

GROUND OBSERVATIONS OF
FALCON-9 SECOND STAGE
ORBITAL VENTING/THRUSTING
AS AID FOR INTERPRETING
UNUSUAL VISUAL FEATURES OF
MYSTERIOUS 'ZUMA' LAUNCH

FINAL DRAFT

March 20, 2018

James Oberg

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PROBLEM AND APPROACH

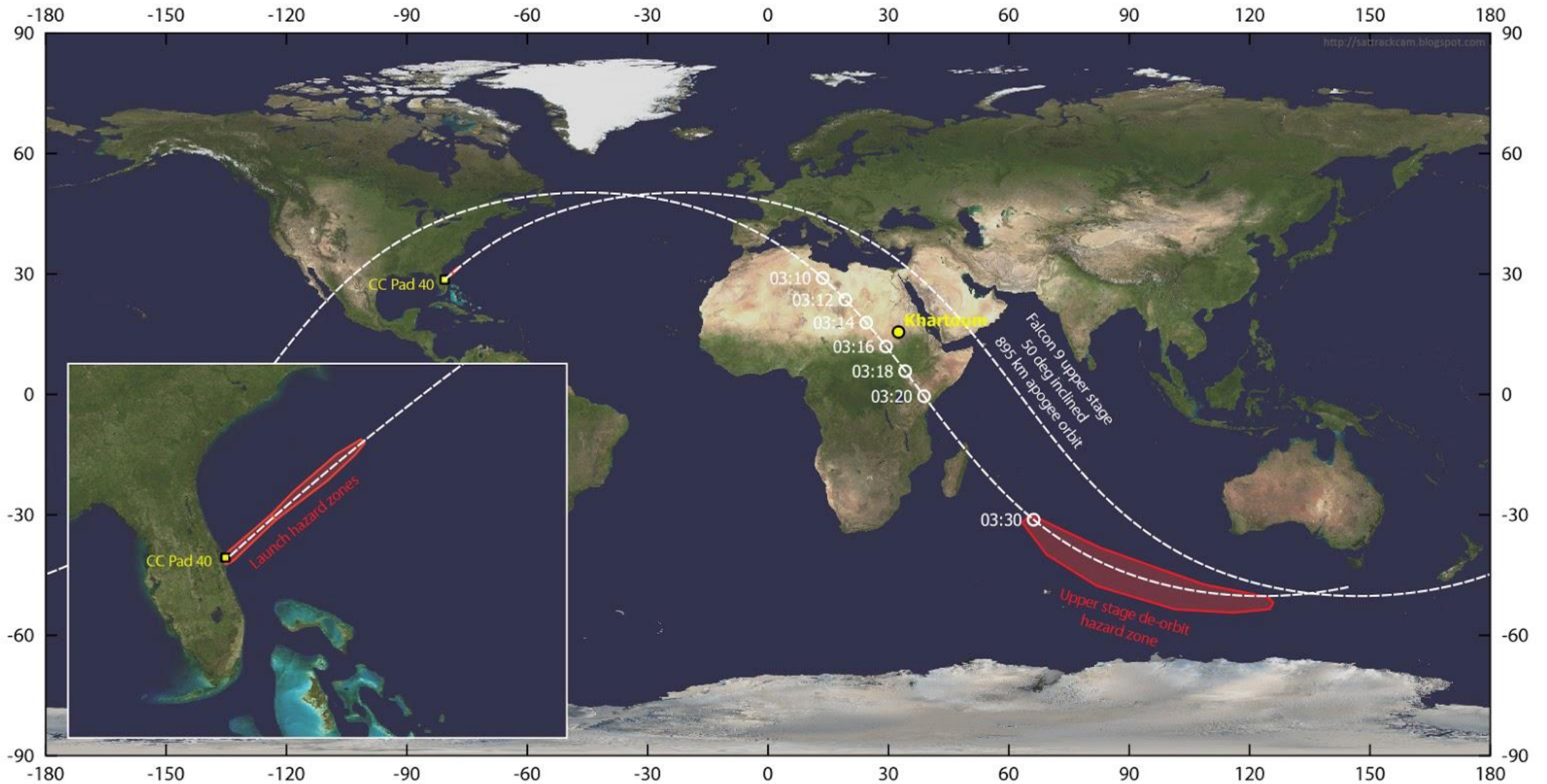
- 1 Classified payload Zuma launched, results not disclosed
- 2 Accidental imaging of second stage venting by MANY observers
- 3 SpaceX disclosure of 'normal' venting procedure is scanty
- 4 However, some past launches had similar venting imagery
- 5 Detailed study of images and descriptions can possibly help characterize spacecraft activities including anomalies
- 6. Random nature of rare enabling conditions will always make such opportunities for insights rare and unpredictable
- 7. All the more motivation to jump on such literally heaven-sent serendipitous opportunities whenever they are discovered
- 6. Assessment of witness misperceptions [based on a known visual stimulus] helps understand reliability of other sky observations
- 7 Two more stage2 burn/dump observations occurred the following month and those events are incorporated into this overview report
- 8. All five 'analogous plumes' have detailed focused reports to be examined

