



OBSERVATIONS OF FALCON-9 STAGE2 DEORBIT BURN [FEB 21, 2018]



FINAL DRAFT
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MARCH 22, 2018
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SIGNIFICANCE OF THIS EVENT

- Validation of serendipitous public sky monitoring activities which reacted awesomely and competently to totally unpredicted spectacle
- Best-ever videos [of at least three launches] of Falcon-9 second stage deorbit burn which occurred three hours after launch
- Clearly illustrated sequence of twin-lobed propellant dump ['butterfly'] followed by brief [1-2 seconds] forward-projected engine plume
- Numerous witness reports confirmed often-seen classic pattern of major misinterpretations and misperceptions of object motion and distance
- Nevertheless, investigation of public observations of the orbital event underscores surprising fact that potentially useful reports might wind up in the 'UFO' data files
- Proper analysis of such accidental observations may reveal vehicle performance parameters not openly discussed by the vehicle's operators

Space-X launch from Vandenberg AFB, California

- Best private discussion group –
- Mission events: <https://forum.nasaspaceflight.com/index.php?topic=44892.0>
- Mission discussion:
<https://forum.nasaspaceflight.com/index.php?topic=42485.0>
- **Spanish radar surveillance PAZ payload mass 1400kg into near-polar orbit. SpaceX also launched their demonstration satellites, Microsat 2a & 2b (a little under 400kg each, plus dispenser?), for the internet constellation.**
- Destination is a sun-synchronous orbit at 514 km altitude with an inclination of 97.44 degrees
- Launch date: Feb 21st 14:17 UTC.

The press kit is available here:

http://www.spacex.com/sites/spacex/files/paz_press_kit_2.21.pdf

John Taylor, Director of Communications, 310-363-6703, media@spacex.com.

PAZ mission statistics

49th launch of a Falcon 9 rocket since 2010
55th launch of Falcon rocket family since 2006
8th Falcon 9 launch from Vandenberg Air Force Base
29th launch of the upgraded Falcon 9
6th upgraded Falcon 9 launch from Vandenberg Air Force Base
1st launch for Spain's Hisdesat by SpaceX
1st launch for SpaceX's Starlink broadband network
18th Falcon 9 night launch
3rd Falcon 9 launch of 2018
4th SpaceX launch of 2018
2nd launch from Vandenberg Air Force Base in 2018

NORTH PACIFIC.

1. HAZARDOUS OPERATIONS, ROCKET LAUNCHING

211350Z TO 211501Z FEB, ALTERNATE 1350Z TO 1501Z

DAILY 22 AND 23 FEB IN AREA BOUND BY

31-50N 121-31W, 31-50N 120-57W,

30-06N 120-50W, 30-06N 122-08W.

2. HAZARDOUS OPERATIONS, SPACE DEBRIS

211718Z TO 211751Z FEB, ALTERNATE 1718Z TO 1751Z

DAILY 22 AND 23 FEB IN AREA BOUND BY

50-17N 168-05W, 50-17N 161-46W,

41-47N 165-43W, 33-14N 168-50W,

33-14N 173-39W, 42-50N 170-58W.

3. CANCEL NAVAREA XII 75/18.

4. CANCEL THIS MSG 231851Z FEB 18.//

ACTUAL LAUNCH WAS 21 14:17Z

DEBRIS WARNING 3h28m LATER

Authority: WESTERN RANGE 172016Z FEB 18.

Date: 172028Z FEB 18

Cancel: 23185100 Feb 18

<https://forum.nasaspaceflight.com/index.php?topic=42485.msg1791170#msg1791170>



NORWAY CAMP-OUT SEES FUEL DUMP LOW IN WESTERN SKY



LAUNCH WAS NOMINAL, AND ORBITAL DATA FOLLOWED

10:09 AM - 22 Feb 2018 // Jonathan McDowell @planet4589

TLEs for the second stage are out, showing that after deploying the Tintin sats **it made a burn over the Arctic to lower perigee**; made one more orbit, fired again on next Arctic pass to complete deorbit into Pacific
The second stage deorbit burns were at 1542 and 1709 UTC (the latter time from Magnus' observations)

Two-line elements for 2018-020A-D (43215-43218) became available on <https://www.space-track.org>

4 objects have been cataloged by USSTRATCOM

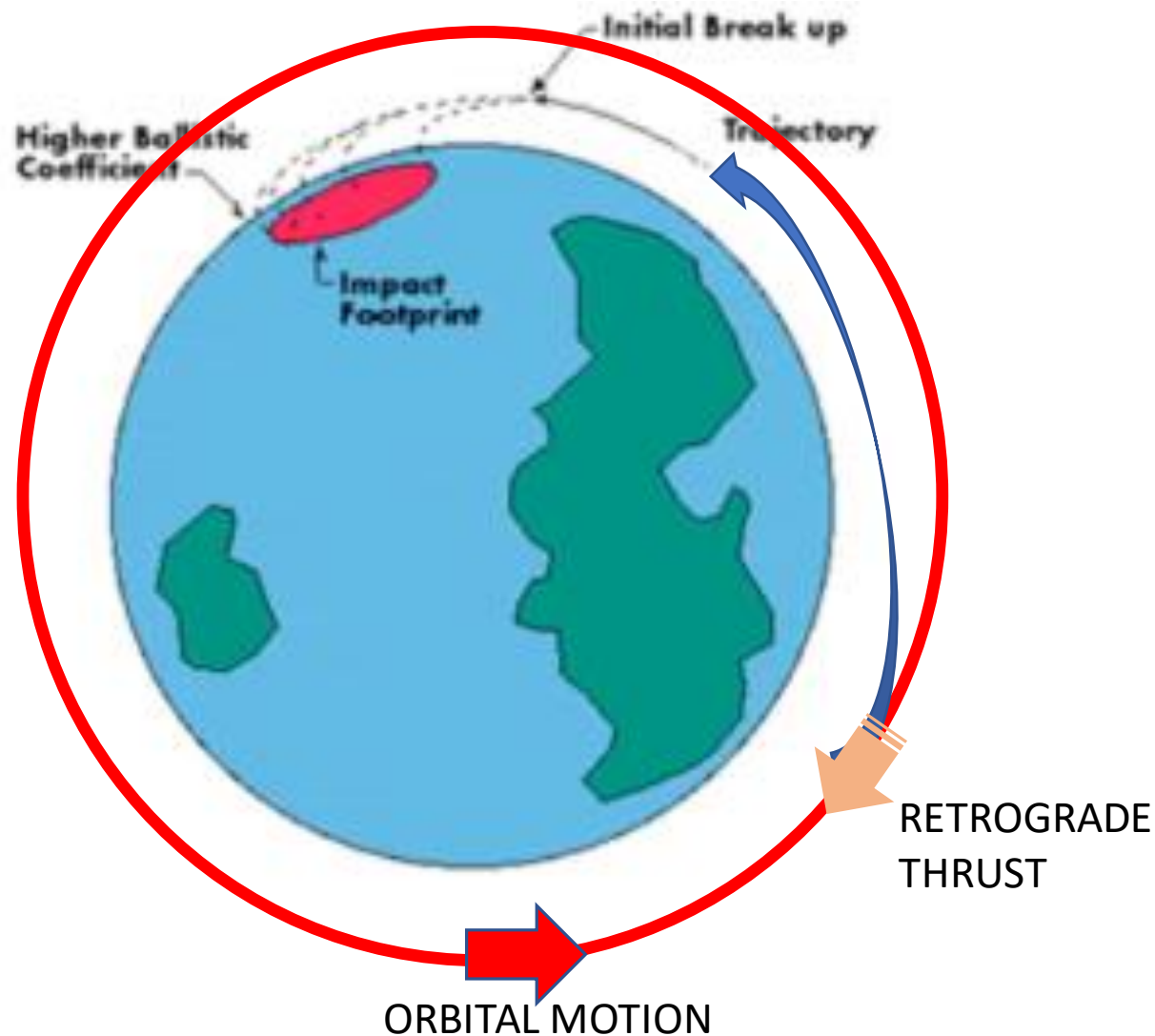
2018-020A/43215 in 499 x 518 km x 97.46° (Paz?)

2018-020B/43216 in 495 x 516 km x 97.46° (Tintin A?)

2018-020C/43217 in 497 x 517 km x 97.46° (Tintin B?)

2018-020D/43218 in 211 x 517 km x 97.27 (2nd stage)

JO question: first on-orbit burn would have been under similar illumination but 22 deg farther east, visible from NW Russia's Komi area [lightly populated]. Reports?



UNWRITTEN SPACE SHUTTLE 'MISSION CONTROL' RULE-OF-THUMB FOR EFFECT OF POSIGRADE/RETROGRADE BURNS WAS "TWO-FOR-ONE" – 2 FT/SEC RAISED/LOWERED OPPOSITE END OF ORBIT BY 1 NAUTICAL MILE.

