
Live video from space
Using COTS hardware
and open source software
COPENHAGEN
SUBORBITALS

Timeline

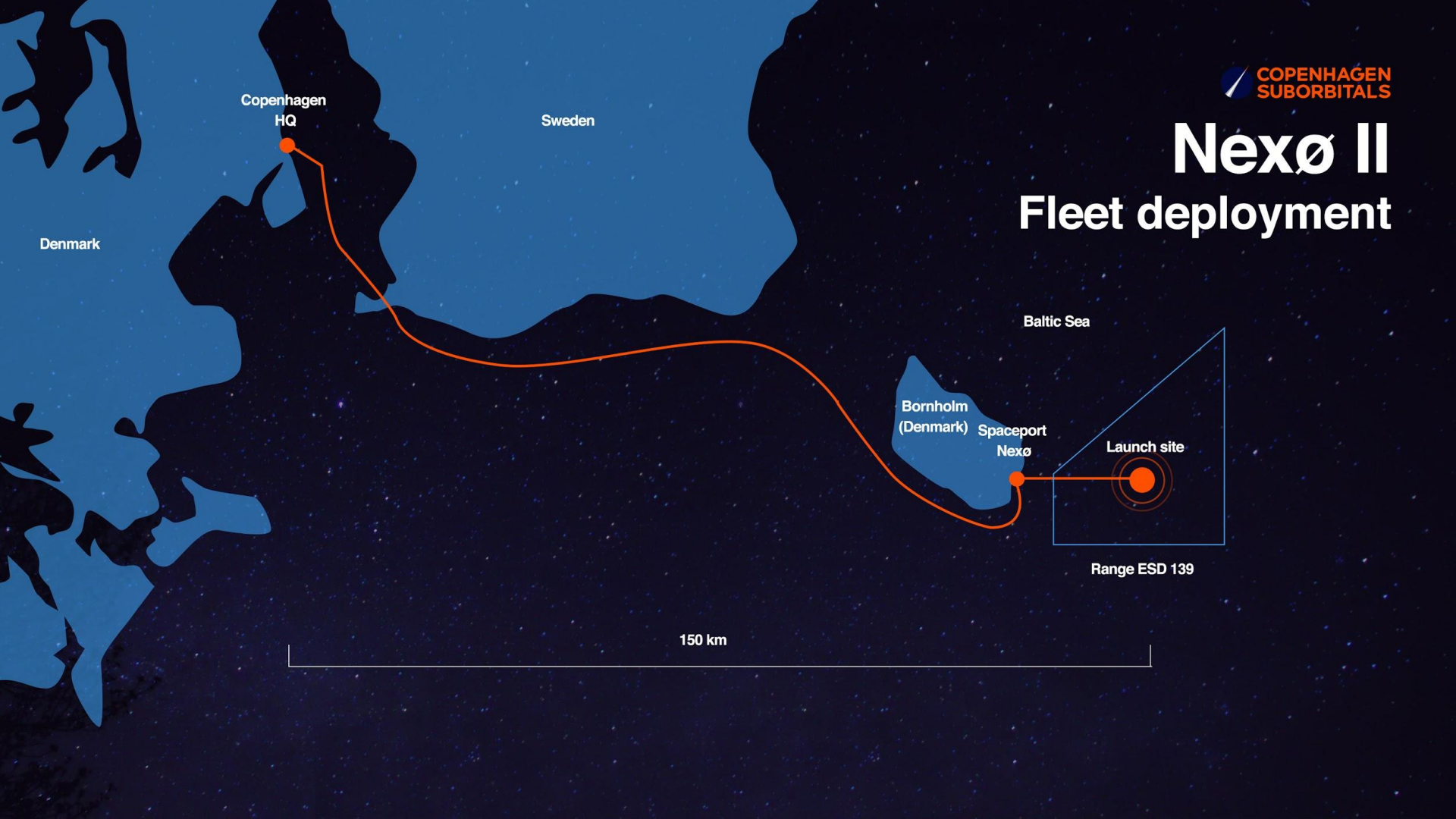
Key programme elements:

- Launch platform
- Spica rocket
- Spica capsule
- BPM-100 engine
- Astronaut selection
- Crowdfunding

COPENHAGEN SUBORBITALS

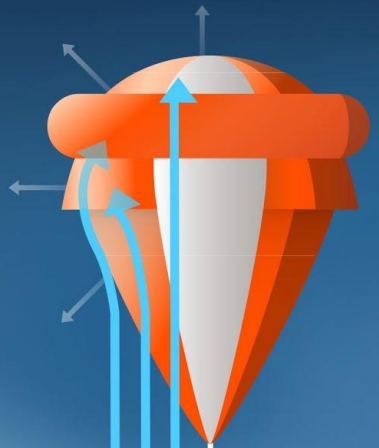
2011	2012	2013	2014	2016	**2018**	?
HEAT-1X	TDS / Smaragd	Sapphire	HEAT-2X	Nexø I	**Nexø II**	Spica

Artwork by Jonas Lindell


COPENHAGEN SUBORBITALS
Nexø II
Fleet deployment
Copenhagen HQ
Sweden
Denmark
Baltic Sea
Bornholm (Denmark)
Spaceport Nexø
Launch site
Range ESD 139
150 km