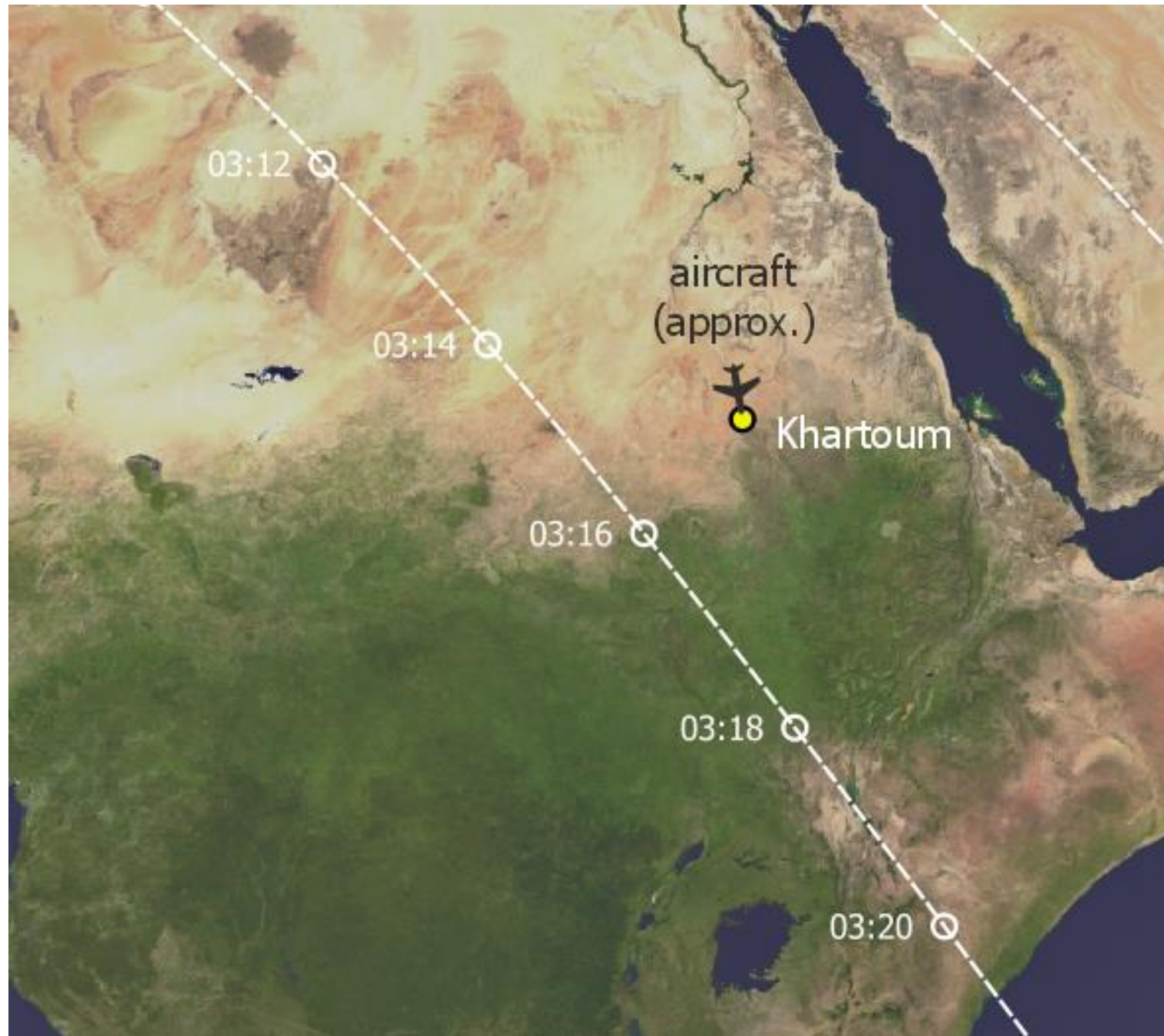
Launch sequence of events & rumors

- LAUNCH
- Mission event discussion:
<https://forum.nasaspaceflight.com/index.php?topic=44175.0>
- Mission results analysis
<https://forum.nasaspaceflight.com/index.php?topic=43976.0>
- Launch video <https://youtu.be/iS644RQYKTw>
- S2 debris warning zone
<https://forum.nasaspaceflight.com/assets/43976.0/1468540.jpg>

The double-spiral “Khartoum Clue”

- Was the mission:
 - A total debacle?
 - A misleading charade?
 - A camouflaged success?
 - Something else entirely?
- Into this deliberate darkness and engineered opacity, appeared literally one beam of light in the skies over Khartoum
- That seems like one of the least likely places on Earth to expect to find clues about outer space mysteries
- But it reminds us again of the world-spanning globe-girdling scope of human activity in outer space which is redefining pre-spaceflight concepts of proximity and distance, time and speed, light and dark
- New awareness allows seeking and recognizing potentially informative related space events of the past with similar hardware and procedures





Object
passes
over
South
Sudan
into
daylight

“This is the image taken by Dutch pilot Peter Horstink, from his aircraft over Khartoum near Jan 08, 3:15 UT, 2h 15m after launch. This is probably the Falcon 9 venting fuel. #Zuma” [or maybe NOT]





Khartoum
ground
witness

https://www.reddit.com/r/whatisthisthing/comments/7oy9yi/a_weird_looking_star_showed_up_in_sudans_sky/



<https://i.imgur.com/kUh1KzY.jpg>



JSpOC ("NORAD") did enter an object from this launch into its master catalogue on January 9th, as object **nr. 43098, COSPAR 2018-001A**, name **USA 280**. They designated it "PAYLOAD" (and the USA 280 designation would point to this as well). As usual for classified missions, they do not give details on the orbit. [Marco Langbroek]