In metric this 'rule' converts to 1 m/sec raises/lowers other end of orbit 3.4 km

MERLIN ENGINE 200,000 lb thrust,
Isp = 348 sec

burn 2 was to lower perigee from 211 km to reentry altitude, probably around 100 km.
so delta-v needed was about 30 m/sec

Stage2 mass unknown, so engine accel could range from 3 to 6 G's or more, or accel of 30 to 60 m/sec/sec. 'Ballpark estimate' shows that a one second burn would easily impart adequate delta-V to cause deorbit.

http://aerospace.wpengine.netdna-cdn.com/wp-content/uploads/2012/04/cords_2018_FEB_21_NORWAY_DEORBIT_VIEWING.jpg

HOW SOON BEFORE NOTAMS DEBRIS ZONE IS DEORBIT BURN?

- Interesting technical question for analysis, TBS

PREVIOUSLY OBSERVED DEORBIT BURN Feb 19, 2017



Observed from Iran north-of-track as stage crossed Persian Gulf.

Burn duration estimate on the order of 1-2 seconds

Occurred 30 min after launch, 20 min after first shutdown.

Butterfly plumes NOT observed [possibly due to rapid restart?]

[Link TBS](#)

PREVIOUSLY OBSERVED ON-ORBIT POSIGRADE BURN



[LEFT] PHASE-1 WITH NORMAL
'BUTTERFLY' PURGE LOBES
SIX HOURS AFTER LAUNCH
[RIGHT] PHASE-2 WITH
EXTENDED [~50-sec] ROCKET
BURN. STAGE2 IS PULLING
AHEAD OF DEPARTING PURGE
LOBES WHICH CAN STILL BE
SEEN IN FAST ENGINE PLUME.
APPARENT DROOP AT FAR END
OF PLUME SUGGESTS SMALL
ERROR IN IGNITION ATTITUDE
FOLLOWED BY CORRECTION.



Feb 6, 2018 – Falcon-Heavy insertion to escape trajectory

Link TBS

Lyset tok raskt oppmerksomheten til Ingvaldsen og andre.
Foto: Øystein Lunde Ingvaldsen [FEB 21, 2018, Norway]
The light quickly took the attention of Ingvaldsen and others.
Photo: Øystein Lunde Ingvaldsen

DIRECTION OF MOTION
RETROGRADE [DEORBIT]
SUNLIT FROM BEHIND



FEB 21, 2018

https://gfx.nrk.no/b3668oH65Ed83oOgMcFEuwsjsnljWVq_iet8-l_egyqw

Steve Jess photo, Feb 6, 2018 from California

DIRECTION OF MOTION
POSIGRADE [ESCAPE]
SUNLIT FROM BEHIND



FEB 06, 2018

<https://news.azpm.org/p/news-articles/2018/2/7/123842-its-a-bird-its-an-angel-no-its-falcon-heavy/>

2018 FEB 21 NORWAY DEORBIT VIEWING

Rfoshaug 02/22/2018 18:18 Z

I wonder if I observed one of the satellites from Northern Norway(!).

At 18:10 local time (173 minutes after the launch of the Falcon 9), I observed an object that appeared to be venting propellants or thrusting, moving from southwest to northwest. My brother also observed it from about 70 kilometers away. It was clearly in vacuum or near vacuum due to the pure arcing shape of the plumes. As it moved further north it seemed to change from plumes going straight up and down from the object to one big plume to the right of the object as it moved. So it looked almost like a plane change manoeuvre.

Now, the reason why I ask if it might be Paz or one of the other payloads is the math. Wikipedia says 514 km altitude for Paz, which gives an orbital period of almost 95 minutes. So when I observed the object, it would be about 1,8 orbits into the flight. [more]

<https://forum.nasaspaceflight.com/index.php?topic=42485.msg1791884#msg1791884>

2018 FEB 21 NORWAY DEORBIT VIEWING

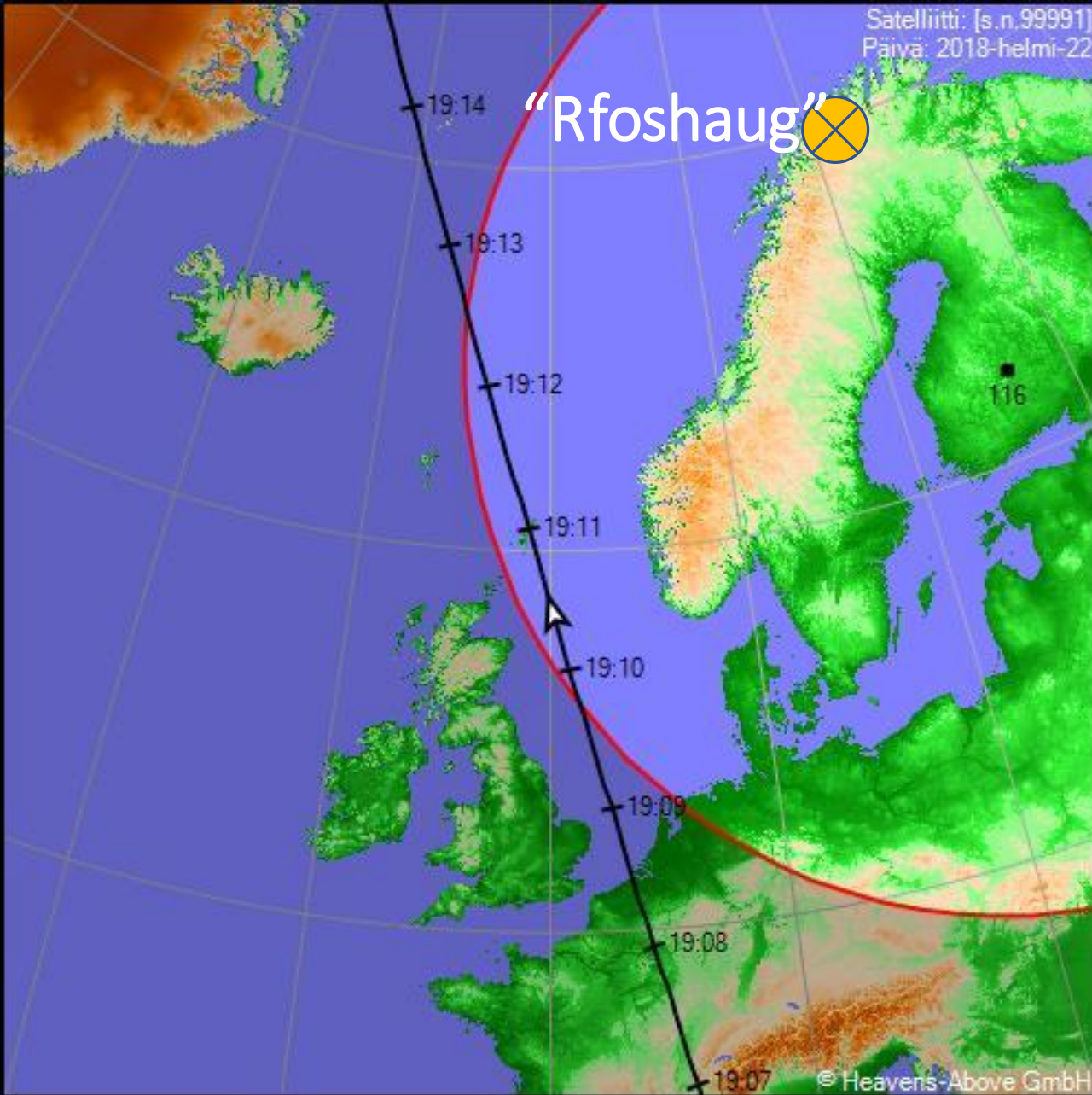


Rfoshaug [continued]

I live at 69° northern latitude. Vandenberg is at 34° , and the launch headed south (at 97° inclination and not 90° , so forgive my naive calculation). So it headed south 34° to equator, 90° to the south pole, 90° north to equator again and 69° north to where I live. That's $(34+90+90+69)=283^\circ$ to travel around the world from Vandenberg to here. That equals $(283/360)=0,79$ orbits. So yes, the timing would match about 1,8 orbits into the mission, not accounting for the few minutes it takes for the rocket to reach orbital speed, although my observation at 18:10 was when it appeared south of me, not quite at my latitude yet.

My observation was after sunset with a not-quite dark sky, so the satellite I observed roughly followed the terminator with the sun on its left relative to its direction. Paz launched in the very early morning in California, following roughly the terminator with the Sun to its left.

.... Or if not the deorbit itself, maybe it was venting? But it did not appear to be rotating at all, as the plumes were very straight and had no spiral shape.



