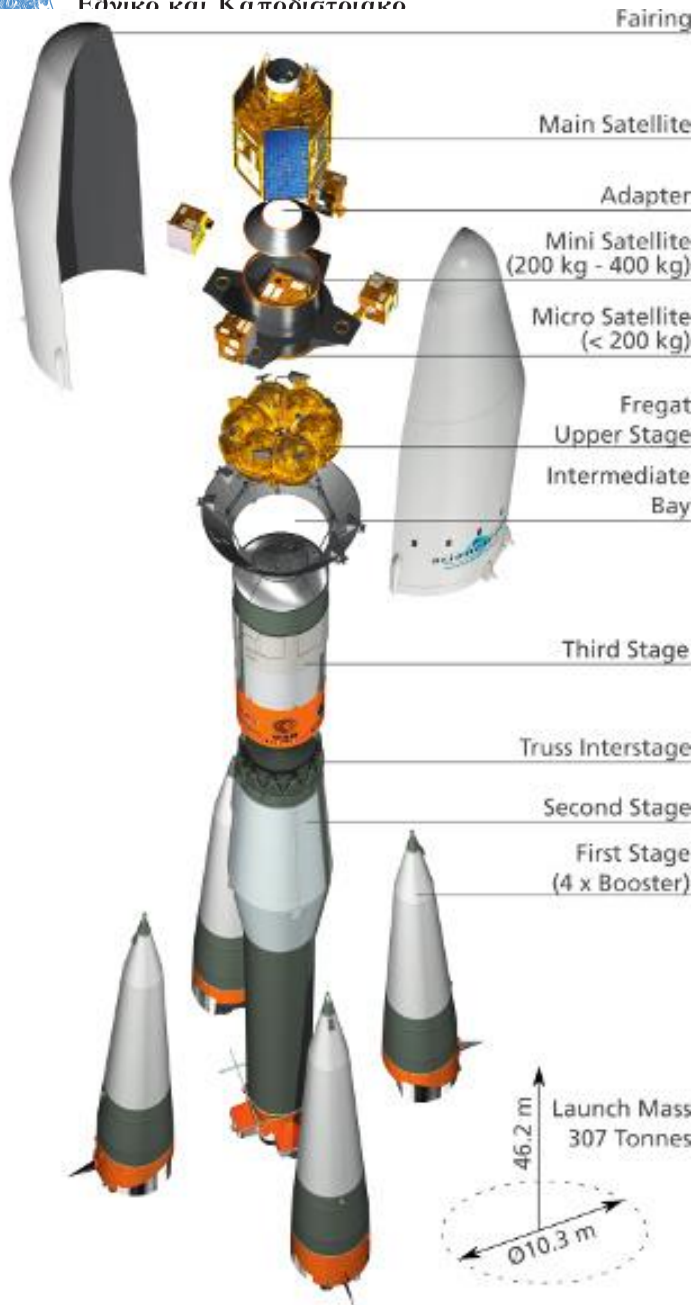


<https://www.youtube.com/watch?v=OBxJSroyTcl&t=8s>





Διαστημικοί Φορείς - Εκτοξευτές





Πως Εκτοξεύονται οι Δορυφόροι?



<https://www.youtube.com/watch?v=IGoVy44C3cA>



How a Rocket Works



<https://www.youtube.com/watch?v=QQB1lw3zJbc>



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Space X Falcon Heavy – Reusable Rockets



FEBRUARY 6TH, 2018

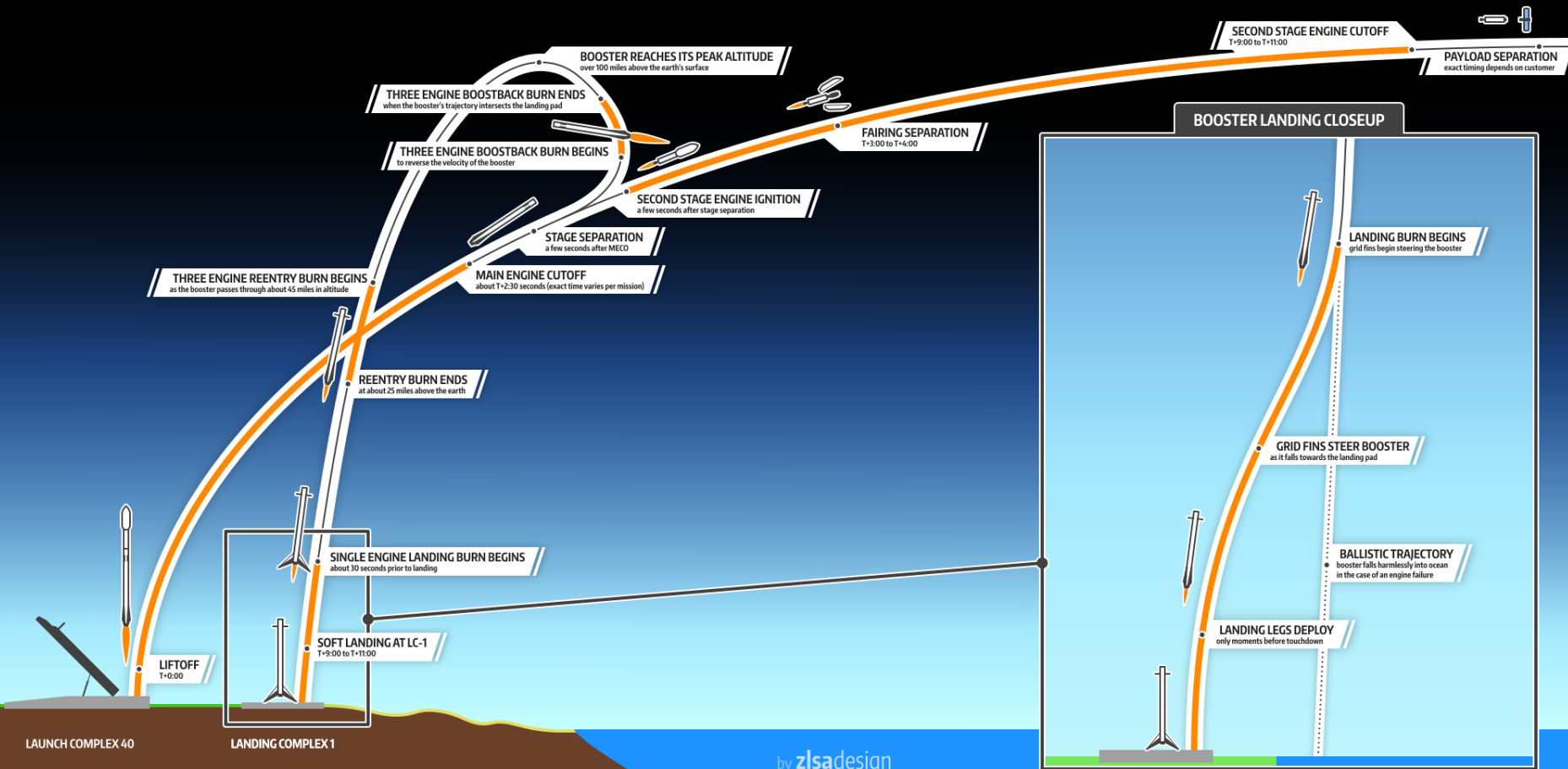
<https://www.youtube.com/watch?v=sX1Y2JMK6g8&t=78s>