SPUTNIK

Nexø II flight events



NOSE CONE SEPERATION

BALLUTE DEPLOYMENT

ENGINE CUT-OFF

PARACHUTE REEFED

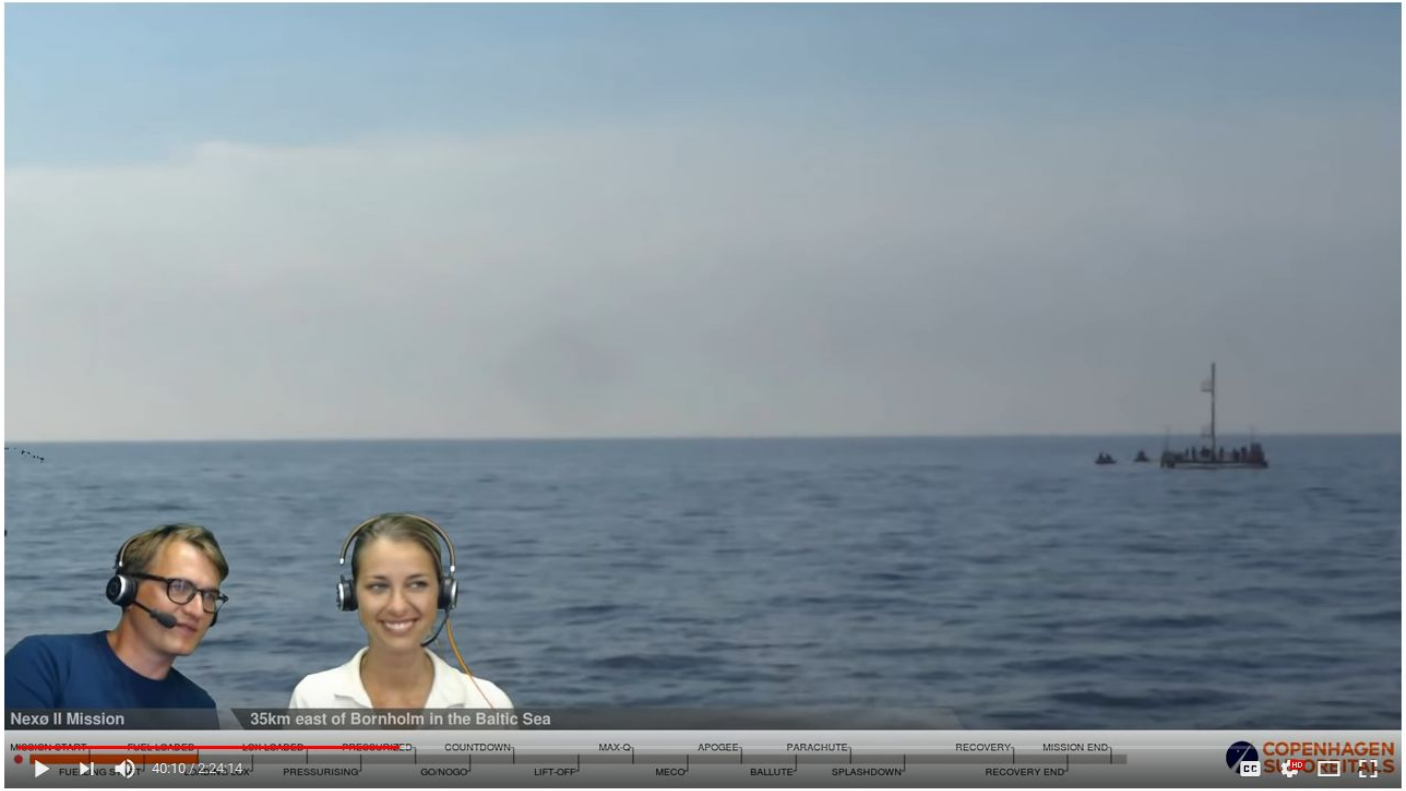
PARACHUTE FULL CANOPY

LIFTOFF

SPLASHDOWN

COPENHAGEN SUBORBITALS

Artwork by Carsten Brandt & Jonas Linell



The Nexø II Mission

38,225 views

830 19 SHARE

Copenhagen Suborbitals
Streamed live on Aug 4, 2018

SUBSCRIBED 25K

Live chat replay

Neb Htims the satanic step

Ultimate Steve watch?v=--U6eptTIY4 mosaic

AntimatePcCustom damn. almost 2500 people watching 😀

Jrcraft Hi from Washington (state)!

Bo Holbo Rasmussen Yes.. Lets see the bottom..

Der Worlg vive la France

AntimatePcCustom everyone watching is awesome!

Argore hello from sweden!

Billy Sugger @Ralf Edmund Stranzenbach CANBUS atarts at about 100kbaud, and goes up way beyond 1Mbaud.

Tom Smith Anyone else in the UK up early?

MicroBlogganism Good LOX 😉

Slamsneider All the computers in mission control and onboard the rocket that alledgedly put a man on the moon was the same computerpower you have in your smartphone!

Frank Olesen The mosaic channel seems to bee without compression/streaming problems

Billy Sugger @Tom Smith Hya!