Flight path of stage-2 past Scandinavia [made for observation from Finland]

From: Arto Oksanen via Seesat-I

<http://satobs.org/seesat/Feb-2018/0220.html>

Date: Thu, 22 Feb 2018 21:19:18 +0200

The same seen from Hankasalmi, Finland
(62,2548°N, 26,5961°E)

17:05-17:10 UT:

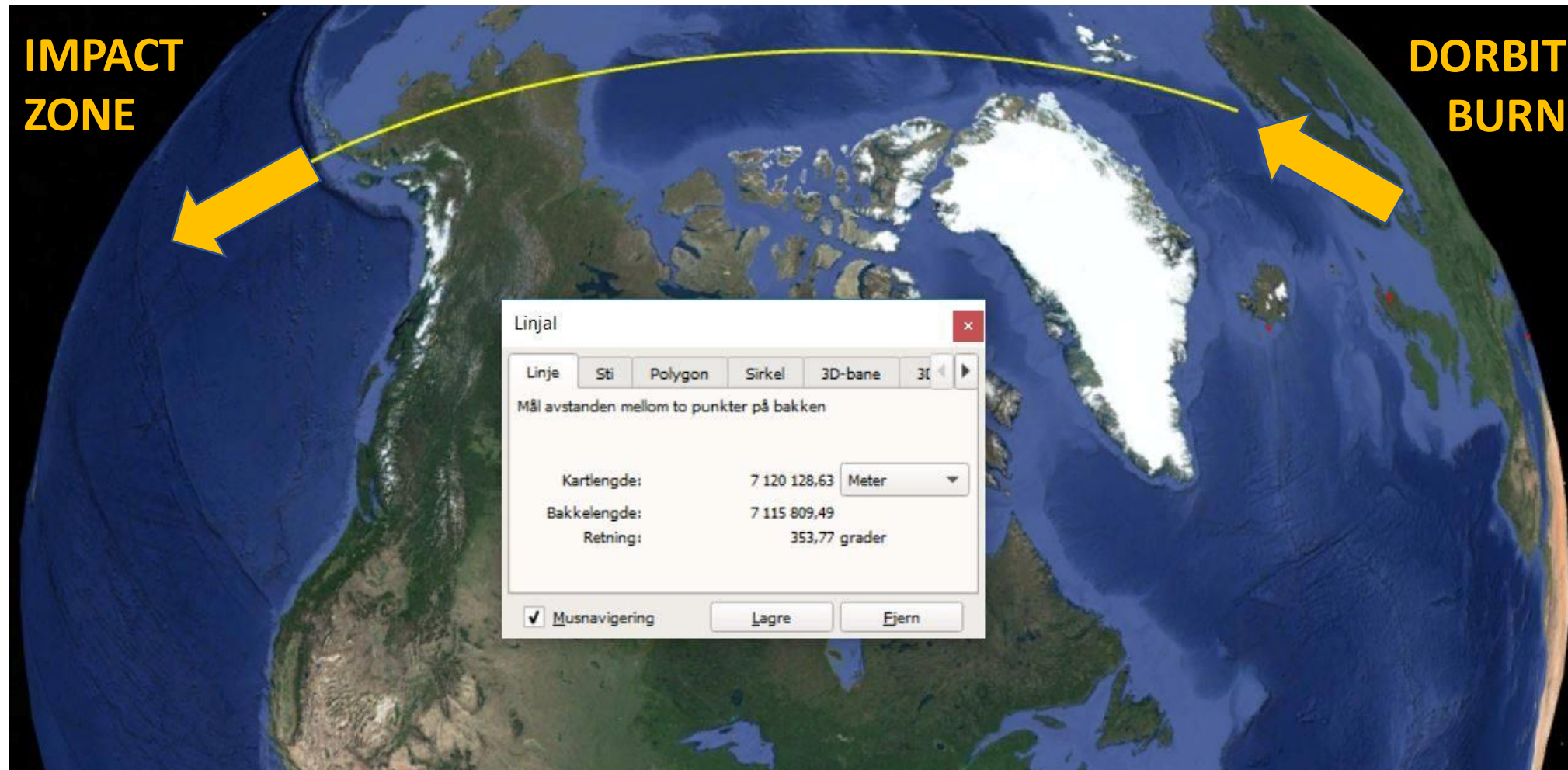
<https://drive.google.com/file/d/1rCt5CZsCdZyIWUk0BKo7DkNZD-ZWsE1b/view>

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https://www.taivaanvahti.fi/images/uploads/201802/70863_ff8cfbde12af9efbaadef9a35d2198cf.jpg

2018 FEB 21 NORWAY DEORBIT VIEWING

PATH FROM DEORBIT BURN TO IMPACT ZONE



<https://www.facebook.com/photo.php?fbid=10155196769841937&set=p.10155196769841937&type=3&theater&ifg=1>

WHY SHOW SO MANY DETAILED EYEWITNESS REPORTS?

- COLLECTING ALL AVAILABLE WITNESS REPORTS SERVES SEVERAL PURPOSES
- IF THEY SEEM TO BE TOO REPETITIVE OR UNINTERESTING, SKIP TO THE END
- BECAUSE THE APPARITION IS SO FAR BEYOND A WITNESS'S EVERYDAY EXPERIENCE BASE, THE DESCRIPTIONS MAY ONLY BE APPROXIMATE, AND ANALYSTS MUST APPRECIATE THE LIMITATION
- ANY POST-EVENT ATTEMPT TO CONDENSE OR EDIT DOWN THE VERBAL PASSAGES THREATENS TO UNINTENTIONALLY INTRODUCE THE BIASES AND EXPECTATIONS OF THE CHRONICLER
- WITHOUT PRESERVING THE FULL RANGE OF PERCEPTIONS AND INTERPRETATIONS, ANY FUTURE ATTEMPTS TO WALK-BACK NEW VISUAL REPORTS TO INTERPRET THE NATURE OF UNDOCUMENTED SPACE EVENTS WILL BE IMPEDED, IF NOT RENDERED TOTALLY UNACHIEVABLE
- RAPID THOROUGH COLLECTION OF ALL IMPRESSIONS IS CRITICAL TO AVOID IRRETRIEVABLE LOSS OF TEMPORARY STATEMENTS AND COMMENTS ACROSS THE INTERNET, ESPECIALLY AS THEY ARE USUALLY VERY POORLY KEYWORDED FOR ANY LATER SEARCH ENGINE APPLICATION
- IN MANY CASES, PSEUDONYMOUSLY POSTED COMMENTS CAN PROVIDE ACCESS TO ORIGINAL WITNESSES FOR FOLLOW-UP QUESTIONS BUT ONLY IF DONE PROMPTLY AND DIPLOMATICALLY

Use and misuse of analogies

- THE EYEWITNESS REPORTS OFTEN REFLECT THE STRUGGLE THAT STARTLED PEOPLE UNDERWENT TO FIND ANY EARTHSIDE TERMS OR ANALOGIES TO USE FOR A ONCE-IN-A-LIFETIME UNEARTHLY APPARITION
- “LOOKED LIKE” IS A COMMON PHRASE WITH REFERENCES TO MANY ORDINARY-LIFE OBJECTS == HEADLIGHTS, ZIG-ZAG CONTRAILS, SPIRAL TOYS OR CANDY, FIREWORKS, SPARKLERS, FRUITS AND VEGETABLES, PARACHUTES...
- COMPARING THE VISUAL STIMULUS TO PAST SIGHTINGS [WHICH IS THE NORMAL COGNITIVE PROCESS] OPENS THE POSSIBILITY THAT UNDER SUBSEQUENT LATER RECOLLECTION, EXTRANEIOUS FEATURES OF THE COMPARED-TO MEMORIES CAN UNCONSCIOUSLY INSERT THEMSELVES SEAMLESSLY INTO THE NEW EXPERIENCE
- THIS MAKES IT ALL THE MORE IMPORTANT TO OBTAIN AND PROVIDE FULL VERBALIZATIONS FROM WITNESSES, UNPROMPTED AND UN-SUGGESTED
- QUICK FOLLOW-UP QUESTIONING NEEDS TO OBTAIN MANY USUALLY OMITTED DETAILS SUCH AS DIRECTION OF SIGHTING AND MOTION, ANGULAR SIZE AND SPEED [ONE FIST AT ARM’S LENGTH = TEN DEGREES], FLUCTUATIONS & TIMING
- IDEALLY, VERBAL DESCRIPTIONS SHOULD BE COLLECTED BEFORE SEEING IMAGES

MOST OF THESE EVENTS ARE SEEN AND REPORTED AS 'UFOs'

- Most primary witnesses did not recognize the apparition as a rocket launch manifestation
- For these witnesses, many descriptions included classic misperceptions of unusual objects at unknown distances in the sky, including speed, size, and course changes during the observation
- Sadly, most observers did not report potentially useful diagnostic data such as date/time, observer location, azimuth/elevation of object, time span and motion of object
- Many MORE commentators refused to accept the missile explanations – mainly based, when explained, on misinformation of realities of missile and space technology
- Nevertheless, the volume of such reports sometimes provided helpful insights into the event
- Volunteer cataloguers of such reports, around the world, are doing a genuinely important service to science, whatever their motives

Airline pilot “210Tom” logs in; Norwegians, too

- 02/23/2018 08:37 AM »

Just registered here today to figure out what this was.

I also saw the event last night from flight deck of an airliner. We were over the Baltic sea and saw the object on a roughly northwest path. Very interesting sight indeed as it was quite bright.

Maybe there's a trajectory map over that area anywhere? And the location of where S2 was de orbiting?

ALL FOLLOW-UP CONTACT ATTEMPTS HAVE FAILED

=====

Magnus Riding // February 22 at 11:25am

Potensial stage 2 deorbit observed over northern Norway, pictures by me.