SpaceX Falcon 9 Πτήση Επιστροφής

SPACE X FALCON 9 LAUNCH AND LANDING PROFILE

NOTE: NOT TO SCALE/TRAJECTORY IS NOT EXACT





Falcon 9

Επαναχρησιμοποιούμενοι Πύραυλοι/Εκτοξευτές



<https://www.youtube.com/watch?v=bvim4rsNHkQ>

Διαστημικοί Φορείς/Εκτοξευτές

SOYUZ FG

Height 49.5 m
Mass 305,000 kg
Payload 7,100 kg
Stages 2



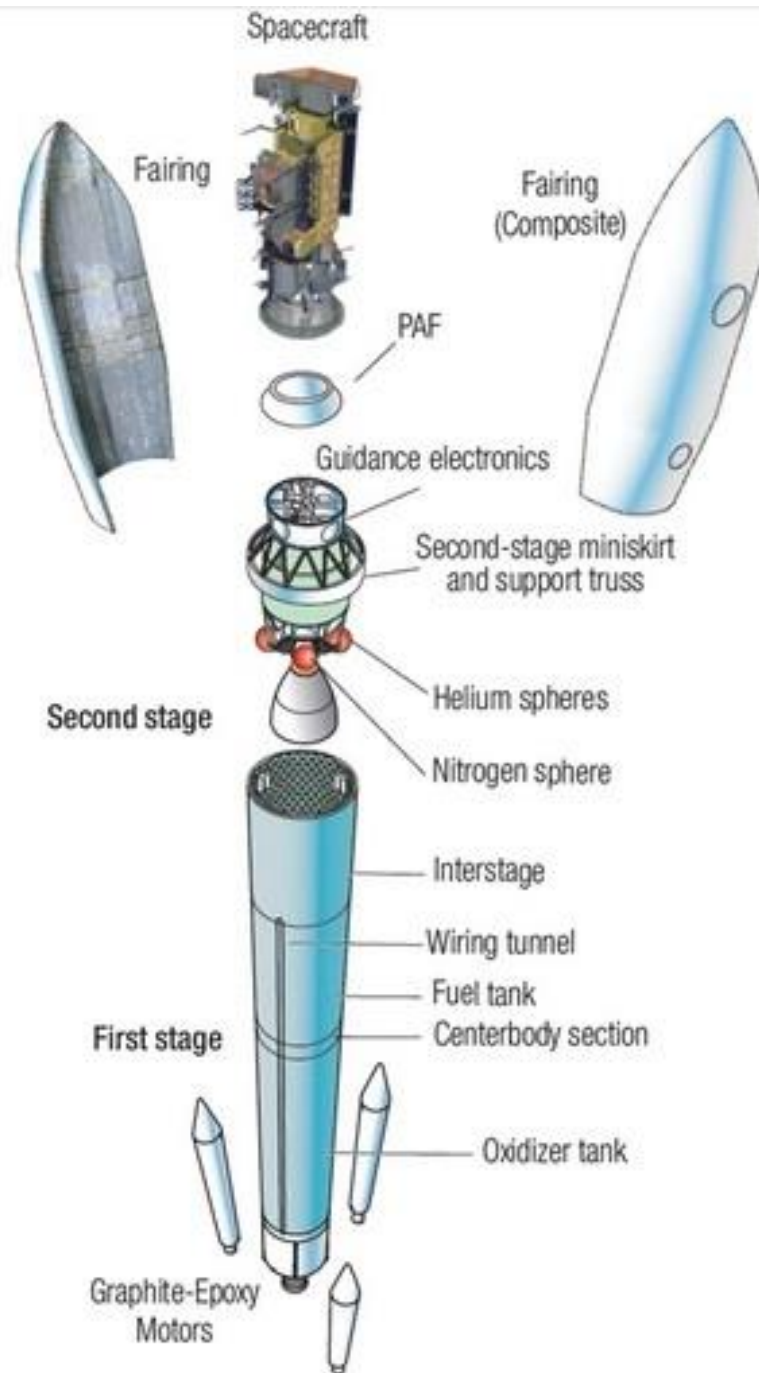
ARIANE 5

Height 46-52 m
Mass 777,000 kg
Payload 21,000 kg
Stages 2

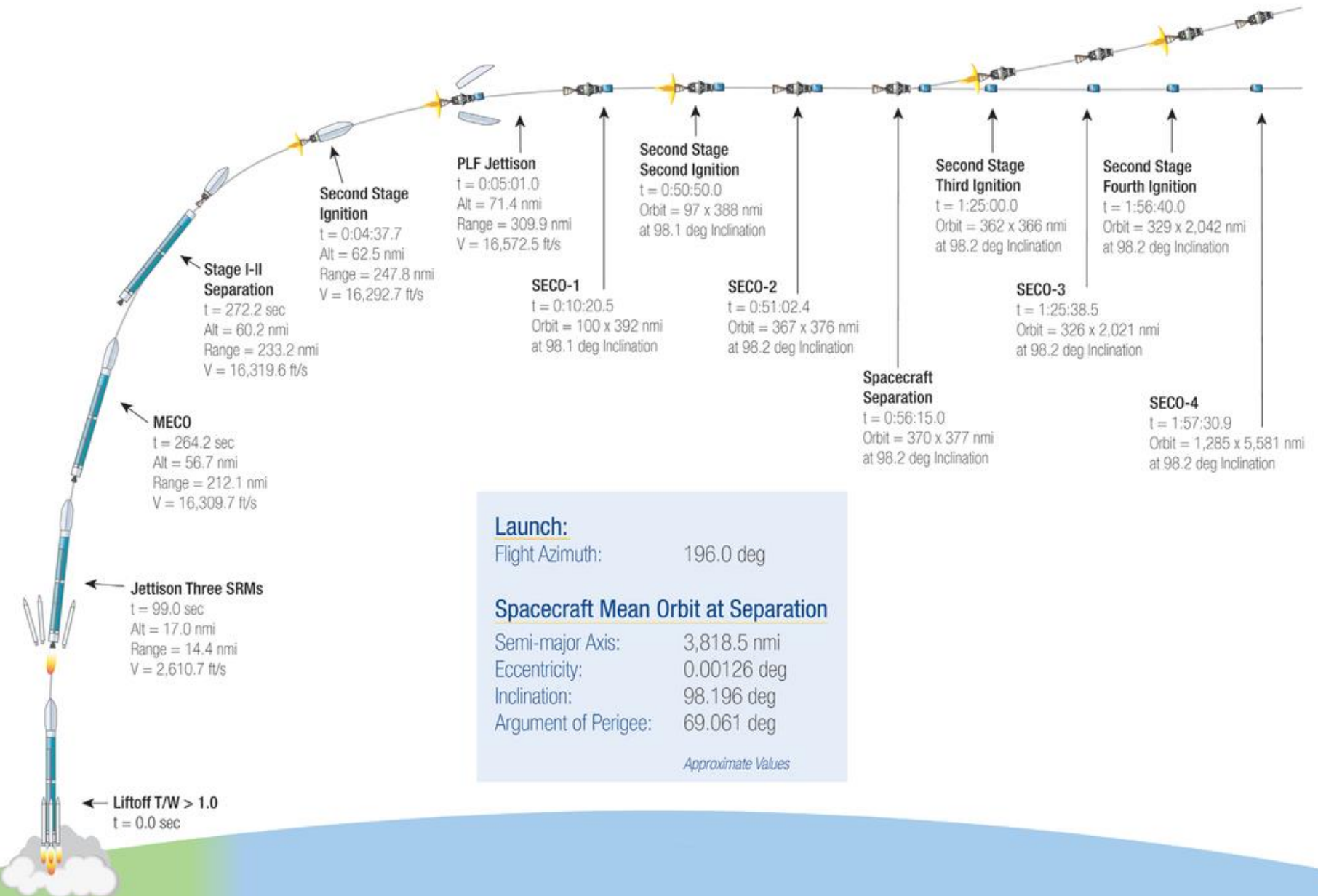




Launch Vehicle: Delta II 7320



Burn Duration	Coast Duration	Burn Duration	Coast Duration	Coast Duration	Burn Duration	Coast Duration	Burn Duration
0:5:42.9	0:40:29.5	0:00:12.4	0:05:12.6	0:28:45.0	0:00:38.5	0:31:01.5	0:00:50.9



Launch:

Flight Azimuth: 196.0 deg

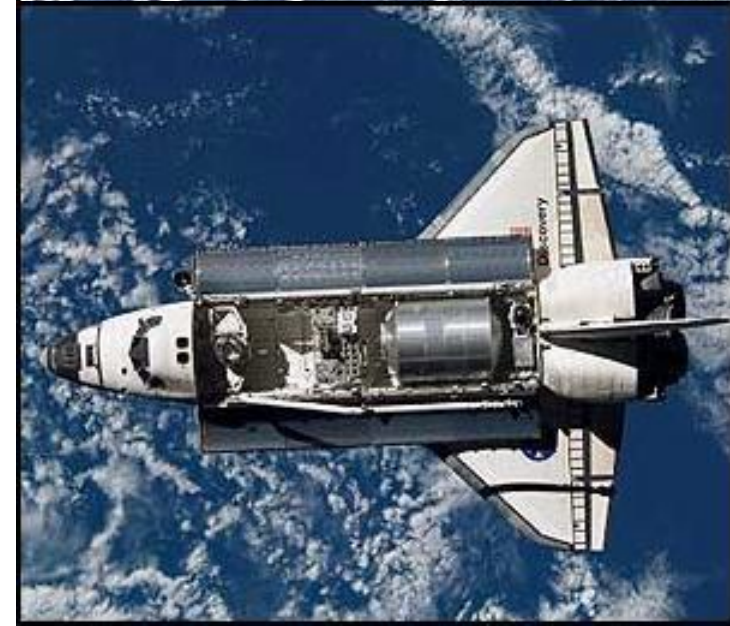
Spacecraft Mean Orbit at Separation

Semi-major Axis: 3,818.5 nmi
 Eccentricity: 0.00126
 Inclination: 98.196 deg
 Argument of Perigee: 69.061 deg