Rob yeah Tom

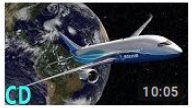
Dollar Projects hi everyone from INDIA

rur nick hi from Russia

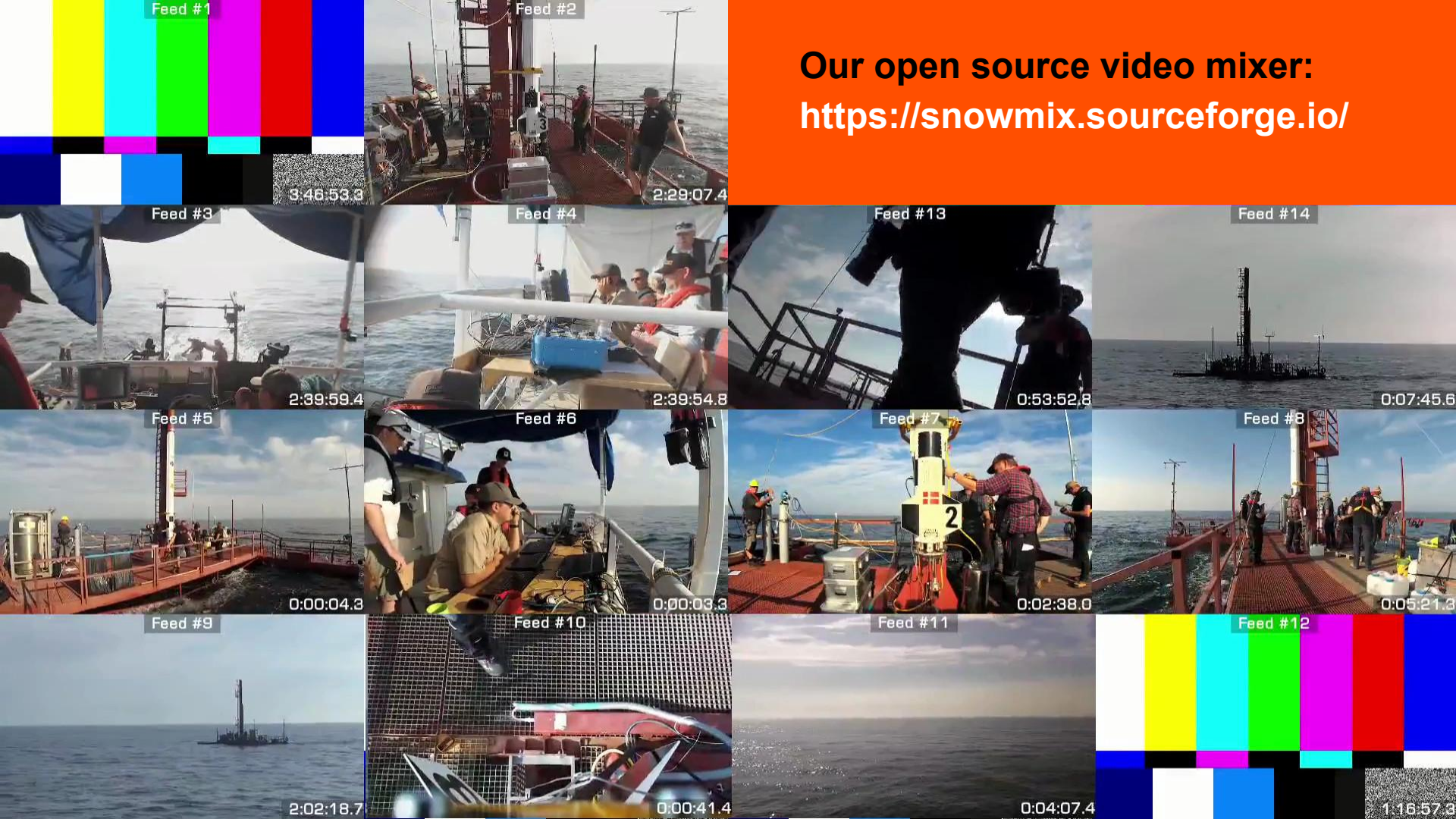
HIDE CHAT REPLAY

Up next

AUTOPLAY



Why can't we fly a plane into space ?
Curious Droid
3.9M views



Our open source video mixer:
https://snowmix.sourceforge.io/

Camera 1 (rear view)