Blew up to a nice cloud of dust a minute later

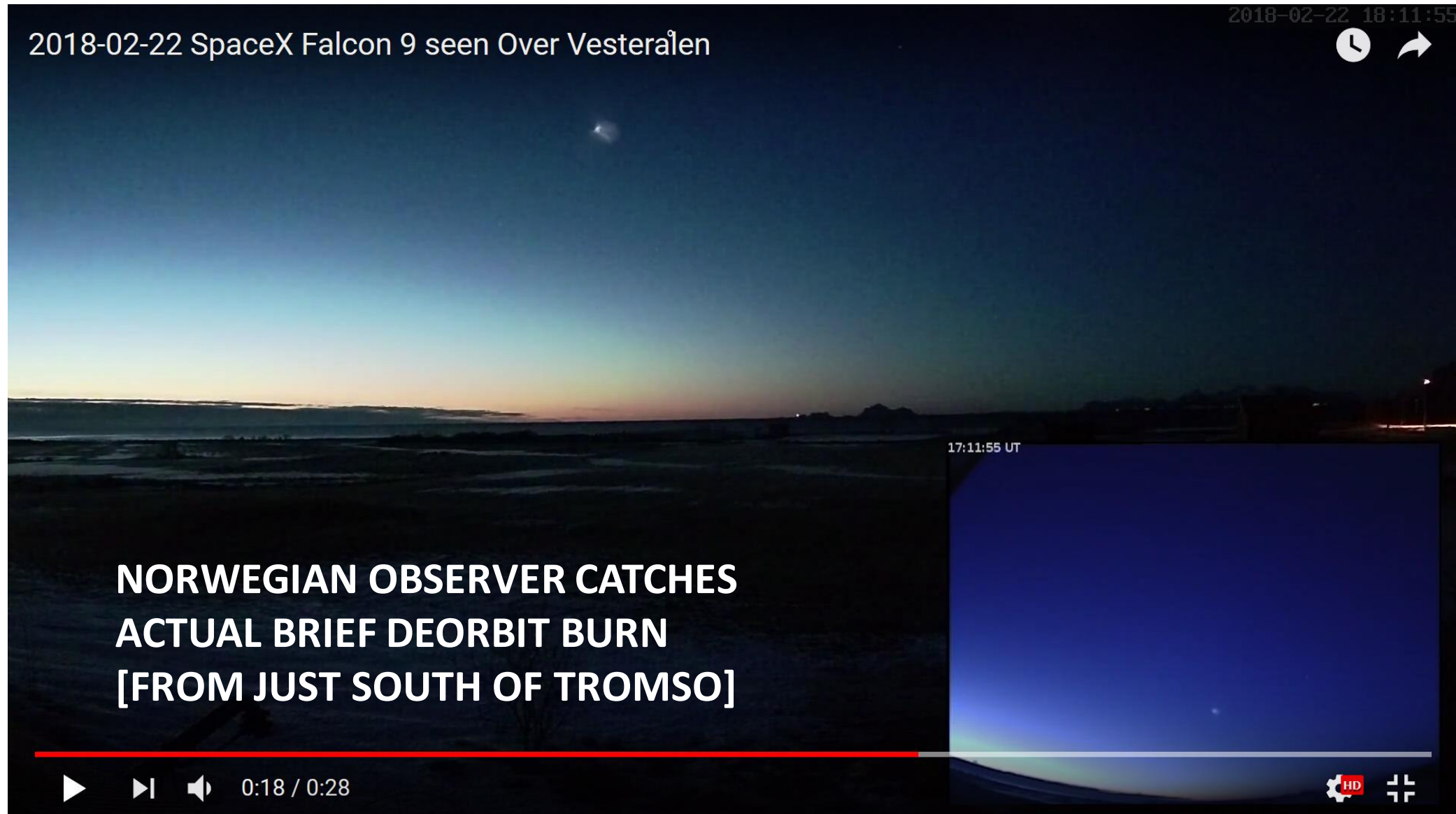
[Magnus Rydningen](#) It was super exciting to observe it, made a nice light show similar to the one observed on the Iridium flight

[Odd Bakken](#) another observation from Andenes, Norway (69N 16E) . picture taken north- north west. It came from the south and "puffed out" a cloud and disappeared.

<https://www.facebook.com/photo.php?fbid=1746250745431793&set=p.1746250745431793&type=3&theater>

<https://www.facebook.com/groups/spacexgroup/permalink/10156332794226318/>

2018-02-22 SpaceX Falcon 9 seen Over Vesterålen



https://www.youtube.com/watch?v=_0BiQInIxAc&feature=youtu.be



At 00:16 a very short pulse [~ 2 sec?] indicates deorbit burn.

ANOTHER EXCELLENT VIDEO OF DEORBIT BURN



<https://www.youtube.com/watch?v=LbfPIK3Ylwc>

2018 FEB 21 NORWAY DEORBIT BURNING

Falcon 9 launch seen from Sørreisa, Norway



AND YET ANOTHER EXCELLENT VIDEO OF DEORBIT BURN

Credit: Ketil Vegum/The
Norwegian Meteor Network.



0:38 / 0:53

<https://www.youtube.com/watch?v=rzEY90ofQPk>



Så mystisk lys over Nord-Norge: – Trolig oppskytning fra SpaceX
Flere har meldt fra om et spesielt lys torsdag kveld. Solfysiker Pål Brekke har forklaringen på hva som har forbauset og begeistret flere.

Quite mysterious light in northern Norway

CraigVG at 02/22/2018 08:35 PM

<https://forum.nasaspaceflight.com/index.php?topic=44892.msg1791945#msg1791945>

Second stage deorbit was seen in Norway:

https://www.nrk.no/nordland/sa-mystisk-lys-over-nord-norge___-hadde-en-tydelig-bevegelse-1.13930492



CraigVG linked photo

CLEARLY SHOWS
FORWARD-FACING
ENGINE PLUME
START AND STOP
BOUNDARY, ALONG
WITH BUTTERFLY
LOBES ALREADY
SEPARATE [END OF
PURGE]. ASSUME
PURGE ENDED
SIMO WITH
ENGINE START,
PURGE VELOCITY
MUCH LOWER
THAN ENGINE
EXHAUST. ²⁷

PLUME DEPARTURE VELOCITY $348 \times 9.8 = 3400$ M/SEC
PURGE DEPARTURE VELOCITY APPROX 50 to 100 M/SEC?

CraigVG's linked article

- – **Jeg så et lys som umiddelbart tok oppmerksomheten min, og som hadde en tydelig bevegelse retning nordover, sier Øystein Lunde Ingvaldsen.** Han observerte lyset over Bø i Vesterålen i kveld, og fikk fanget det på foto og film. Ingvaldsen, som tilfeldigvis var ute, sier fenomenet gikk mer og mer i oppløsning etter hvert og at lyset spredte seg utover et tilsynelatende stadig større område.
- **"I saw a light that immediately took my attention, and that had a clear moving direction northward," said Øystein Lunde Ingvaldsen. He observed the light of Bø in Vesterålen tonight, and had captured it in photography and film. Ingvaldsen, who happened to be out, said the phenomenon went more and more in the resolution gradually and that the light spread beyond a seemingly increasingly larger area.**
- **Også andre har meldt fra om fenomenet i kveld.** – Det var veldig snodig. Vi satt på hytta i Steigen da jeg så dette sterke lyset utenfor vinduet, sier Karina Sætermo. Hun og kjæresten David reagerte med å løpe ut, og de begynte straks å filme lyset som beveget seg på himmelen. – Vi sprang ut døren på andre siden, og vi så et lys som strålte ut fra begge sidene av objektet. Det var ikke skarpt lys, men litt uklart. Litt som nordlyset.
- **Others have reported the phenomenon tonight. -it was very odd. "We sat at the hut in Steigen when I saw this strong light outside the window," said Karina Sætermo. She and her boyfriend David responded with their run-out, and they immediately started filming the light that moved to the sky. – We sprang out the door on the other side, and we saw a light that radiated from both sides of the object. It was not a bright light, but a little blurry. A bit like the Northern Lights.**

CraigVG article [continued]

– Til slutt eksploderte det, gikk i oppløsning og etterlot seg en stor boble av lys på himmelen. Det var som om du så en ballong eksplodere i sakte film. Solfysiker bekrefter teori. Pål Brekke er utdannet solfysiker, og har jobbet for NASA. I dag jobber han for Norsk Romsenter. Han konstaterer at det sannsynligvis er en rakett skutt opp fra USA.

– Eventually it exploded, dissolved and left a great bubble of light in the sky. It was as if you saw a balloon explode in slow motion.

Solar physicist confirms theory -- Pål Brekke is an educated solar physicist and has worked for NASA. Today he is working for the Norwegian Space Centre. He notes that there probably is a rocket shot up from the United States.