Approximate Values

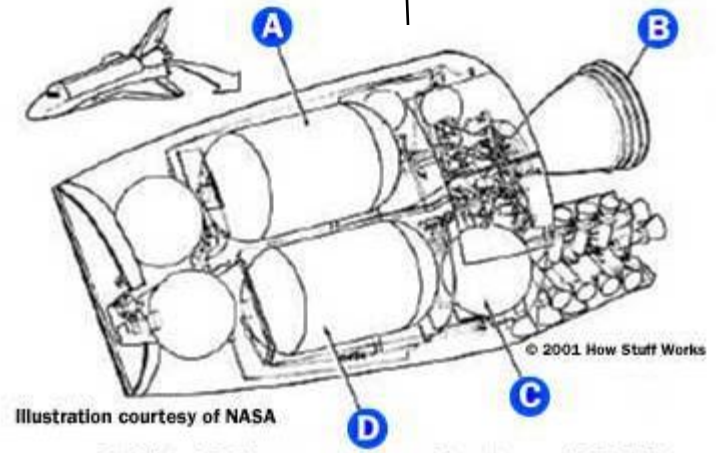
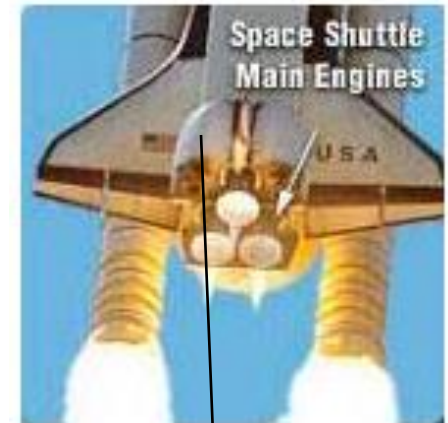
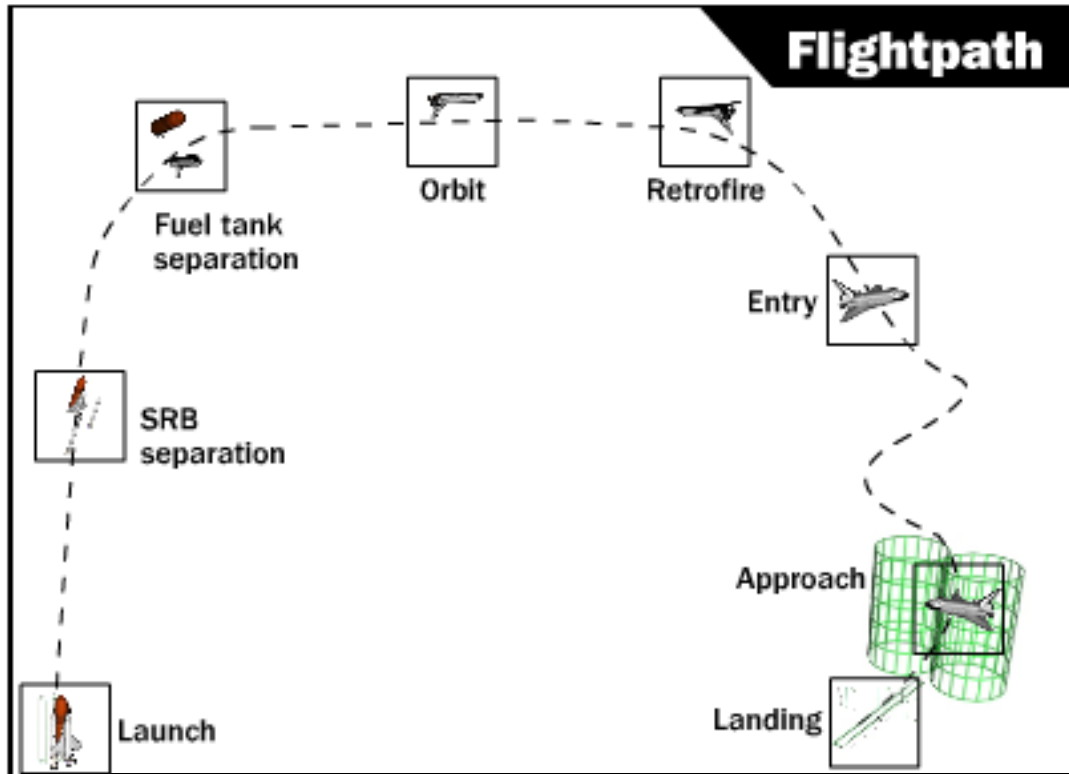