INTLDES	NORAD_CAT_ID	OBJECT_TYPE	SATNAME	COUNTRY	LAUNCH	SITE	DECAY	PERIOD	INCLINATION	APOGEE	PERIGEE	COMMENT
2018-002F	43104	DEBRIS	CZ-2D DEB	PRC	2018-01-09	TSC		94.55	97.45	535	459	
2018-002E	43103	DEBRIS	CZ-2D DEB	PRC	2018-01-09	TSC		95.78	97.72	583	530	
2018-002D	43102	DEBRIS	CZ-2D DEB	PRC	2018-01-09	TSC		95.47	97.47	554	528	
2018-002C	43101	TBA	OBJECT C	PRC	2018-01-09	TSC		95.09	97.58	534	512	
2018-002B	43100	TBA	OBJECT B	PRC	2018-01-09	TSC		95.10	97.58	533	513	
2018-002A	43099	TBA	OBJECT A	PRC	2018-01-09	TSC		95.17	97.58	536	518	
2018-001A	43098	PAYLOAD	USA 280	US	2018-01-08	AFETR						NO ELEMENTS AVAILABLE

<https://sattrackcam.blogspot.co.uk/2018/01/fuel-dump-of-zumas-falcon-9-upper-stage.html>



DAY/NIGHT
TERMINATOR
DURING ZUMA
OVERFLIGHT

LOCAL MEDIA



<http://english.alarabiya.net/en/variety/2018/01/11/Mysterious-UFO-seen-over-Khartoum-on-Monday-night-and-stifles-military.html>

Mysterious UFO spotted in Sudanese capital perplexes military

Antar Saeed, Al Arabiya English Thursday, 11 January 2018

- A mysterious Unidentified Flying Object (UFO) was spotted in the skies of Khartoum on Monday night. The luminous body, seen clearly at around 3:15 am local time, was surrounded by a radiant green light, according eye witnesses.
- The Sudanese military released a statement on Monday morning confirming the presence of a UFO and claiming that it is a 'suspected' satellite.
- "Our base in Omdurman has received notifications from some nearby stations of the emergence a bright body flying at low altitude over the Wadi Sayidna military zone," said the Sudanese military in a statement on Monday.
- "A state of extreme readiness was undertaken to deal with the aerial target and intercept it as a photographic reconnaissance vehicle," the statement said. The object however was not identified, the Sudanese military added.