– Det er nok Falcon 9-raketten til Space X som passerte over Nord-Norge. Den ble skutt opp fra California 17:15 norsk tid, og passerte over Svalbard i hvert fall én gang, kanskje to ganger. Brekke sier at raketten hadde med seg tre satellitter som skulle frigjøres, og det er mulig at det var dette som så ut som en stor eksplosjon på himmelen. – Raketten hadde med seg to små internettsatellitter og én stor spansk jordobservasjonssatellitt. Det kan hende at det man ser er den siste fasen, når satellittene blir løsrevet fra raketten.

[discusses Falcon-9 launch] It is possible that what you see is the final phase when the satellites get detached from the rocket.

Romeksperten forklarer at Norge ikke bare får æren av å se på lyset fra raketten, men også er en viktig del av oppskytingen til raketten. – Det som er litt morsomt er at Norge har en finger med i spillet under alle oppskytingene til Space X. Kongsberg Satellite Service i Tromsø støtter ved å ta imot data og sende informasjon opp igjen fra sin antenne i Svalbard. – Det er litt stilig at vi er involvert, og er en viktig del av oppskytningen.

The space expert explains that Norway will not only get the honour of looking at the light from the missile, but also is an important part of launching into the rocket. "What's a little fun is that Norway has a hand in the game during all of the launches to Space X." Kongsberg Satellite Service in Tromsø supports by accepting data and sending information back up from its antenna in Svalbard. – It is a bit classy that we are involved and is an important part of launch.

Spectacular sights before (?!) the predicted PAZ pass [<http://satobs.org/seesat/Feb-2018/0219.html>]

- From: Björn Gimle via Seesat-l <[seesat-l at satobs.org](mailto:seesat-l@satobs.org)>
Date: Thu, 22 Feb 2018 20:07:01 +0100

Spectacular sights about a minute before (?!) the predicted PAZ pass 17:10 UTC

- Deorbit burn or PAZ orbital altitude boost imaged 17:06:45 - 17:08:45 ?
- On bright twilight sky, but astrometry should be possible.
- <https://tinyurl.com/FalconExhaust>
- But no sign of the satellite(s) on the twilight sky 17:09:57 - 17:14:15 around
- Center (RA, hms): 20h 58m 57.475s
- Center (Dec, dms): +37° 44' 33.985"
- Size: 21.7 x 14.5 deg
- -----
- Björn Gimle, COSPAR 5919
- 59.2617 N, 18.6169 E, 51 m

Björn Gimle photo



https://eefef5be-a-62cb3a1a-s-sites.googlegroups.com/site/starrymdnytt/dokument-och-länkar/P1300429.JPG?attachauth=ANoY7cpv0m8N-LIiamT1EkBfno9jGLWnZLdF_eDoRlo7Mr3_ZPTOSUudjMK80CrAaH-FPY845kMaF-rwtpfz6-_noOKeGWq6m6mgMCCfBV7035449y89AnGku2BVLyuOPp845Q_59cqryfpXLF0-uUQmiWNGApsiSDnpMhcCif786RpU9APt_wZE6ehzKB6g58AAS6haTy7NgYg1D2JYtK7UBuQoQbQQYDSBJvpxClh7ONfFQodmOEvUhPZkNXfz9W5oLNW2S2tq&attredirects=1



2018 FEB 21 NORWAY DEORBIT VIEWING

Finland astronomy website

Näyttävyyys: V / V -- Arto Oksanen, Jyväskylän Sirius

- Hyvin kirkas kohde Jyväskylän länsitaivaalla klo 19 jälkeen. Pistemäinen ja kirkas, liikkui tasaisesti etelästä pohjoiseen. Silminnäkijähavainnon mukaan "Kuun kirkkauksinen". Oheiset kuvat ovat Hankasalmen allsky-kamerasta.
- A very bright Object in the western skies of Jyväskylä after 19 p.m. A bright point-source, steadily moved from the south to the north. Eyewitness to the "moon's bright". The pictures below are from the Allsky camera in Hankasalmi.
- Edit: Lisäsin Heavens-abowesta Falcon-9 kantoraketin avaruuteen viemän PAZ-satelliitin lentoradan Hankasalmen horosintista. Hyvin osuu kohdalleen, mutta on kolmisen minuuttia etuajassa satelliittiin nähden. Katoraketti oli näkyessään Pohjanmeren päällä.
- I added the heavens-above Falcon-9 launcher from the PAZ-satellite, a flight path from Hankasalmi. Well, but it is about three minutes ahead of the satellite.
- Raketin vaihe taivaalla – Ilmianna Rocket path in the sky -- Report
- Kommentteja: Samuli Ikäheimo - 22.2.2018 klo 20.10 Ilmianna -- Pohjois-Norjassa on mahdollisesti näkynyt SpaceX:n Falcon-9:n kakkosvaiheen poltto klo 18.09 CET (19.07 Suomen aikaa?):
- In northern Norway, the second stage of SpaceX's Falcon-9 was 18.09 CET (19.07 Finnish time?): <https://twitter.com/steinegal/status/966727109761818624>

Finland astronomy website 2

- Juho Häivälä - 22.2.2018 klo 20.14 Ilmianna
- No tämä sen täytyi olla Ylivieskassakin. Läntisellä taivalla kun killotti niin kirkkaasti ja isohko.
- In the West, it was so bright and sizable.
- Petri Martikainen - 22.2.2018 klo 20.35 Ilmianna
- Samaa ihailtiin Etelä-Juvalla, todella kirkas.
- The same was admired in the south of the Jualla, really bright.
- Marika Terä - 22.2.2018 klo 21.19 Ilmianna
- Samaan aikaan Kouvolaassa lähes vastaava ilmiöi Ensin mietin olisiko ollut Utin kopterit valot päällä (valokeila ylös ja alas) mutta liian korkealla. Liike suunta sama - etelästä pohjoiseen. Todella kirkas ja suuri valoilmiö
- Meanwhile, in Kouvola lähes a similar phenomenal first I wondered whether it would have been the Utin chopper lights on the ground (spotlight up and down) but too high. The direction of movement is the same-from south to north. Really bright and great light phenomenon

<https://www.taivaanvahti.fi/observations/show/70863>

Finland astronomy website 3

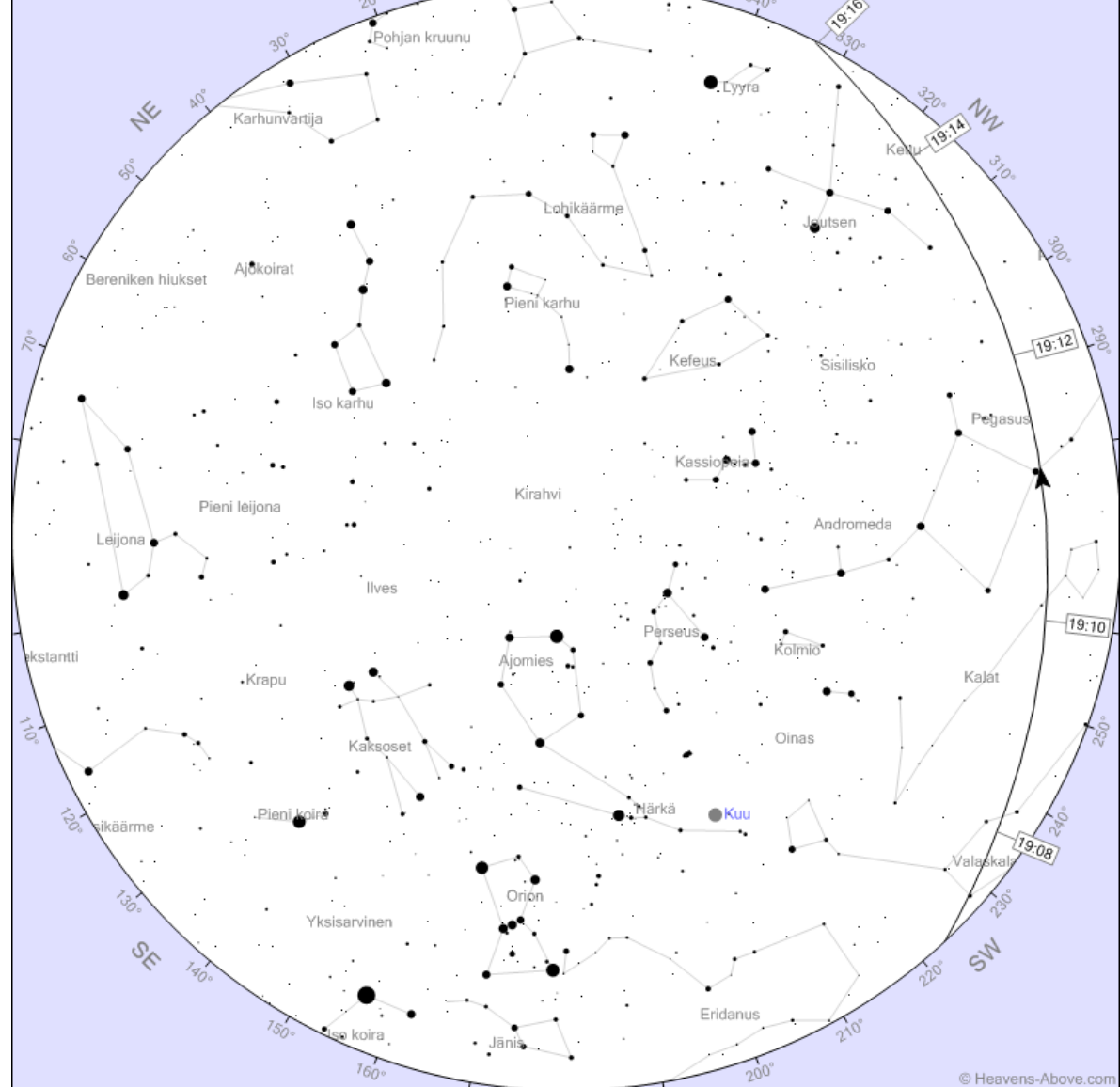
- Markku Kaakkolammi - 22.2.2018 klo 21.23 Ilmianna
- Ilmeisesti sama kohde havaittu Ruovedellä, Mäntässä ja Oulussa.
- Apparently the same item was observed in Ruovedellä, Mäntässä, and Oulu.
- Valtteri Ruusola - 22.2.2018 klo 21.24 Ilmianna
- Näkyi myös Uudessakaupungissa. Lähtisellä taivaalla, suuntana etelä-pohjoinen. Valon ympärillä hohtava "usva" muuten taivas täysin pilvetön.
- In the nearby Sky, heading south to North. Glowing around the light "Usva" otherwise the sky completely cloudless.
- Anne Ylipelkonen - 22.2.2018 klo 22.50 Ilmianna
- Katselimme ja ihmettelimme tätä myös Kauhavalla n. Klo 19.00.
- We watched it in Kauhavalla and wondered about it at 19.00.
- Heikki Malkavaara - 23.2.2018 klo 18.27 Ilmianna
- Raumalla illansuussa näkyi myös selvästi. Sumuinen täplä (jota ensin luulin Kuuksi), mutta kun pahuus liikkui selvästi, etelästä pohjoiseen.
- The evening in Rauma it was also evident. A hazy spot (which I thought I could hear [?]was a hot), but when the heck was moving clearly, from south to north.
- Jari Laikko - 23.2.2018 klo 20.29 Ilmianna
- sama ilmiö näkyi myös nokialla noin klo 19 aikaan
- The same phenomenon was also evident at Nokia around 19