Space Shuttle Transportation System

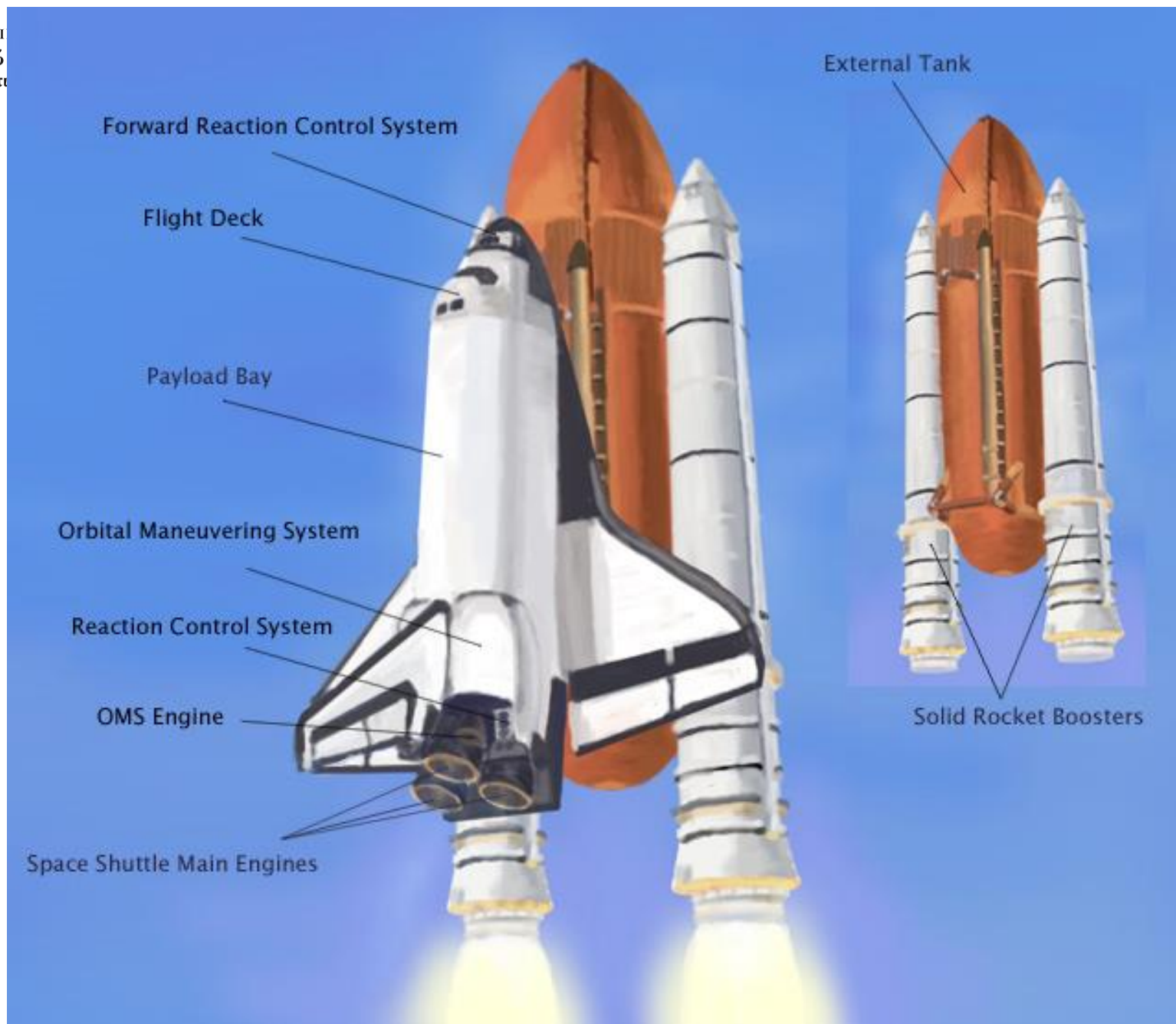


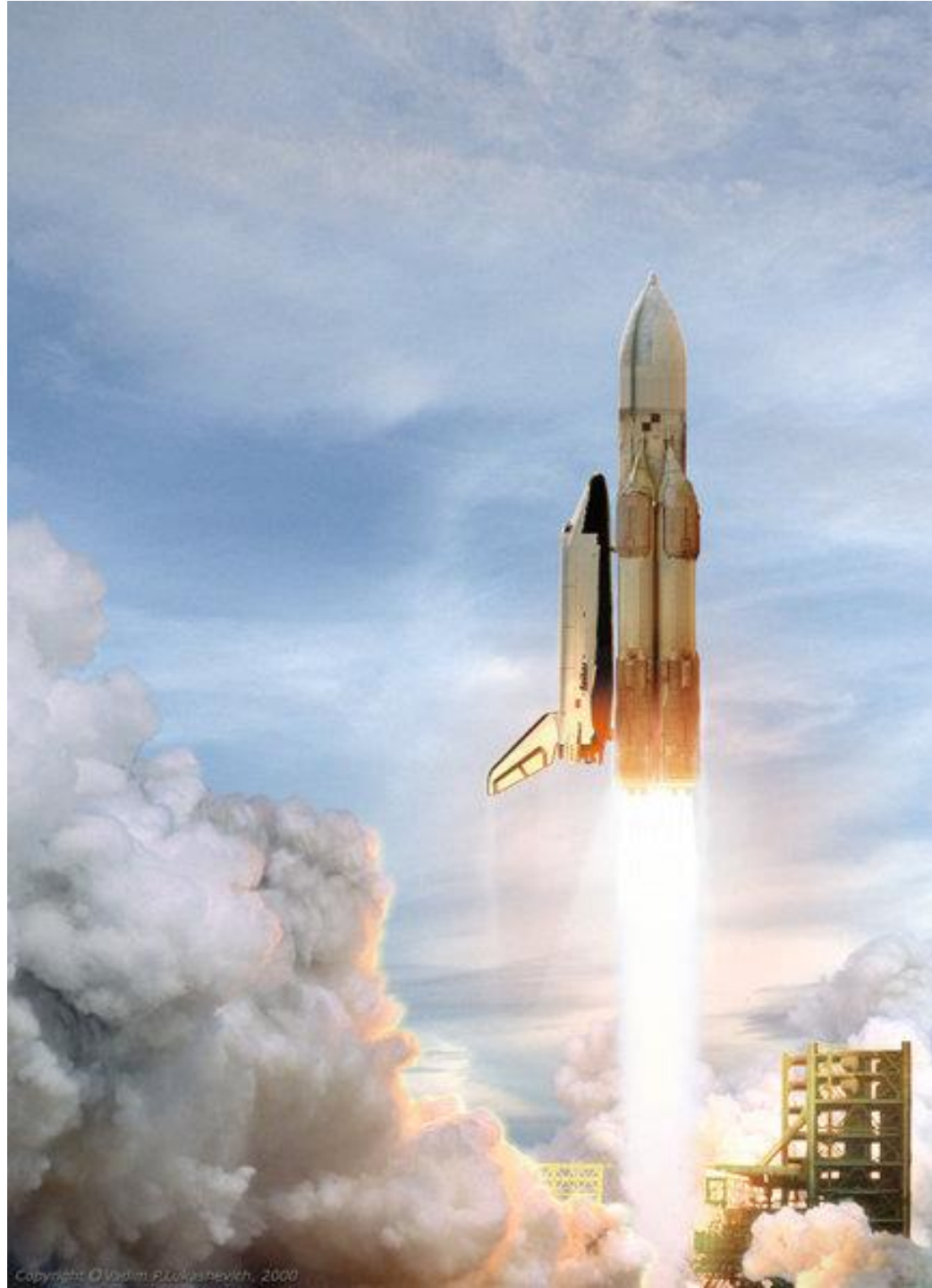


Space Shuttle



<http://science.howstuffworks.com/space-shuttle1.htm>





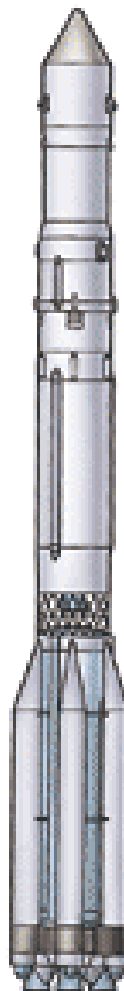


Ariane 5



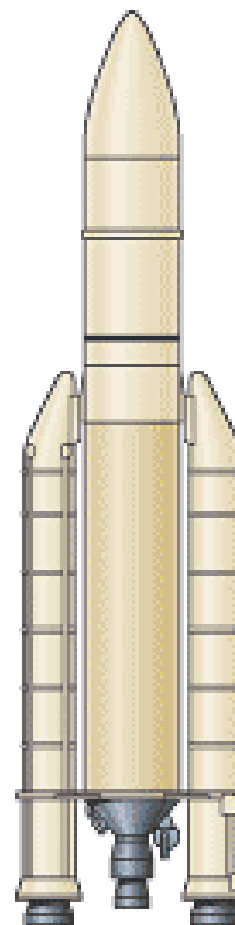
Proton

Russia
180 feet
(55 meters)



Ariane 5

European
Space Agency
167 feet
(51 meters)



A Class

(Soyuz-U)
Russia
165 feet
(50 meters)