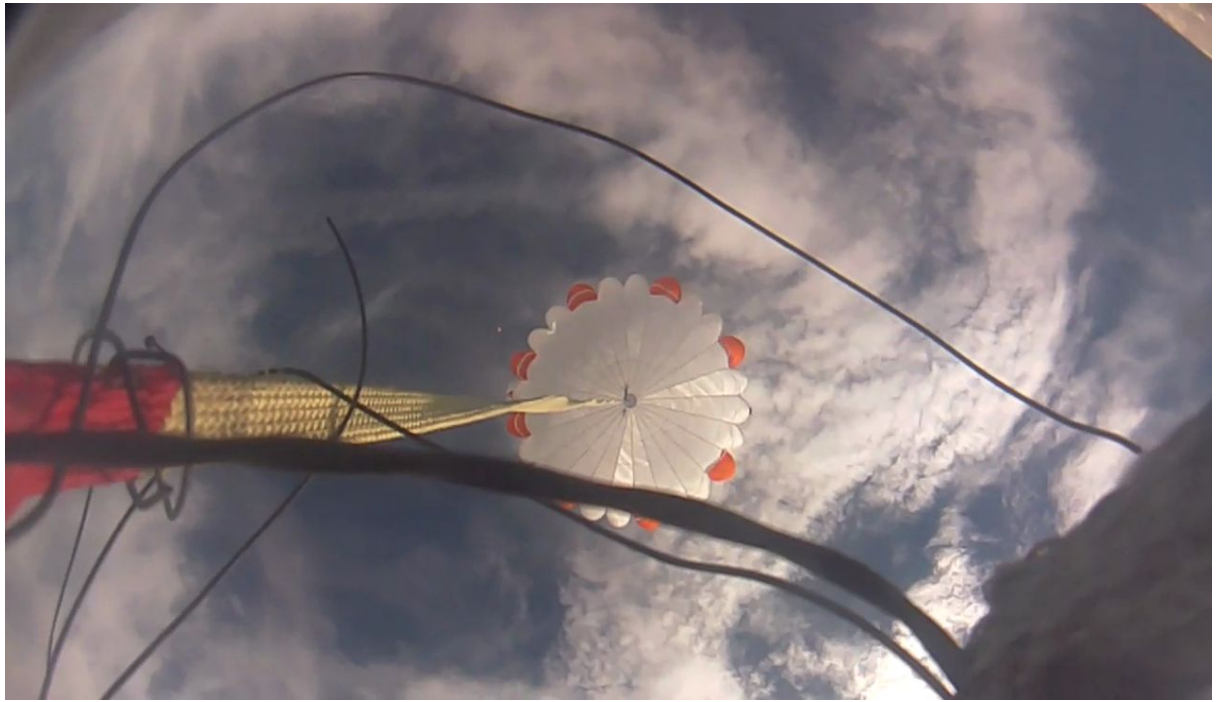
1

Camera 2 (horizon view)

2

Camera 3 (parachute)