East Africa followup very difficult

- Initial responses were encouraging but little new information
- In particular, effort to determine if any ground witnesses observed brief forward-projected deorbit burn plume – no results
- Cooperative responses included confirmation Khartoum has no continuous all-sky meteor or weather cameras

Abdelrahman Osman @Abdelrahmanxyz Jan 27

Replying to **@Jim_Oberg @NecromanceRaven**

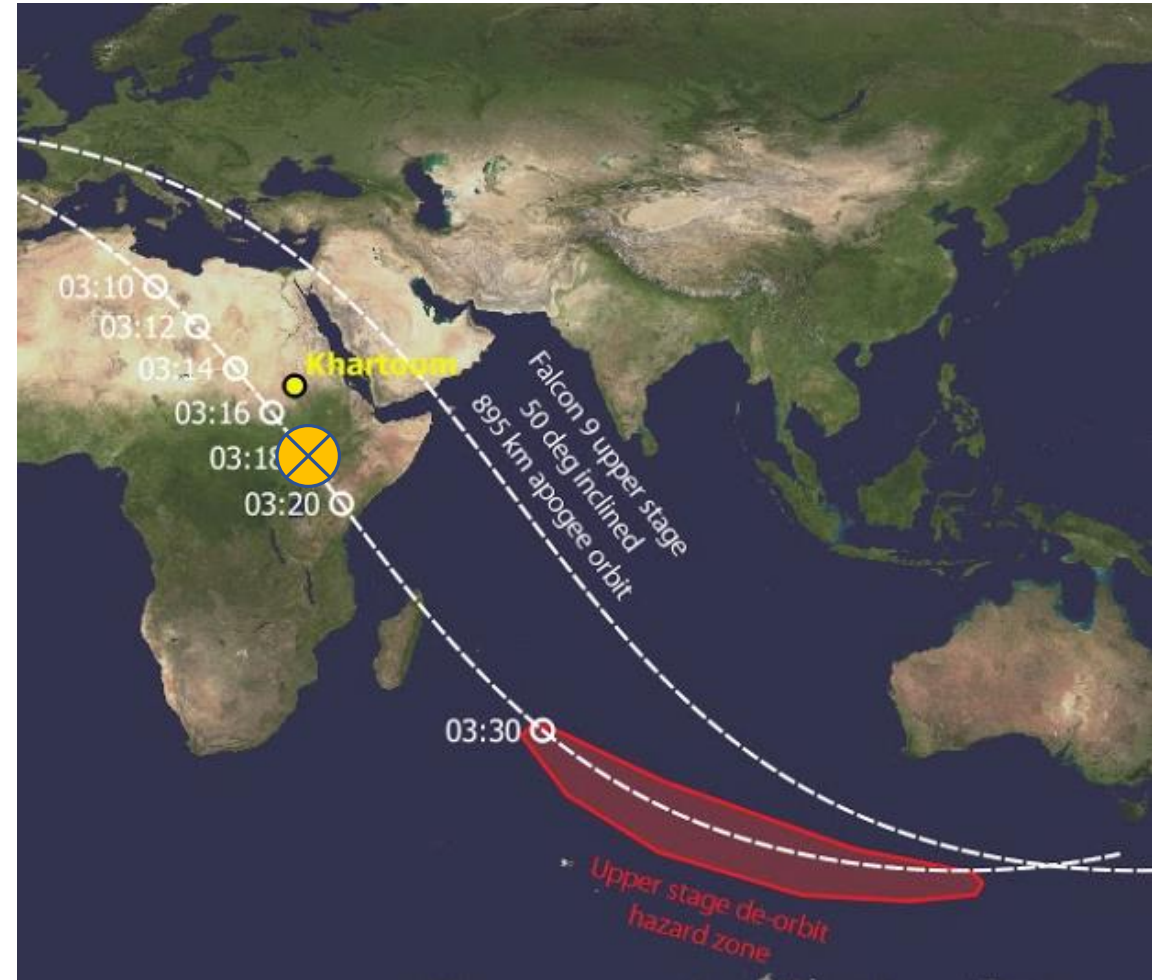
Unfortunately there are not such cameras!