ALL-SKY IMAGE WITH PATH OF OBJECT

<https://lh5.googleusercontent.com/ZFMjks0U3-oXxExsSWMwXbvfhu5MWNPxilkZ6eK1I8tr9siyqdqzIXXzYa6LYKTVPPw98moyYZvAnSLuOzYP=w1919-h892>

FINLAND ALL-SKY CAMERA
CAPTURED STAGE2 PASS
LOW IN WESTERN SKY,
SOUTH TO NORTH [LEFT TO
RIGHT] SHOWING HOW
LOW IT WAS. OBSERVERS
CLOSER TO PATH [FARTHER
WEST] WOULD HAVE HAD
HIGHER PASS BUT ALSO
HIGHER SUN, SO SKY WAS
TOO BRIGHT.



https://www.taivaanvahti.fi/images/uploads/201802/70863_9121d27b528efcbefa97378519b9bc74.png

2018 FEB 21 NORWAY DEORBIT VIEWING

SUNSET TIMES FOR OBSERVATION POINTS

- TBS

EARTH SHADOW HEIGHT IN STAGE2 ORBIT

- TBS



UFO sweden

[Benjamin Sehlstedt](#)

Published on Feb 22, 2018

Skellefteå Sweden [NW Gulf of Bothnia]?



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

2018 FEB 21 NORWAY DEORBIT VIEWING

48

Murmansk region sightings [1710 UTC]

Several reports from Murmansk-Khibiny & from Pushnoy, on the west coast of the White Sea in Karelia, south of Murmansk. Very low on western horizon. Farthest east of any known observations.

 = other reports



23.02.2018 -- Соцсети: в небе над Мурманском снова видели НЛО

SOCIAL NETWORKS: They see a UFO again in the sky of Murmansk

<http://rostovdrive.ru/sotsseti-v-nebe-nad-murmanskom-snova-videli-nlo/>

НЛО (неопознанный летающий объект) в очередной раз увидели жители Мурманска и ближайших окрестностей в минувший четверг, 22 февраля, в вечернее время, примерно в 20:30. Информация об НЛО сразу же появилась на страницах региональных интернет-сообществ в соцсетях.

Residents of Murmansk and the surrounding area once again saw a UFO (Unidentified flying object) last Thursday, February 22, in the evening, at about 20:30. Information about the UFO once again appeared on the pages of regional Internet communities in social networks.

Murmansk 2

Уточняется, что неопознанный летающий объект местные жители видели в районе федеральной автотрассы «Кола» со стороны улицы Шабалина в Мурманске. Тот же самый летающий объект видели в небе и жители поселка Пушной, расположенного недалеко от Мурманска.

It is clarified that the unidentified flying object locals saw in the area of the federal highway "Kola" from the street Shabalin in Murmansk. Residents of the village of Pushny, located near Murmansk, saw the same flying object in the sky.

Жители Мурманской области описывают НЛО, как большой светящийся шар, который несся на огромной скорости по вечернему небу. Пользователи сообщают в соцсетях, что двигался светящийся круг на очень большой скорости, а затем скрылся за горизонтом. Теперь специалистам предстоит выяснить, что именно видели накануне в небе жители региона.

Residents of the Murmansk region describe the UFO as a large glowing ball, which was at a huge speed in the evening sky. Users report in social networks that the glowing circle was moving at a very high speed, and then fled beyond the horizon. Now the specialists have to find out what the inhabitants of the region saw in the sky last night.

Над Мурманской областью снова пролетел метеор? 22.02.2018

The meteor flew over the Murmansk region again?

МУРМАНСКАЯ ОБЛАСТЬ. В соцсетях пользователи активно обсуждают, как сегодня вечером около половины девятого, примерно в районе над Пушным пролетел «круглый объект с сильным свечением вокруг». Первой об этом написала Вероника Попкова. Пользователь сообщает, что двигался светящийся круг очень быстро и затем скрылся за горизонтом.

In social networks, users are actively discussing how about half of the ninth in the evening, around the fur-bearing area flew a "round object with a strong glow around". Veronica Popkov was the first to write about it. The user reports that the glowing circle was moving very quickly and then vanished beyond the horizon.

К сожалению, пока очевидцы не выложили в сеть фото или видео объекта, хотя сообщают, что есть запись камеры видеорегистратора.

Вероника оказалась не единственной, кто разглядел светящийся шар в небе. Несколько человек подтвердили, что тоже наблюдали нечто похожее приблизительно в то же время.

Unfortunately, until the eyewitnesses have posted a photo or video of the object, although they report that there is a record of the camera DVR.

Veronica was not the only one who saw a glowing ball in the sky. Several people confirmed that they also observed something similar around the same time.

Конечно, пост собрал и немало иронических комментариев. Например, что инопланетяне решили поздравить землян с Днем защитника Отечества. А еще один пользователь написал автору поста, что этот объект – Луна, просто девушка на нее быстро смотрит.

Of course, the post has collected and a lot of ironic comments. For example, that aliens decided to congratulate Earthlings on the day of Defender of the Fatherland. And another user wrote to the author of the post that this object-the moon, just the girl quickly looked at it.

<http://www.mvestnik.ru/newslent/nad-murmanskoj-oblastyu-snova-proletel-meteor/>

REPETITIONS OF ORIGINAL RUSSIAN STORY

В небе над Мурманском заметили НЛО

In the sky over Murmansk they spotted a UFO 23.02.2018 05:36

<https://wek.ru/v-nebe-nad-murmanskom-zametili-nlo>

Под Мурманском пролетел метеорит – соцсети | 22 02 2018, 20:59

<http://severpost.ru/read/62953/>

В небе над Мурманском было замечено таинственное НЛО 23.02.2018 10:56 1781

Северяне, увидевшие объект, дают ему разное описание.

<https://nevnov.ru/region/Murmansk/536720-v-nebe-nad-murmanskom-bylo-zamecheno-tainstvennoe-nlo>

Ночью над Мурманском кружил светящийся НЛО 23.02.2018 - Илья Круглей

<http://gazetadaily.ru/02/23/nochyu-nad-murmanskom-kruzhil-svetyashhiysya-nlo/>

Над Мурманской областью увидели «НЛО»

23 Фев 2018, 09:10 "Мурманск и область" Ника Меркулова

OVER MURMANSK REGION THEY SEE A 'UFO'

<https://www.hibiny.com/news/archive/159034/>

Severopost comments

- Dmitriy Shtonda | 2018-02-22 21:28:12
 - Тоже наблюдал, с 312-го микрорайона. Не похоже на метеор, объект был в воздухе несколько минут и больше походил на что-то ракетно-космическое. **С Плесецка может что запускали.**
 - Unlike a meteor, the object was in the air a few minutes and **more resembled something rocket-space**
- romik | 2018-02-23 06:45:23
- Странное свечение 22 февраля 20.33 видно было в Хибинах. Объект огромных размеров быстро передвигался в сторону Мурманска.
 - A strange glow on February 22, 20.33 was seen in Khibiny. The object of huge size quickly moved in the direction of Murmansk.