3



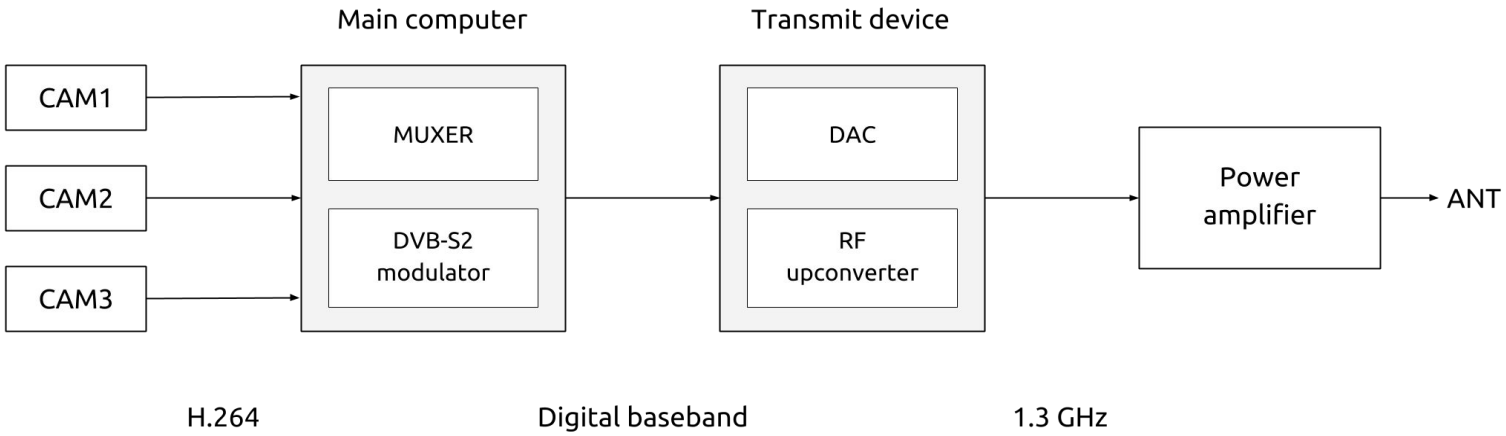
DVB-S2 transmitter

8-PSK, 2/3 code rate

12.1 Mbps data rate

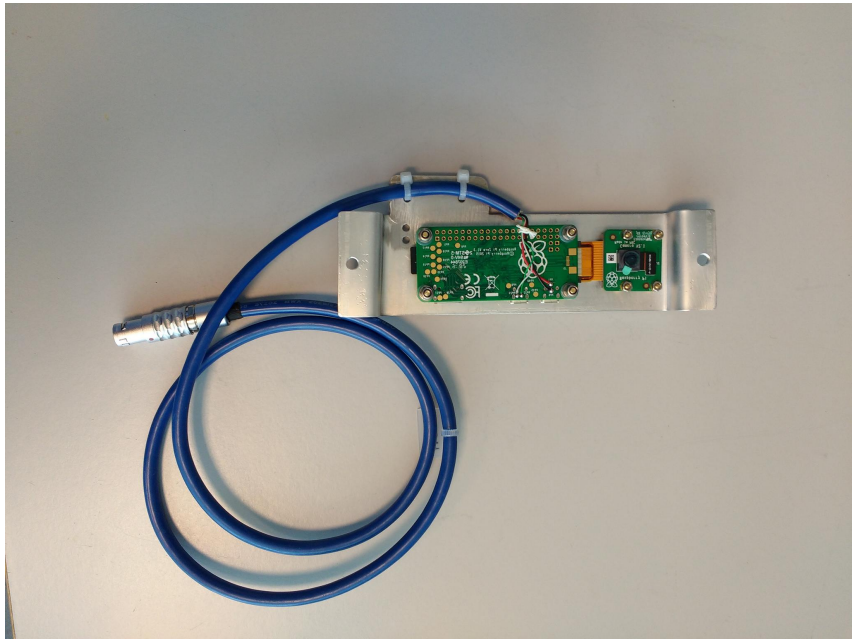
6.25 MSps / 8.4 MHz RF

3.5 W RF (30 W DC)

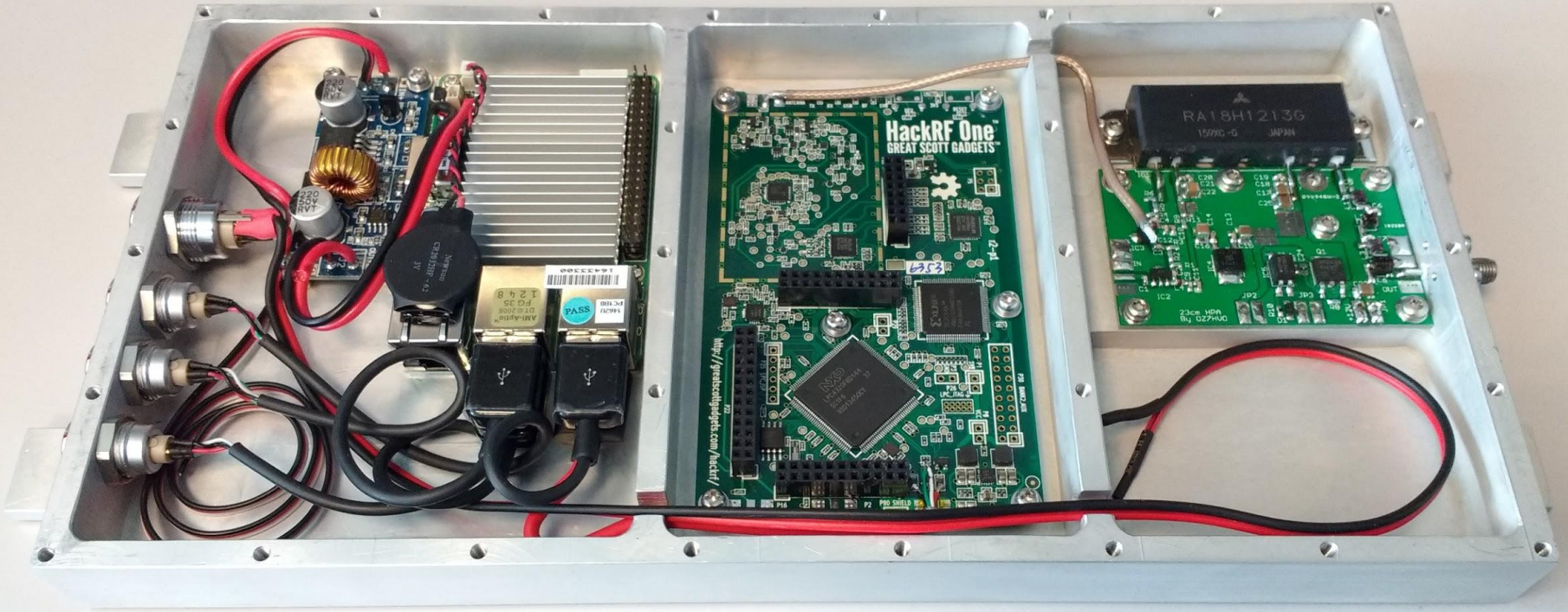