- Several communications outreach efforts to Juba, South Sudan [even more directly under rocket's path] total strike-out
- Outreach efforts continue and advice and assistance is appreciated

Feb 2017 deorbit



Jan 2018 Zuma deorbit



PLUMING LOCATION RELATED TO IMPACT WARNING ZONE₁₆

Falcon-9 second stage disposal practices

- Deorbit delta-V highly dependent on parking orbit altitude
- Falcon-9 design involves unusually high-acceleration engine
- Remaining propellant load highly variable [payload dependent]
- SpaceX not obligated to disclose or explain procedures



<http://digitalvideo.8m.net/SpaceX/AIAA/2ndstage-dragon640.jpg>

FALCON-9 SECOND STAGE



	Second stage
Engines	FT: 1 Merlin 1D Vacuum+ v1.1: 1 Merlin 1D Vacuum v1.0: 1 Merlin 1C Vacuum
Thrust	FT: 934 kN (210,000 lbf) ^[2] v1.1: 801 kN (180,000 lbf) ^[3] v1.0: 617 kN (139,000 lbf) ^[4]
Specific impulse	FT: 348 seconds ^[2] v1.1: 340 seconds ^[3] v1.0: 342 seconds ^[12]
Burn time	FT: 397 seconds ^[2] v1.1: 375 seconds ^[3] v1.0: 345 seconds ^[4]
Fuel	LOX / RP-1

What does Space-X tell us?

- TBD

What does the Internet tell us?

- **Intentional Deorbit ==** This is done for missions where the upper stage has enough remaining fuel reserves to ensure an intentional decay can occur safely. This has been done on every [LEO](#) mission since CRS-3 (including Orbcomm OG2), and usually results in the stage being deorbited Southsouthwest of Australia in the Indian Ocean. We know this because occasionally SpaceX will post a NOTAM declaring the zone unsafe for a certain time.
- **Left in GTO to decay ==** So far, this has been standard operating procedure for all 4 Falcon 9 upper stages that have delivered communications satellites to [GTO](#). At this time, none remain in orbit, as the periapsis of each is so low (~200-300km) that they decay within 2-6 months. No deorbit profile has been attempted as it presents SpaceX with a liability if the stage decides to explode, scattering debris in GTO (additionally, if not enough fuel remains, they cannot safely deorbit either).
- The standard apoapsis for GTO is about 35,000km, but for the first two GTO missions (SES-8 & Thaicom 6), they were injected into what is known as a "Supersynchronous Orbit" with an apoapsis beyond 35,000km. In the latter, it was in excess of 90,000km. It was launched on January 6 and decayed May 28, 2014.
- **Left in LEO to decay ==** This has been the case for Falcon 1 Flights 4 & 5 which remain in a nearly equatorial LEO to this day, as well as the first 5 Falcon 9 flights - of which COTS1 performed an unannounced upper stage restart boosting it into a 290x10,700km orbit & CASSIOPE, which attempted a "sideways" upperstage restart which failed, stranding it in a 900km polar orbit.
- <https://space.stackexchange.com/questions/7814/what-happens-to-the-falcon-9-second-stage-after-payload-separation> [Feb 20, 2017 note]

What happens with random reentries?

You'd also expect the stage to disintegrate upon reentry, wouldn't you. Not always! The upper stage of [AsiaSat 6 reentered over Brazil and parts of it were found scattered in an open field](#). It made quite the fireworks on reentry though [Some of the largest items found intact were the Composite Overwrapped Pressure Vessels (COPV's), which stored helium]:





SURVIVING STAGE-2 DEBRIS

- <http://forum.nasaspaceflight.com/index.php?topic=36440.0>
- https://www.reddit.com/r/spacex/comments/2qwrnq/from_nsf_possible_falcon_9_second_stage_found_in/?st=jcwvvhw3&sh=d3ebb3ad3

Hello, I have the news that a second debris was found in Brazil, possibly an Annulus.