Soyuz





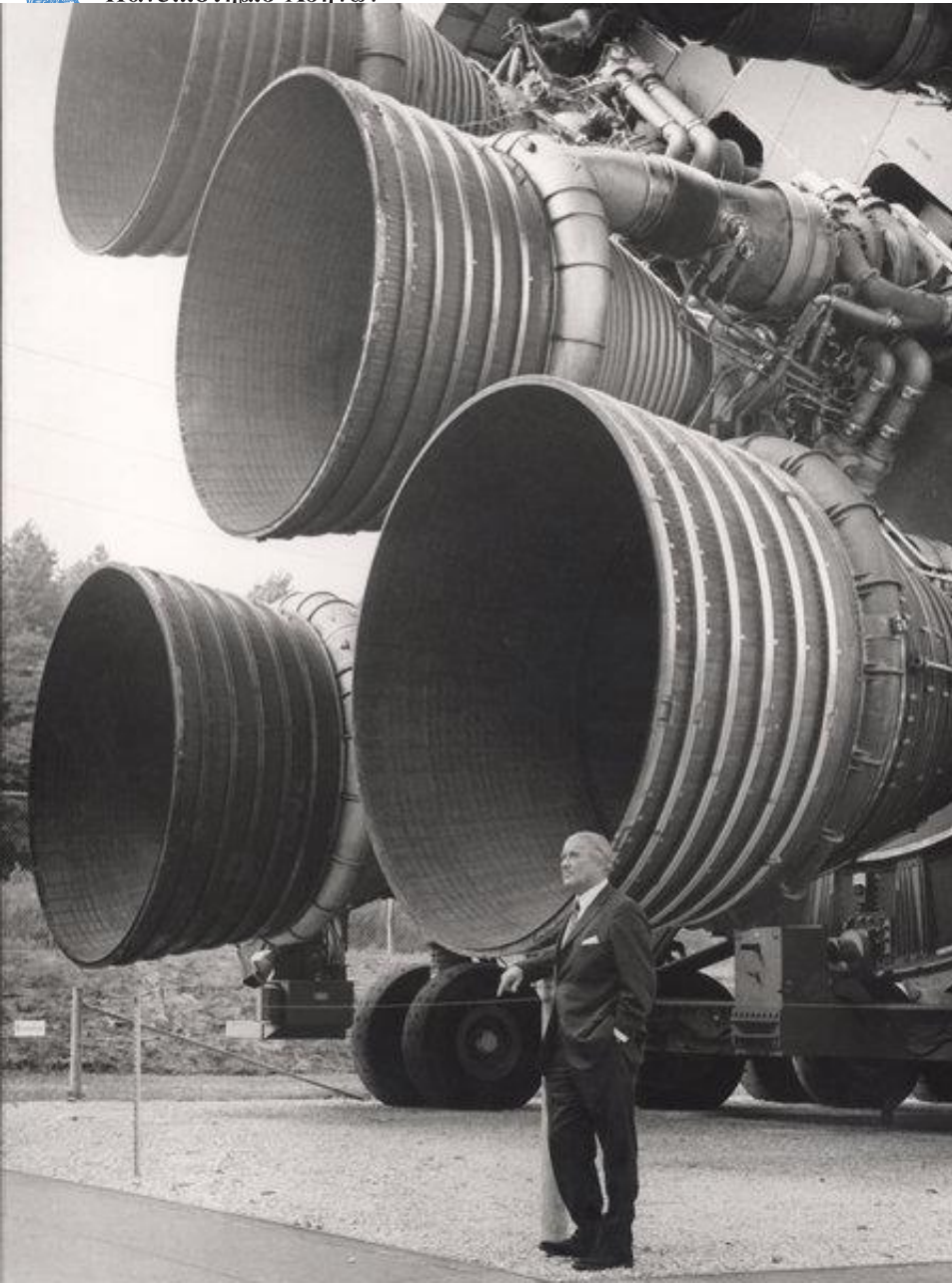
Other Launch Vehicles

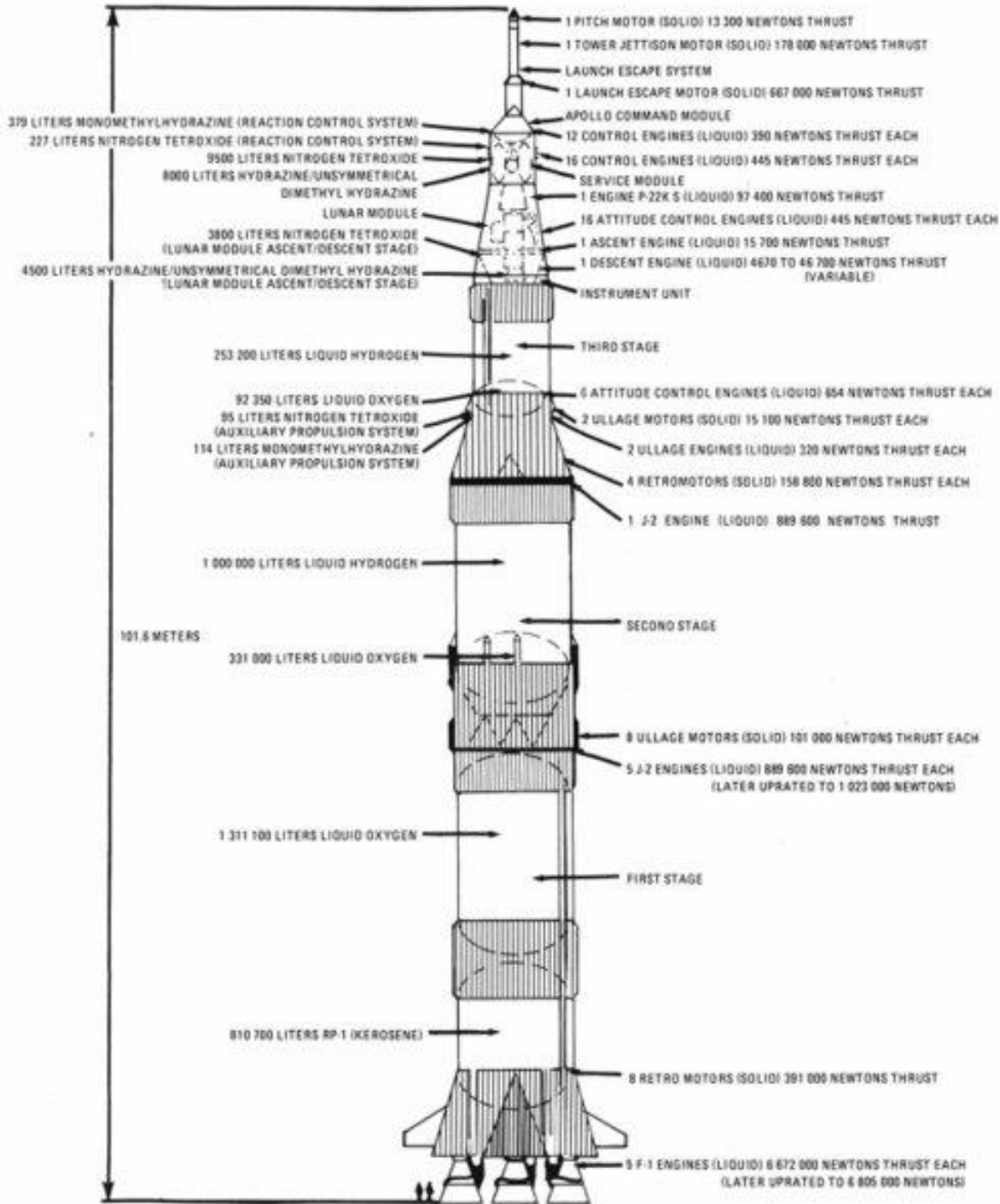


Saturn 5



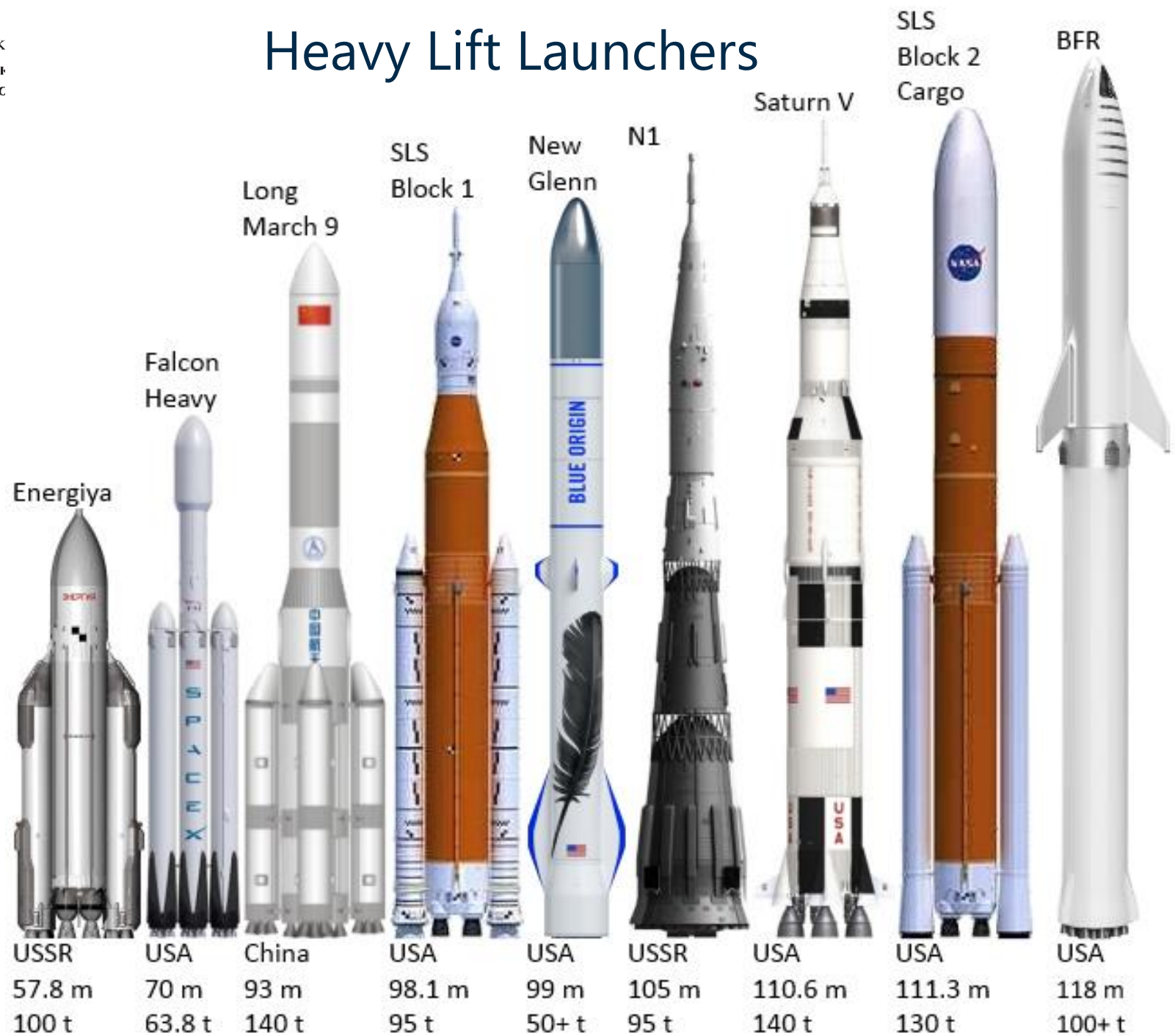
ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
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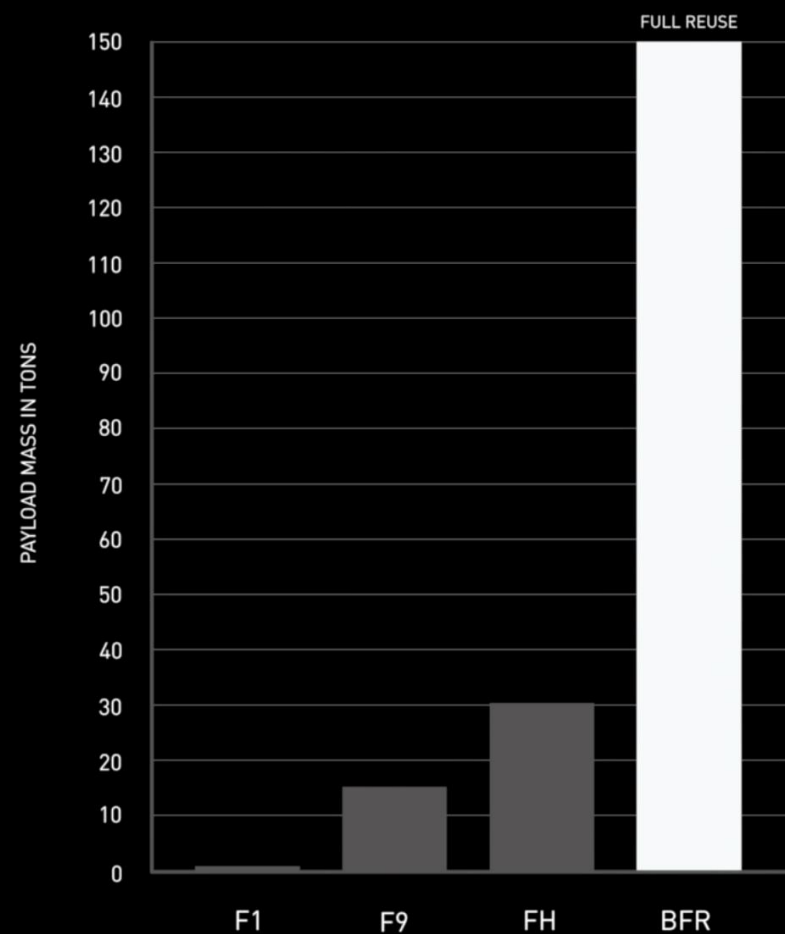
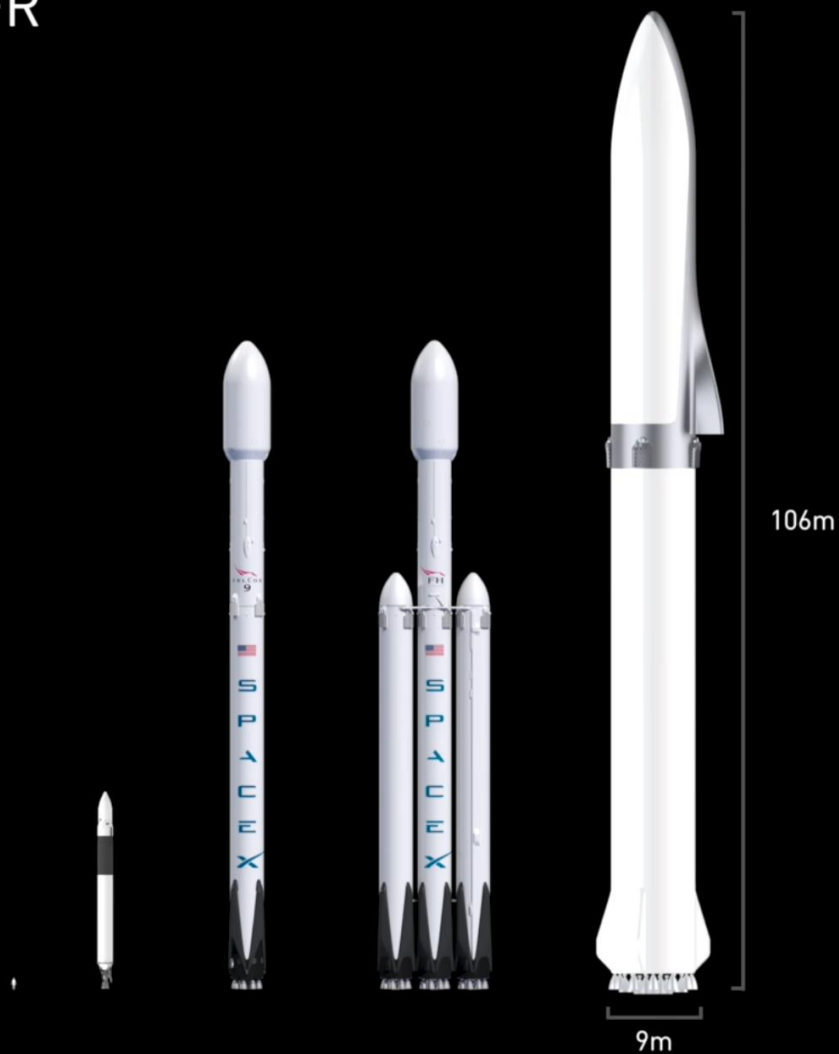
Heavy Lift Launchers