Software source code: http://github.com/csdvb

Cameras



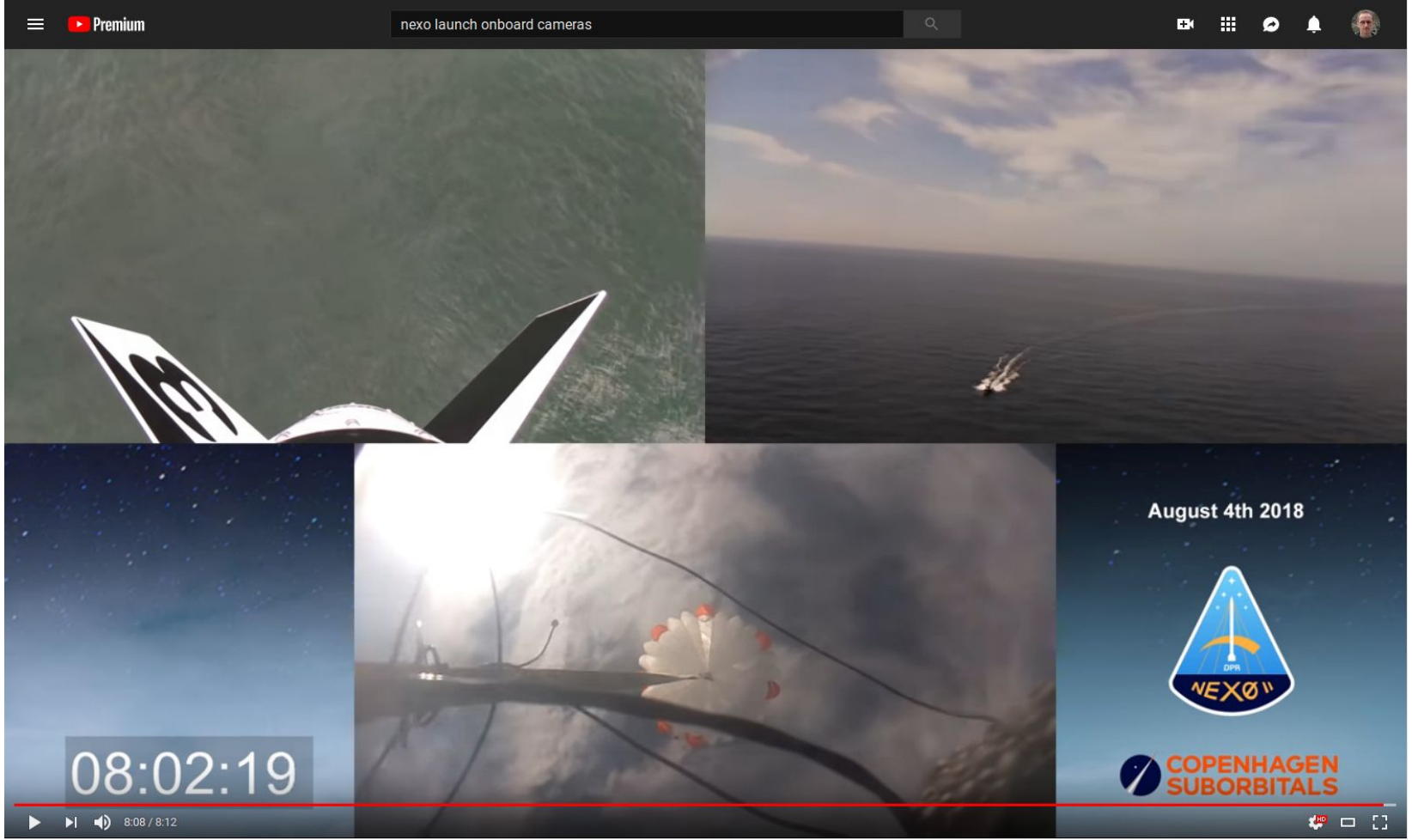
Raspberry Pi Zero and camera module



Main computer
(up-board)

DAC + RF
(HackRF)

Power amplifier
(Mini-Kits)



The Nexø II launch as recorded on all three onboard cameras.