Подробнее: <http://severpost.ru/read/62953/>

Some clues?

<https://www.opentown.ru/novosti/50192>

<https://murmansk247.ru/articles/11935-sotsseti-nad-murmanskom-snova-proletel-meteorit/>

- Russian UFO nut freaks out -- <https://www.youtube.com/watch?v=JVfsReXhJugJ>

https://vk.com/video-120051603_456239364

https://vk.com/video57777703_456240185

Уфологи обсуждают НЛО, который был замечен жителями Мурманской области. Очевидцы сообщают, что видели яркий светящийся шар, который на большой скорости скрылся за облаками....2/22 Источник: <https://newinform.com/106386-ufologi-obsuzhdayut-nlo-kotoryi-byl-zamechen-zhitelyami-murmanskoi-oblasti>

[RUSSIAN UFOLOGISTS SAY IT HAPPENS A LOT]

[Used Oct 27 ICBM photo]

В Мурманской области очевидцы сообщают о том, что наблюдали в небе неопознанный летающий объект, который на большой скорости скрылся за облаками. Как заявляют очевидцы, в минувший четверг, около девяти часов вечера они наблюдали в небе странный и загадочный объект, похожий на яркий светящийся шар, перемещающийся на огромной скорости. По сообщениям очевидцев, запечатлеть возможный корабль представителей внеземной цивилизации не было возможным, именно потому что он передвигался на огромной скорости и появился в поле зрения всего лишь на несколько секунд. Как предполагают уфологии, в Мурманской области очень часто наблюдаются подобные явления, и действительно, это мог быть корабль пришельцев. Скептики в свою очередь утверждают, что люди могли видеть в небе обычный пассажирский лайнер....

23.02.2018 - Илья Круглей ILYA KRUGLEY
Apparent 'stock footage' of rocket launch



<http://gazetadaily.ru/wp-content/uploads/2018/02/Nochyu-nad-Murmansk-kom-kruzhilo-NLO-298x168.jpg>

Над Мурманской областью увидели «НЛО»

23 Фев 2018, 09:10 "Мурманск и область" Ника Меркулова

OVER MURMANSK REGION THEY SEE A 'UFO'

<https://www.hibiny.com/news/archive/159034/>

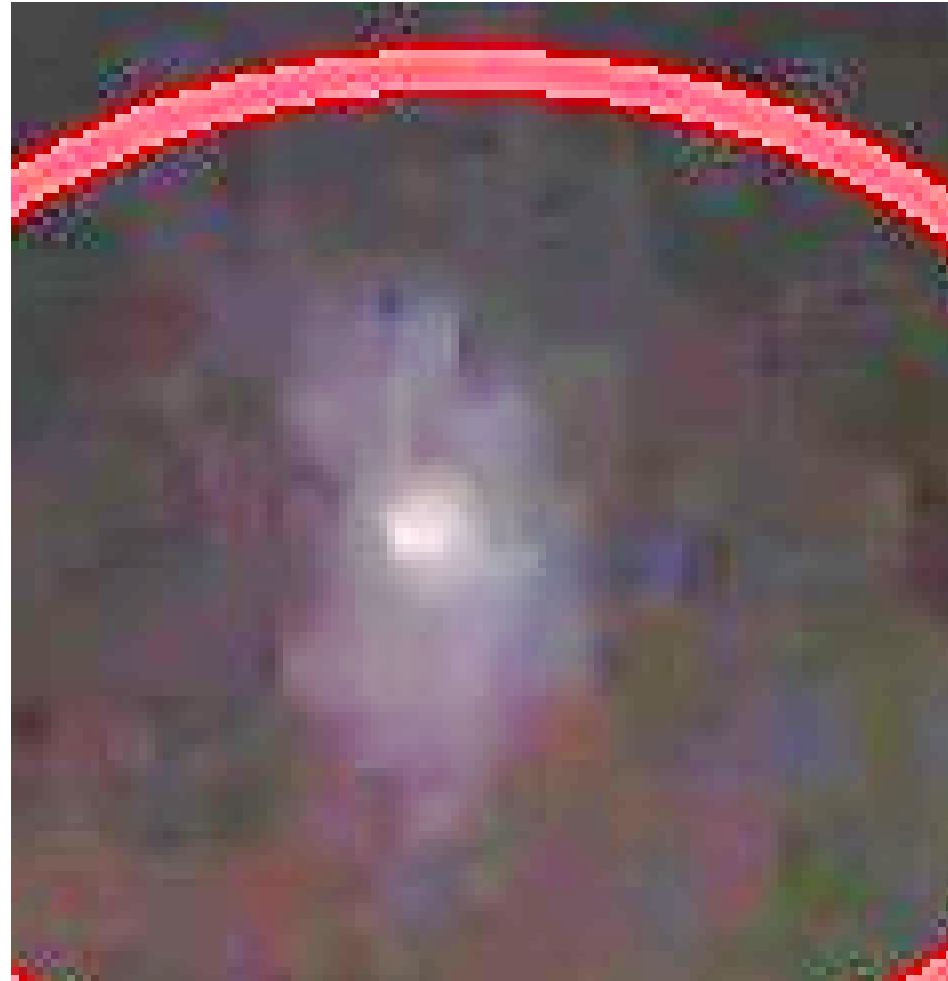
Пользователи соцсетей сообщают, что в небе над регионом снова видели сгорающий метеор или какой-то загадочный объект.

- Ребята, никто светящегося круга не видит в небе? С Пушного десять минут назад был виден летящий круглый объект с сильным свечением вокруг, движется достаточно быстро. Скрылся за горизонтом, может, еще летит, - написала в группе «Мурманск ДТП ЧП» жительница поселка.

По словам других очевидцев, шар зависал над землей, летал из стороны в сторону. Поэтому его уже называли «НЛО». В феврале поступало несколько сообщений о метеорах, которые попали на видео.

Khibany photo [probably authentic]

<https://www.hibiny.com/news/archive/159034/>



**OPEN ISSUE –
SEARCH RUSSIAN
UFO WEBSITES
FOR PHOTOS.
SINCE OBJECT
WAS SO LOW
ON HORIZON,
THERE MIGHT
NOT BE MANY.**

Вадим Ботнарюк Февраль 25, 2018 // Жители Норвегии заметили таинственный сверкающий Residents of Norway spotted a mysterious sparkling UFO

В северной области Норвегии местные жители увидели большой сверкающий НЛО. Некоторые уверены, что это инопланетный корабль, а другие считают, что этим объектом была ракета Falcon 9, [JO: some say meteorite, some say Falcon9 rocket]

Данный НЛО впервые был замечен в минувший четверг в небе над небольшим норвежским городком Бардусфосс. Он светился ярким белым светом, а затем вспыхнул, создав в небесах «бабочку», и пропал. Позднее его обнаружили неподалеку от Тромсе. Этот объект летел по небу практически до захода Солнца, а потом снова взорвался....

This UFO was first seen last Thursday in the sky over a small Norwegian town Bardufoss. It glowed with bright white light, and then flared up, creating a "butterfly" in the sky, and disappeared. It was later spotted near Tromso. This object flew through the sky just before sunset, and then exploded again....

<https://discover24.ru/2018/02/zhiteli-norvegii-zametili-tainstvennyj-sverkayushhij-nlo/>

04:30 - 25.02.2018 ЖИТЕЛЕЙ НОРВЕГИИ НАПУГАЛ СВЕРКАЮЩИЙ ОБЪЕКТ В НОЧНОМ НЕБЕ

Накануне в небе над Норвегией местные жители заметили необычный сверкающий объект, происхождение которого неизвестно.

A sparkling object in the night sky frightened inhabitants of Norway

Yesterday in the sky over Norway the locals noticed an unusual sparkling object whose origin is unknown.