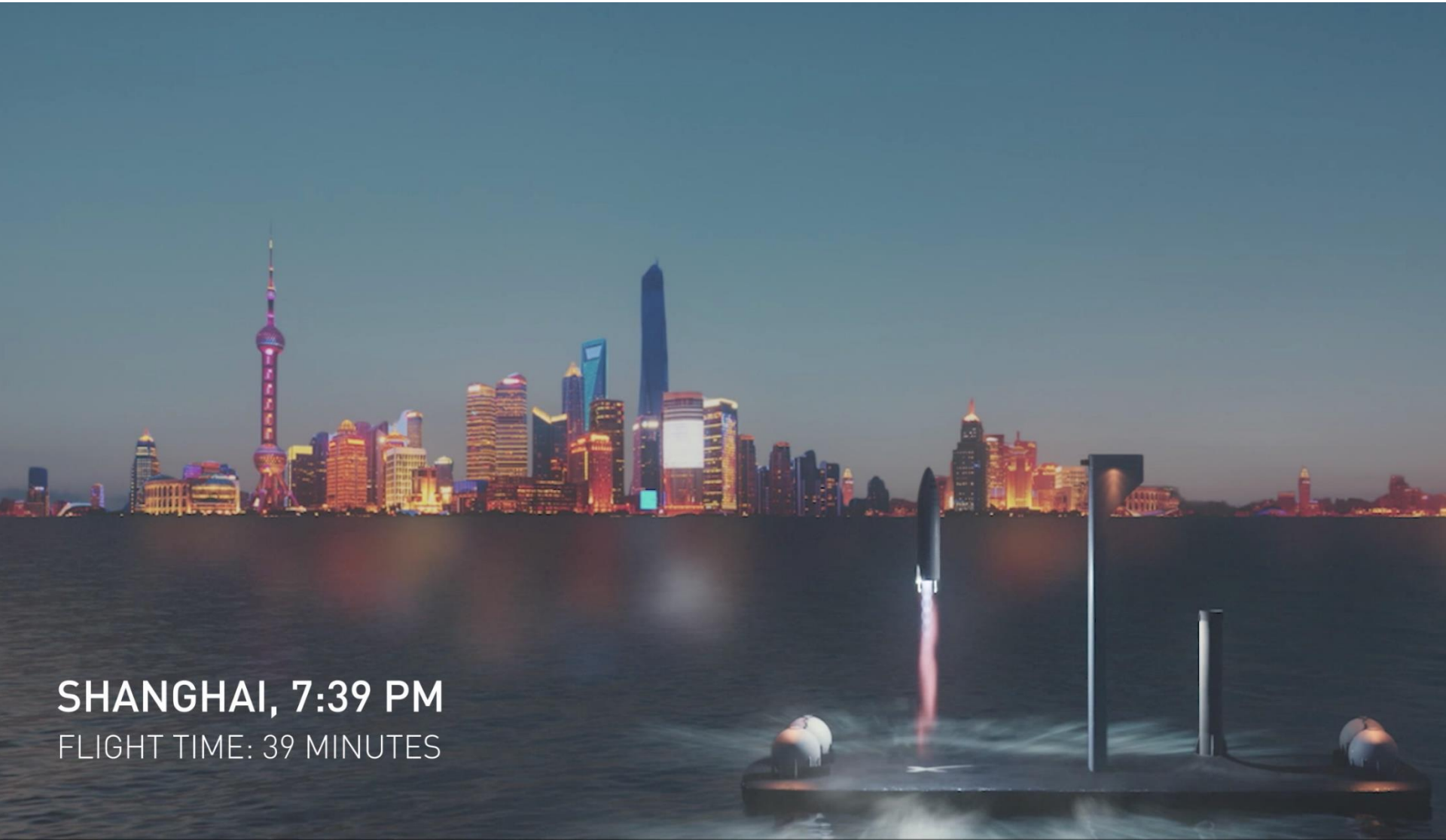
Space X BFR Reusable Heavy Launcher

BFR





BFR: New York to Shanghai in 40 Minutes!