The piece fell on the roof of a country club, which luckily was empty at the time, in the city of Andradina, around 166km from the city where the tank fell.

A friend, Robson Hahn, aerospace engineer of the Department of Aerospace Science and Technology of Aeronautics

Robson is Investigating the area of possible falls using the coordinates that Ted Molczan suggested for possible point of falls, today he visited the site of the COPV fall (Which is isolated by the local police), and he is Maintaining contact with SpaceX.

About the COPV the tank fell only fifteen meters of a house and the heat melted and sealed it. Seems there is still que pressure inside it.

I believe que more debris will be found, all towns of the region are very small and the news sometimes linger to get out of the place.

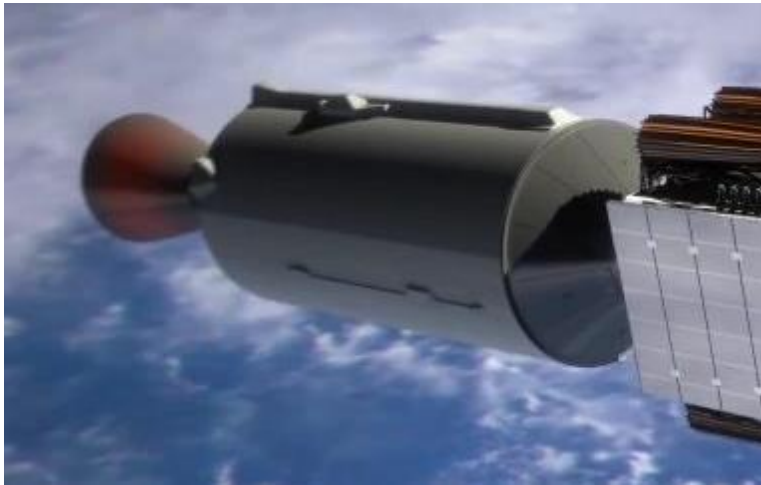
<http://forum.nasaspaceflight.com/index.php?topic=36440.msg1308656#msg1308656>

SURVIVING STAGE-2 DEBRIS



Spaceflight101.com [end]

- **Falcon 9's second stage is quite a sizeable object with a separated length of 12.6 meters, a diameter of 3.66 meters and an inert mass on the order of four metric tons. Some of its components are known to survive re-entry including the now infamous Composite Overwrapped Pressure Vessels that have been identified as the cause of the September 1st explosion of SpaceX's workhorse rocket. In 2016, debris from a second stage that had been left in orbit after a GTO launch rained down over Indonesia [<http://spaceflight101.com/falcon-9-jcsat-16/spacex-rocket-parts-rain-down-over-indonesia/>], causing damage to property on two small islands, illustrating the importance of safely removing rocket stages from orbit whenever possible.**



<https://ekliptika.wordpress.com/2016/09/26/roket-falcon-9-full-thrust-penerbangan-28-jatuh-di-pulau-madura/>

Five known stage-2 post-launch events created similar mass ground sightings of plumes/clouds

- 1 SE Australia on June 4, 2010 morning twilight
- 2 South Africa & Indian Ocean on Sep 29, 2013 evening twilight
- 3 Persian Gulf on Feb 19, 2017 evening twilight
- 4 ZUMA -- Sudan on Jan 8, 2018 morning twilight
- 5 California/Mexico on Feb 06, 2018 evening twilight
- 6. Scandinavia/NW Russia on Feb 19, 2018 evening twilight
- ***Sightings/videos of additional events are still being sought.***
- OTHER FIVE EVENTS ARE SUMMARIZED HERE – SEE DETAILED REPORTS

SEPARATE DETAILED REPORTS

- LINKS TBD.

- .

- .

- .

- .

- .