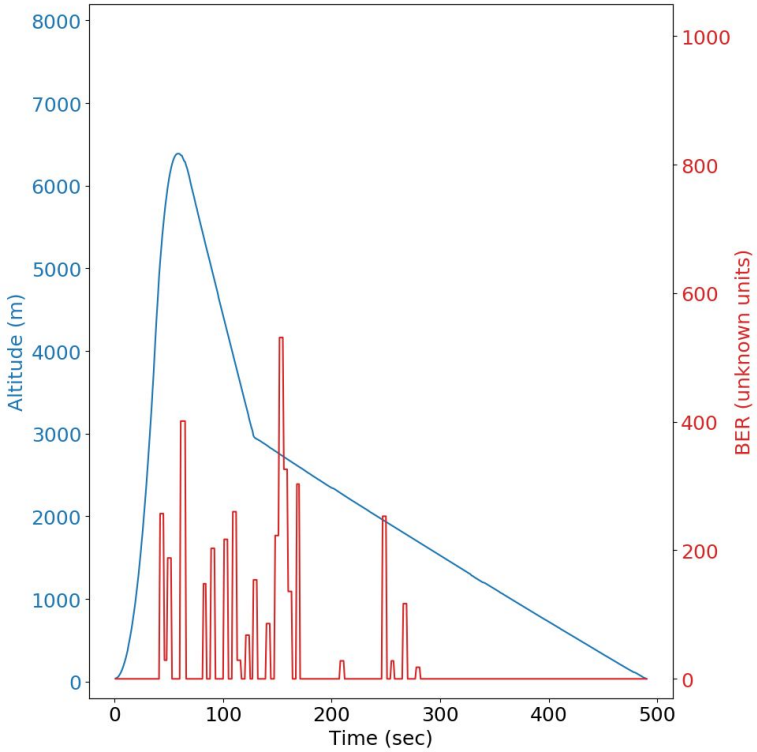
11,205 views

640 6 SHARE

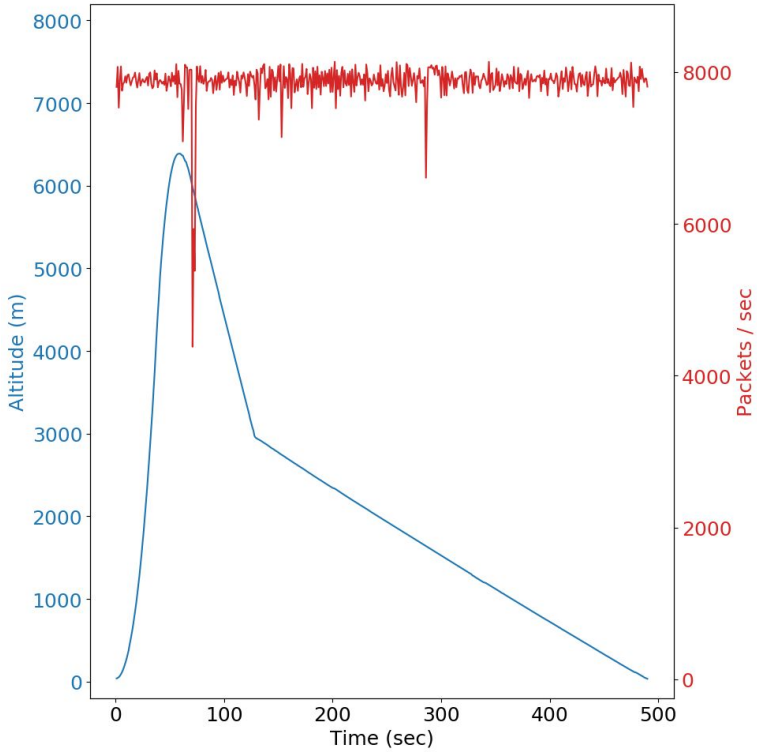
Up next AUTOPLAY

Air Breathing Ion Thrusters & Low Orbit Satellites

Bit error rate



Received packet rate



Conclusion

- Using COTS and open source to implement DVB-S2 worked
- The patch array antenna worked very well
- Modular design scalable to 50+ Mbps @ 10 MHz RF
- Flexible design for future evolution (4K, UHD, etc.)

Thank you!

Visit https://copsub.com for official updates

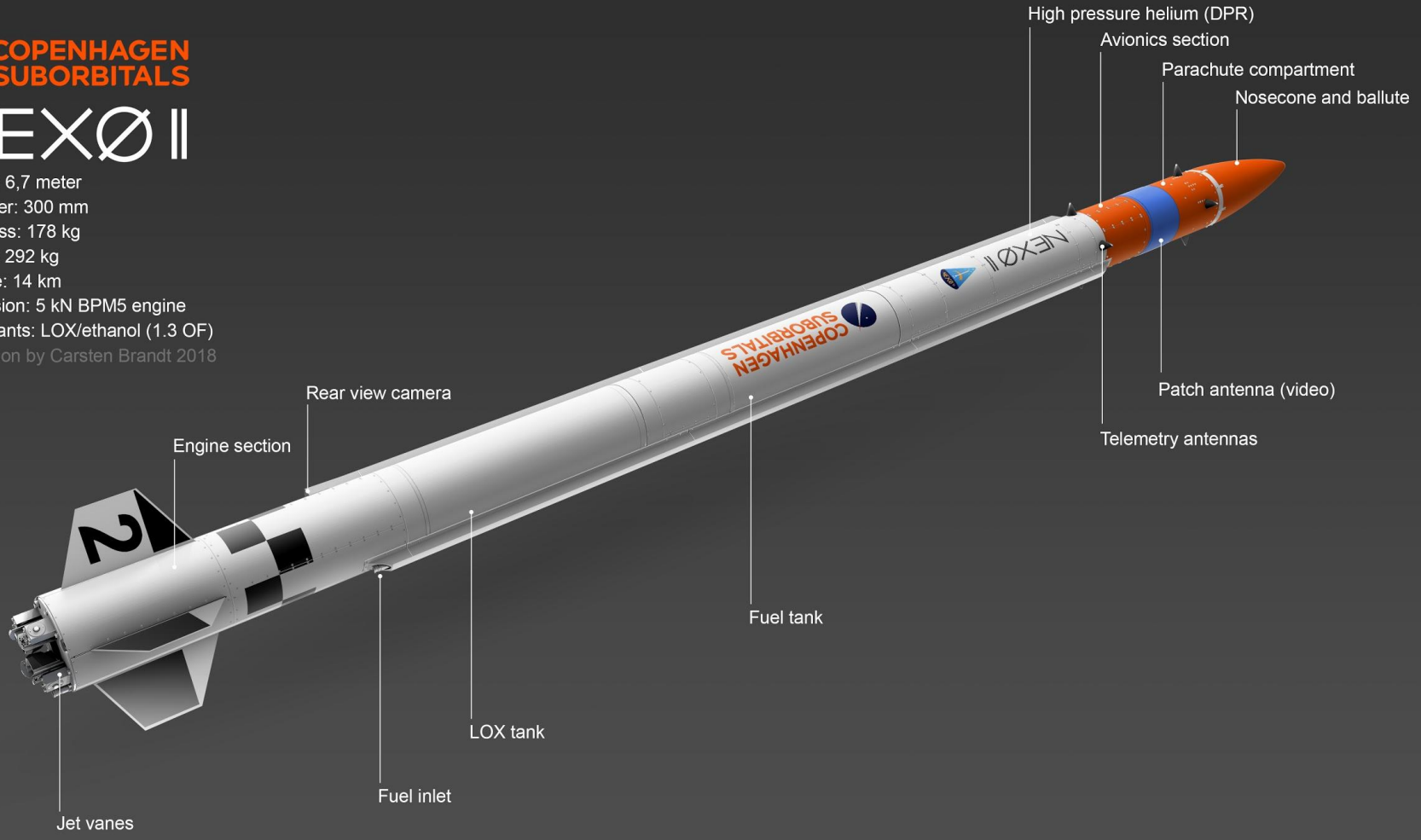
Follow @csete on Twitter for technical updates