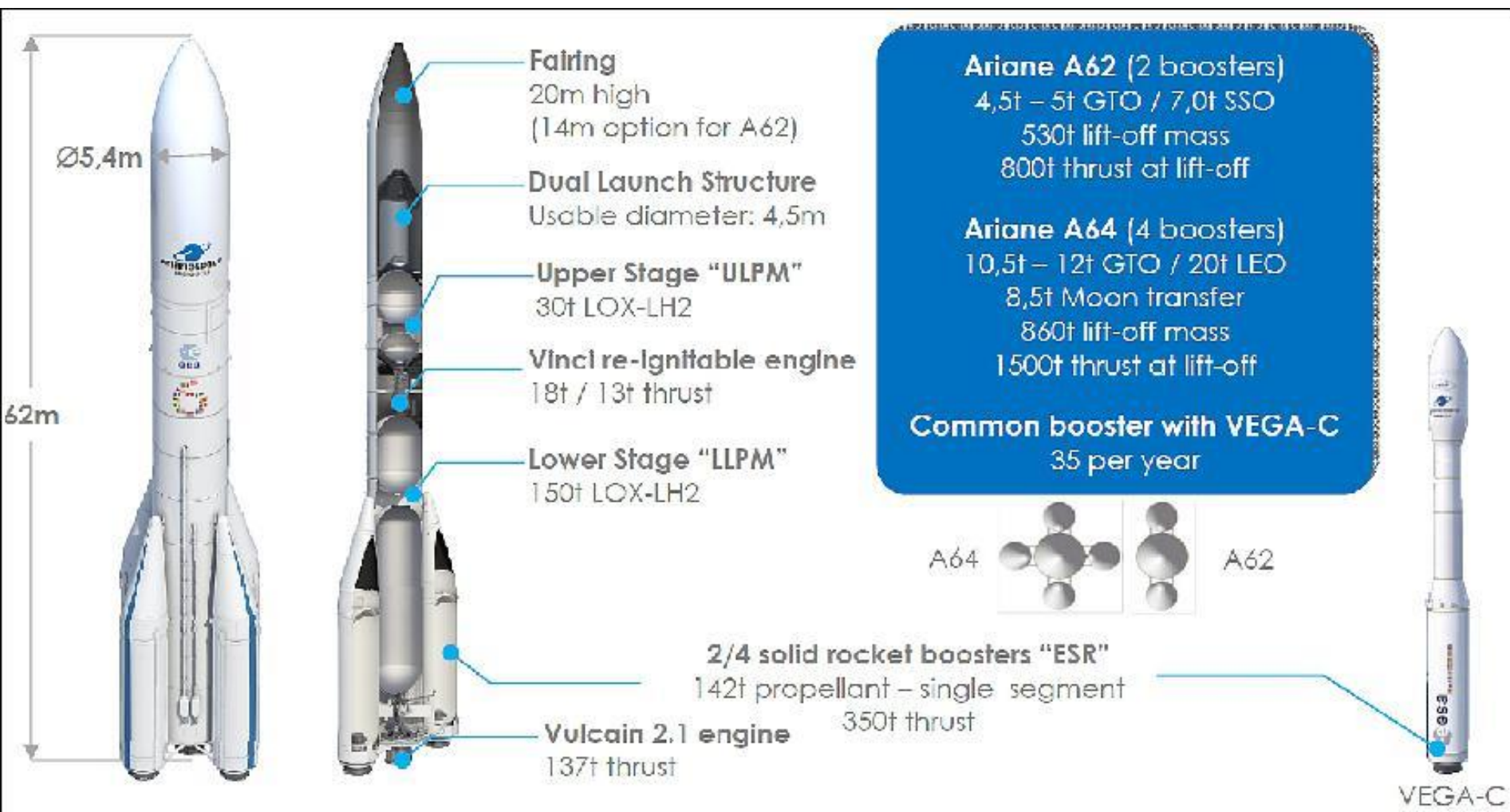


SHANGHAI, 7:39 PM

FLIGHT TIME: 39 MINUTES

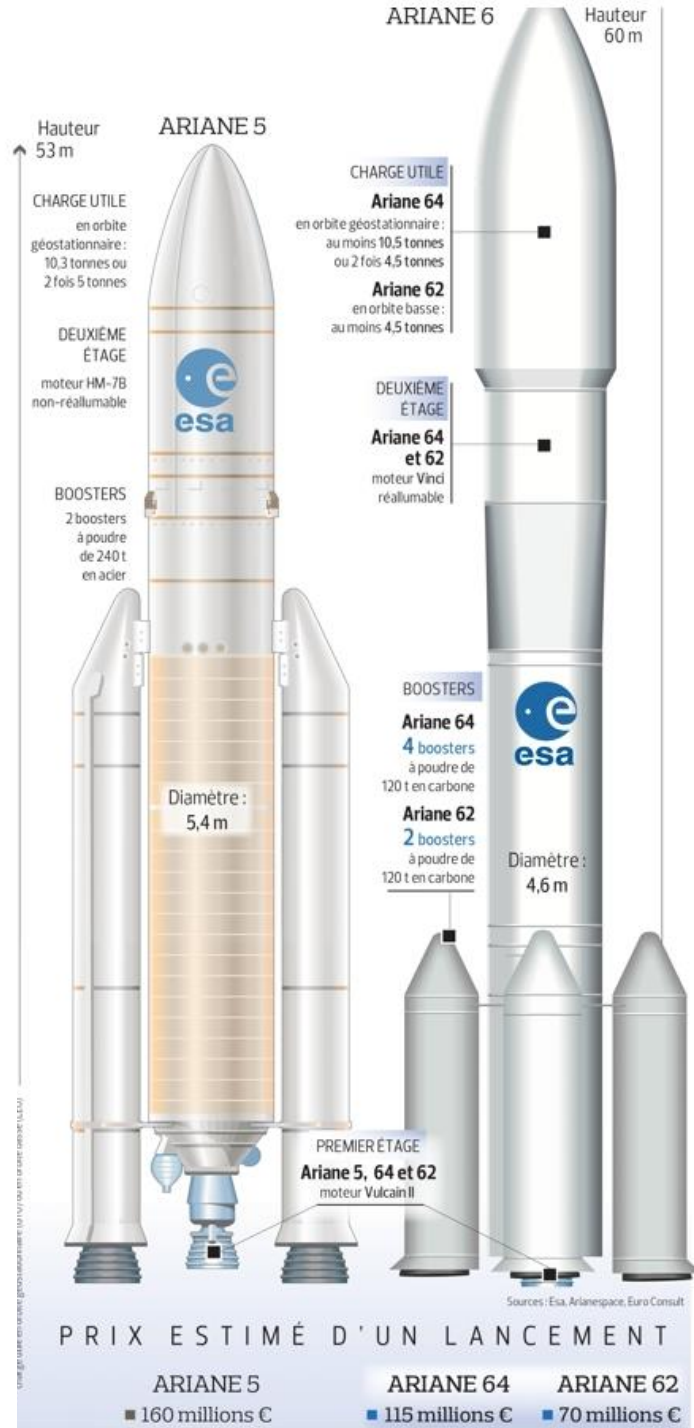


Ariane 6





Ariane 6



FALCON HEAVY

The world's most powerful rocket

Height: 70 meters (229.6 feet)