June 4, 2010
Falcon-9 second stage
post-insertion prop venting
observations from SE Australia



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March 20, 2018

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FINAL DRAFT

SUMMARY

- FIRST-EVER FALCON-9 ORBITAL MISSION
- LAUNCH DELAYED INTO WINDOW SO TWILIGHT CONDITIONS OVER AUSTRALIA NOT ANTICIPATED
- Second stage lost roll control during ascent.
- An engine restart attempt failed because of the roll
- PLANNED RESTART TIME NOT KNOWN

June 4, 2010 ufo
East coast of
Australia
at 19:48 UT



- 2010 Jun 4 1845:00 UT
- Designator '2010-026A'
- Dragon Qual Unit. "Dragon Spacecraft" FIRST ORBITAL FLIGHT
- $i = 34.50^\circ$ // $H_p = 236.6 \text{ km}$ // $H_a = 273.3 \text{ km}$ // $P = 89.47 \text{ min}$
- DRAGON/FALCON 9 R/B

June 4, 2010

1 36595U 10026A 10155.91803255 .00078673 32520-5 10000-3 0 41
2 36595 34.4959 40.7086 0023426 215.5471 255.2519 16.05715940 20

Actual ground track

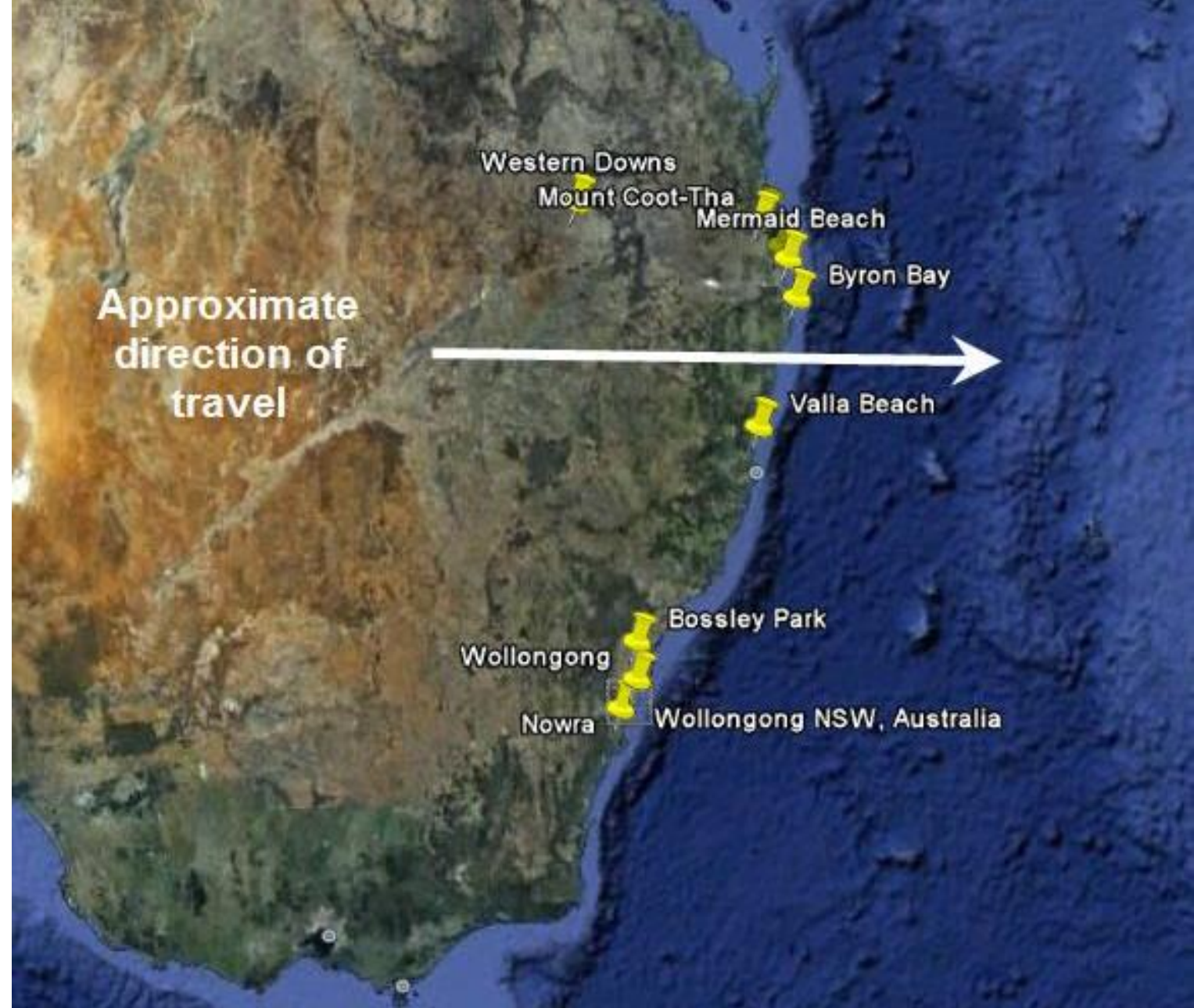
Australia June 4, 2010



- Link tbs

Australia June 4, 2010

Map of reporting sites [per comment from 'Tauristercus']





Monique Bevan snapped this photo near Banora Point in NSW.