Extra slides

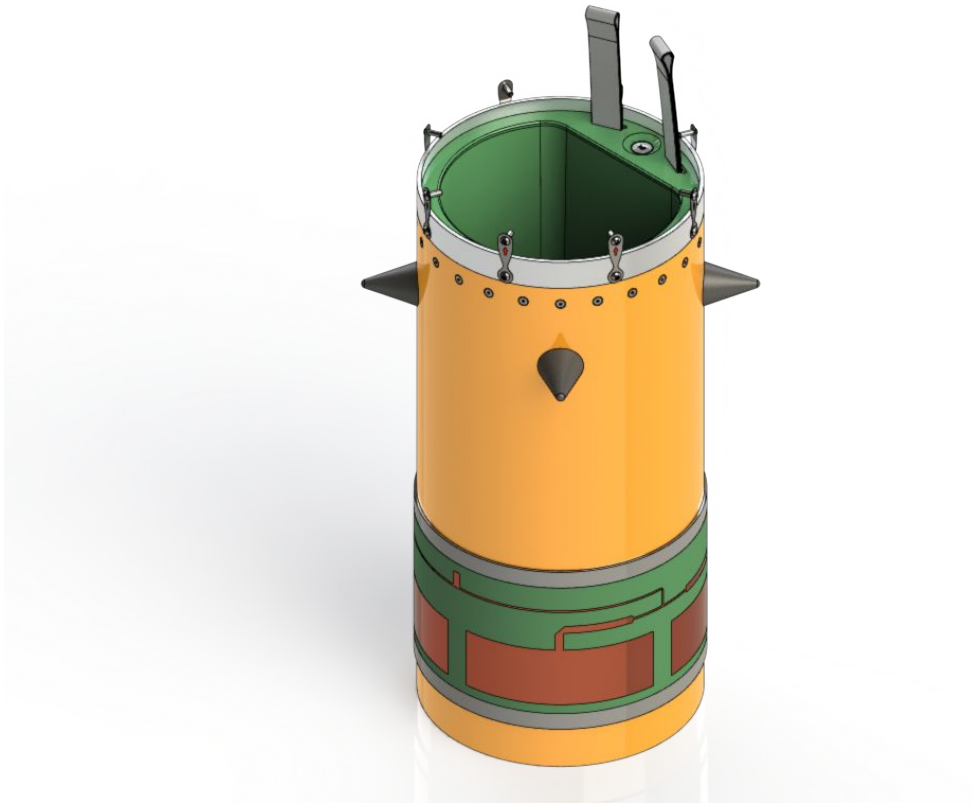
COPENHAGEN SUBORBITALS

NEXØ II

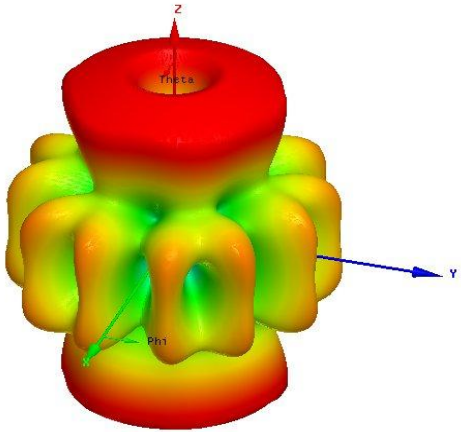
Length: 6,7 meter
Diameter: 300 mm
Dry mass: 178 kg
GLOW: 292 kg
Apogee: 14 km
Propulsion: 5 kN BPM5 engine
Propellants: LOX/ethanol (1.3 OF)
Illustration by Carsten Brandt 2018



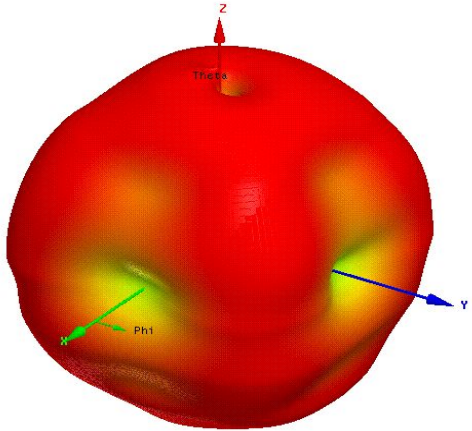
Patch array antenna



Radiation pattern



Monopoles



Patch array