Stages: Two

Boosters: Two

Re-usable Cores: Three

Engines: 27

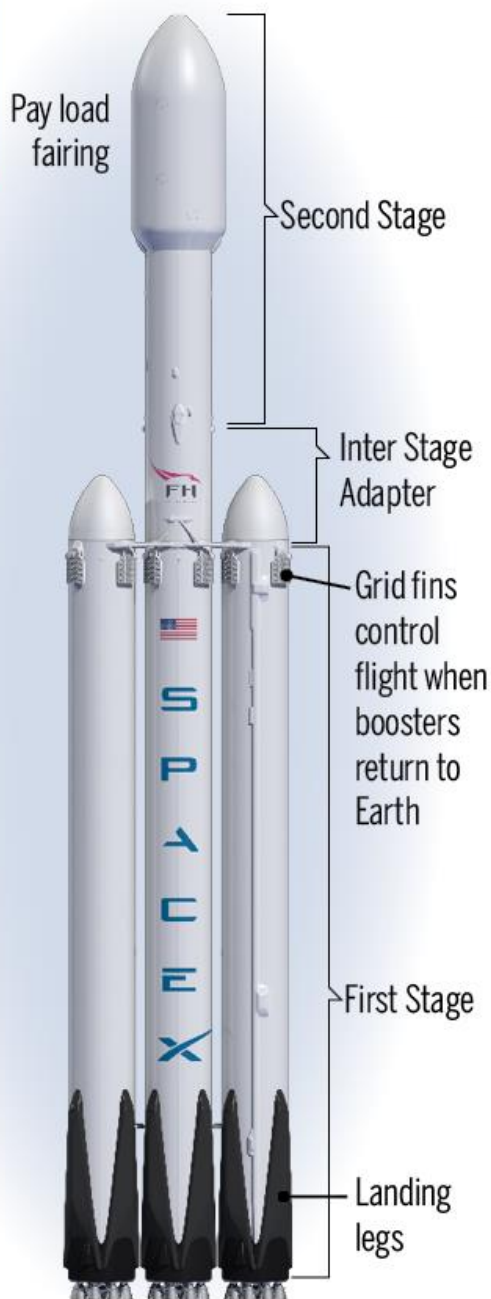
Total width: 12.2m

Mass: 1,420,788kg

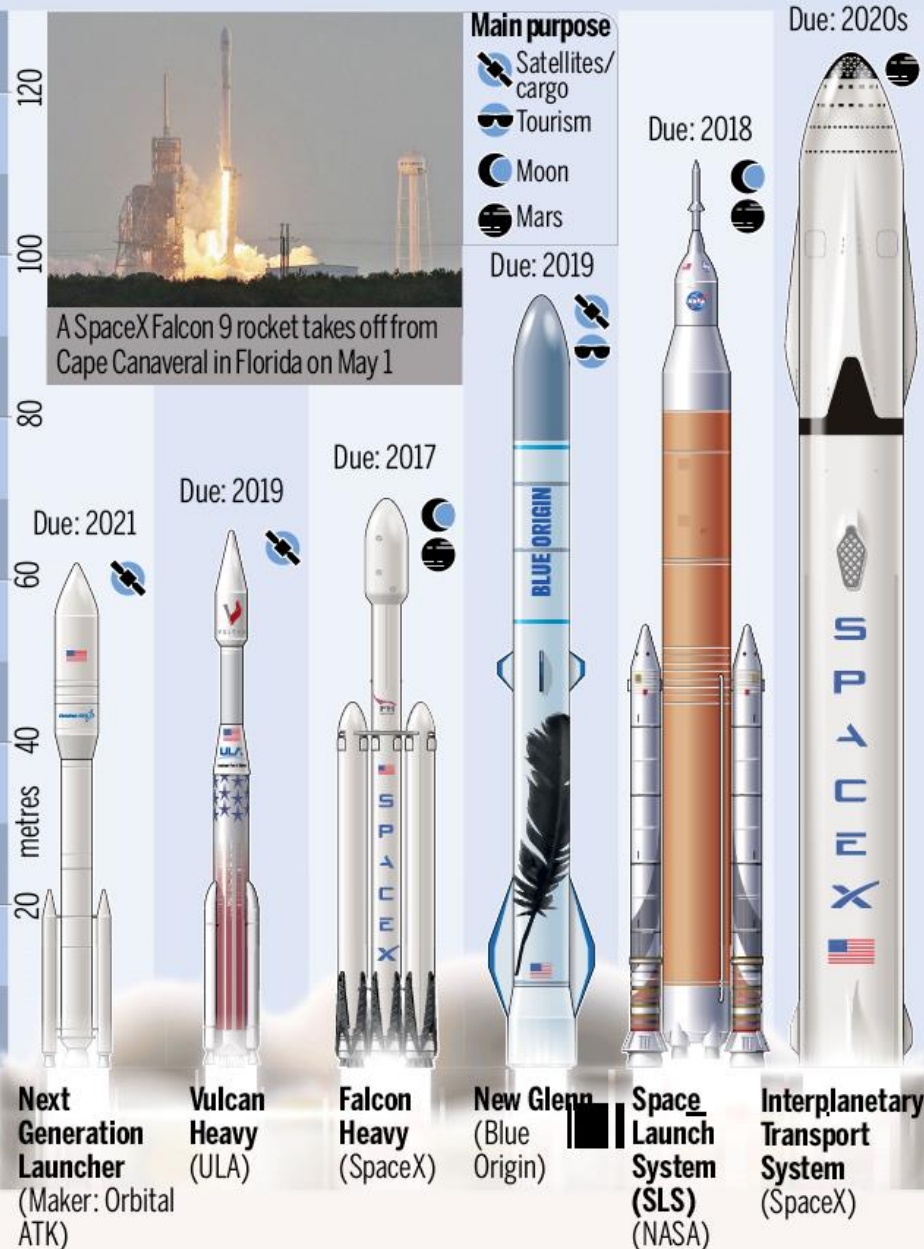
Total thrust at lift-off: 22,819 kilonewtons

PAYLOAD

- To Low Earth Orbit: 63,800kg
- To Mars: 16,800kg
- Will allow SpaceX to enter the new satellite launch markets



US ROCKETS IN THE RACE TO EXPLORE SPACE



Blue Origin 'New Glenn'

3-STAGE

2-STAGE

7-M FAIRING

New Glenn features more than twice the payload volume of any 5-meter class commercial launch system.

SECOND STAGE

Powered by a re-ignitable BE-4U, the second stage is optimized for operations in the vacuum of space.

96 m
(313 ft)

PERFORMANCE

2-stage New Glenn can lift 13 metric tons to GTO and 45 metric tons to LEO.

THRUST

With seven reusable BE-4 liquid oxygen, liquefied natural gas engines, the first stage generates 17300 kN of thrust (3.85 million lbs.).

THIRD STAGE

Our BE-3U liquid hydrogen, liquid oxygen upper stage engine propels the third stage.

99 m
(326 ft)

LIFT

Unique aerodynamic control surfaces provide maximum lift and cross range for controlled first stage reentry and landings.

REPEAT

New Glenn's first stage is designed for operational reusability with minimal service between flights.





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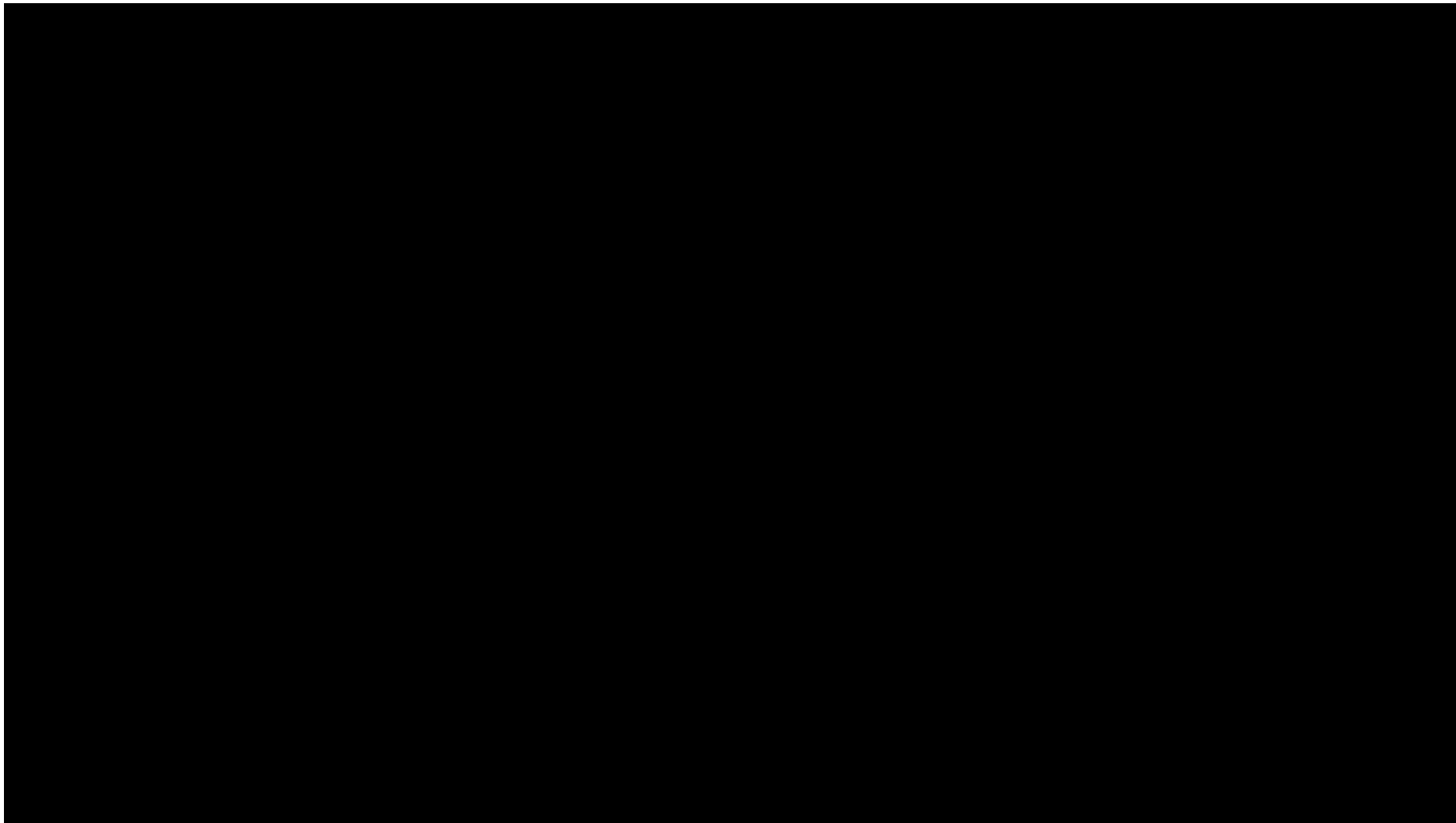
Soyuz Launcher – Failure (2018)

<https://www.youtube.com/watch?v=5boa6wAK0Sc&t=141s>



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Εθνικό και Καποδιστριακό
Πανεπιστήμιο Αθηνών

Space Shuttle Columbia Accident



<https://www.youtube.com/watch?v=dNdDpc8HsaY&t=326s>



Soyuz Docking with the ISS



<https://www.youtube.com/watch?v=yW-0WM1VjIQ>



Conclusion: Destination Earth