- Некоторые люди успели сфотографировать НЛО. Эти снимки планируется передать специалистам для подробного изучения.
- Сообщается, что объект на некоторое время завис в небе, а после двинулся к закату, разделился на две части и исчез.
- **It is reported that the object for some time hung in the sky, and then moved towards the sunset, divided into two parts and disappeared.**
- [JO comment == Third hand description gets even more garbled]

<http://runews24.ru/science/25/02/2018/bb4518910db45ec88430768eaf659f76>

"Falcon 9, ты ли это?": **FALCON 9, IS THAT YOU?**

Очевидцы заметили светящийся НЛО в Норвегии

Вчера, 03:30 \ \ Происшествия

- Свидетели утверждают, что видели крупный сферический объект, который светился на большой высоте. По их мнению, явление не было похоже ни на один из возможных предметов с Земли. После появления НЛО на короткое время застыл, а затем начал неторопливо перемещаться по небесному своду. В конечном итоге, он развалился пополам и скрылся из виду.
- **After the appearance of the UFO, for a short time it froze, and then began to move slowly through the heavenly vault. Finally it broke in half and vanished from sight.**
- Спустя некоторое время, аналогичные сообщения стали появляться от пользователей из другой части государства. Они даже зафиксировали свечение на камеры своих устройств. В это же время многие комментаторы уверенно предполагают, что зафиксированное небесное тело может быть одной из частей Falcon 9
- **After some time, similar messages began to appear from users from other part of the country. They even recorded the glow on cameras of their devices. At the same time, many commentators are confident that the captured celestial body could be a part of the Falcon 9**

<https://versiya.info/proisshestviya/60603>

Access My Account | Email | UFO is spotted over ren X + v

www.dailymail.co.uk/news/article-5428285/UFO-spotted-remote-northern-Norway.html

google translate space - Google Search spacetoday.net: spac

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Saturday, Feb 24th 2018 3AM 65°F 6AM 65°F 5-Day Forecast

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EXPLORE MORE THE FUTURE LAUNCHES HERE NASA Kennedy Space Center VISITOR COMPLEX

Shining UFO is spotted over remote northern Norway and 'EXPLODES into two' as stunned onlookers watch before 'fading into dust'

- The object was first seen above Bardufoss in northern Norway on Thursday afternoon and evening
- It had a bright, white light which exploded into two butterfly shapes then faded into 'dust'
- Stunned onlookers on the ground said they first mistook it for a chopper because it appeared so quickly

Type here to search

8:30 PM 2/23/2018

<http://www.dailymail.co.uk/news/article-5428285/UFO-spotted-remote-northern-Norway.html>

By Jennifer Smith For Dailymail.com
PUBLISHED: 15:20 EST, 23 February 2018
| UPDATED: 16:12 EST, 23 February 2018

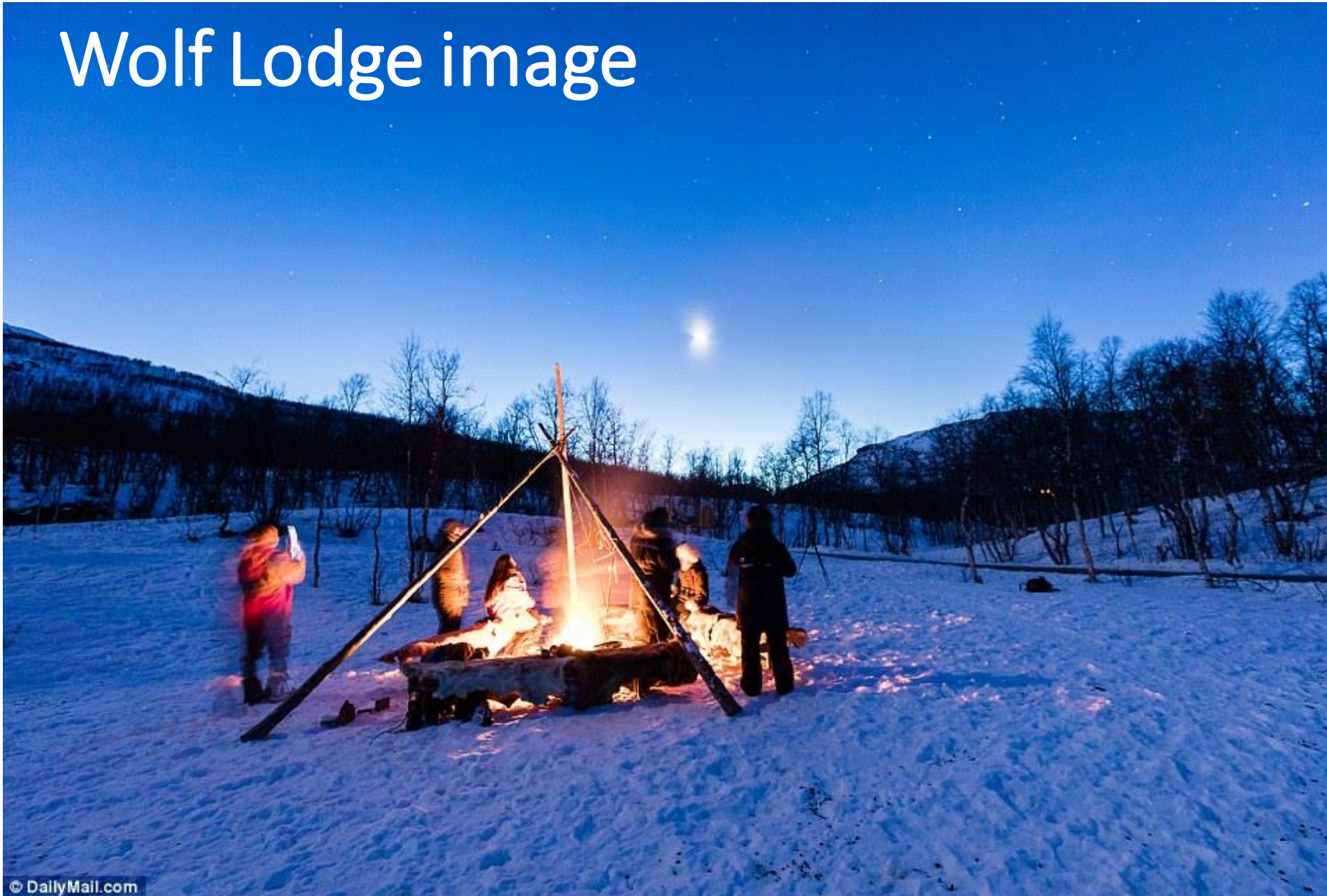
- A bright, white UFO has been spotted over a remote part of northern Norway.
- The aircraft was seen by stunned onlookers in Bardufoss on Thursday afternoon. A short while later, it was seen again in 80 miles away in Tromsø.
- It lingered until after sunset then exploded neatly into two parts before disappearing into dust, according to witnesses.
- Perplexed locals shared photographs and videos of the structure as it hovered above them near the town of Tromsø on Thursday night.
- Tarquin Millington-Drake of Frontier Travels told DailyMail.com how he witnessed the spectacle.
- 'We thought it was a chopper coming towards us - a very bright light which came over the mountain and headed toward us - then it turned and went past us.
- 'Then it seemed to explode but the explosion was very uniform and symmetrical like two butterfly explosions either side of the light.
- 'It then seemed to turn and go away but no longer as one bright light - just bright dust that faded,' he said.
- Mr. Millington-Drake watched it from the Wolf Lodge, a remote hideaway in Bardufoss where guests have up-close experiences with wolves.
- He and other guests were gathered around a fire outside waiting for the northern lights when the UFO appeared.

Jennifer Smith For Dailymail.com 2

- Stunning photographs from the lodge show the group watching, stunned, as the UFO hovered above them, far outshining the stars.
- 'We assumed it was some special event laid on but the luxury Wolf Lodge but when our hosts starting taking photos it became clear that was not the case.'
- 'It veered away from coming directly from us and just went across the valley.'
- 'By now we were all watching intently and then suddenly it seemed to explode with those butterfly shaped wings.'
- 'It slowed dramatically, now the bright light was more subdued and the light from the explosion joined to form an amoeba-like circle of light which then seemed to turn away from us and then slowly faded totally.'
- 'It seems nobody in Bardufoss knows what it was.'
- 'There is a big military base there but still no definitive theories from anyone.'
-

Read more: <http://www.dailymail.co.uk/news/article-5428285/UFO-spotted-remote-northern-Norway.html#ixzz57zQeuVJK>

Wolf Lodge image



© DailyMail.com

http://i.dailymail.co.uk/i/newpix/2018/02/23/20180223156F00000578-5428285-image-a-9_1519416487925.jpg



Zoom in on
Wolf Lodge image

2018 FEB 21 NORWAY DEORBIT VIEWING



CONTRAST-ENHANCED

OPEN WORK

- Continue survey of internet sites which traditionally report spectacular sky apparitions
- Follow up on all indirect links to suggested other witness comments
- Press SPACEX for generic technical details of stage-2 restart procedures that can create visible traces
- Press SPACEX for generic deorbit planning/aiming practices
- Press SPACEX for generic surplus fuel dump strategies
- Continue seeking OTHER previous Falcon missions with stage-2 restarts to actively analyze solar illumination conditions and line-of-sight from inhabited surface regions

DISCUSSION AND CONCLUSION

- 1 CLEAREST IMAGING YET OF PLUMING DYNAMICS
- 2 THIRD DATA POINT FOR ASSESSING DEORBIT TO ENTRY RANGE
- 3 SERIOUS AMATEUR OBSERVERS IN SCANDINAVIA DOMINATED NEWS FLOW
- 4 OPPORTUNITY TO SEEK & COLLECT AIRLINE PILOT REPORTS HINTED
- 5. REMINDER OF INTERNET MISLABELING PREVIOUS VIDEOS/IMAGES
- 6 REPORTED AS 'UFO' ON SOME MEDIA
- 7. GROWING BODY OF REPORTS ENCOURAGES FUTURE ANTICIPATION
- 8. OVERLOOKED OBSERVATIONS ON PAST MISSIONS STILL POSSIBLE
- 9. AWESOME POWER OF WORLD SKILLED-AMATEUR OBSERVER NETWORK