NEWS REPORTS OF EYEWITNESS ACCOUNTS, INTERPRETATIONS

Canberra resident James Butcher says he was driving home from a night out with his brother when they spotted the "strange spiral light in the sky". "It had a distinct bright centre, much like a bright star, indicating an object **shedding light trails, spiralling and fattening out from it,**" he said. "The effect lasted only two or three minutes, moving and descending quickly out of view. The colour was yellowish but this may have been blurred and tinted by the morning fog."

Wollongong man Eddie Wise says he also saw the light during his morning walk just before 6:00am. He says he has never seen anything like it.

"It was like a yellowish, greenish light with a light spiral around it," he said. "It sort of **moved around, bobbed up and down and then it went behind a cloud.** I'm just amazed. I want to know what it was."

A caller to the ABC, Robyn, says she saw the phenomenon from her home on Sydney's north shore just before 6:00am.

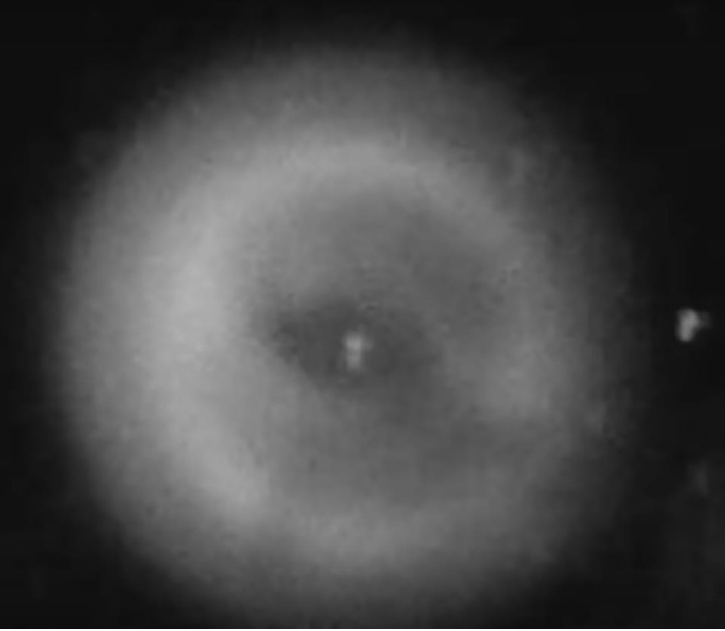
She says it was over within two minutes. "There was this white light up in the sky like a **huge revolving moon,**" Robyn said. "At first I thought it was the moon but it was travelling so fast, high up above the eastern horizon and **twirling** as it went. "It was just amazing and to be quite frank, I was quite frightened and my heart's still pounding."



Lance Godwin took this photo in NSW [New South Wales].

SUMMARY OF AUSTRALIA EVENT

- 1 Spiral was due to loss of stage2 roll control during ascent
- 2 Sense of spiral was constant in inertial space but Oz is DOWN UNDER
- 3 No engine restart planned, but nominal fuel dump probably intentional
- 4 Illumination conditions not expected, all viewing was accidental
- 5 Nevertheless some excellent photos and videos captured
- 6 Many witnesses reported inaccurate sky motion ['stood still']
- 7 Many commentators rejected rocket explanation based on wide range of misinformation on basic principles of spaceflight and rocketry
- 8 UFO interpretation enhanced by internet dissemination of recent sensational sky spiral images seen in Norway and Russia six months earlier



Sep 29, 2013
Ground observations
of Falcon-9 second stage
fuel dump over Madagascar
[to compare with
other events]



SpaceX over southern Africa. Madagascar, and SW Indian Ocean
First-ever SpaceX orbital launch from Vandenberg AFB
First-ever second stage engine restart test -- failed

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March 20, 2018

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FINAL DRAFT

CASSIOPE

position

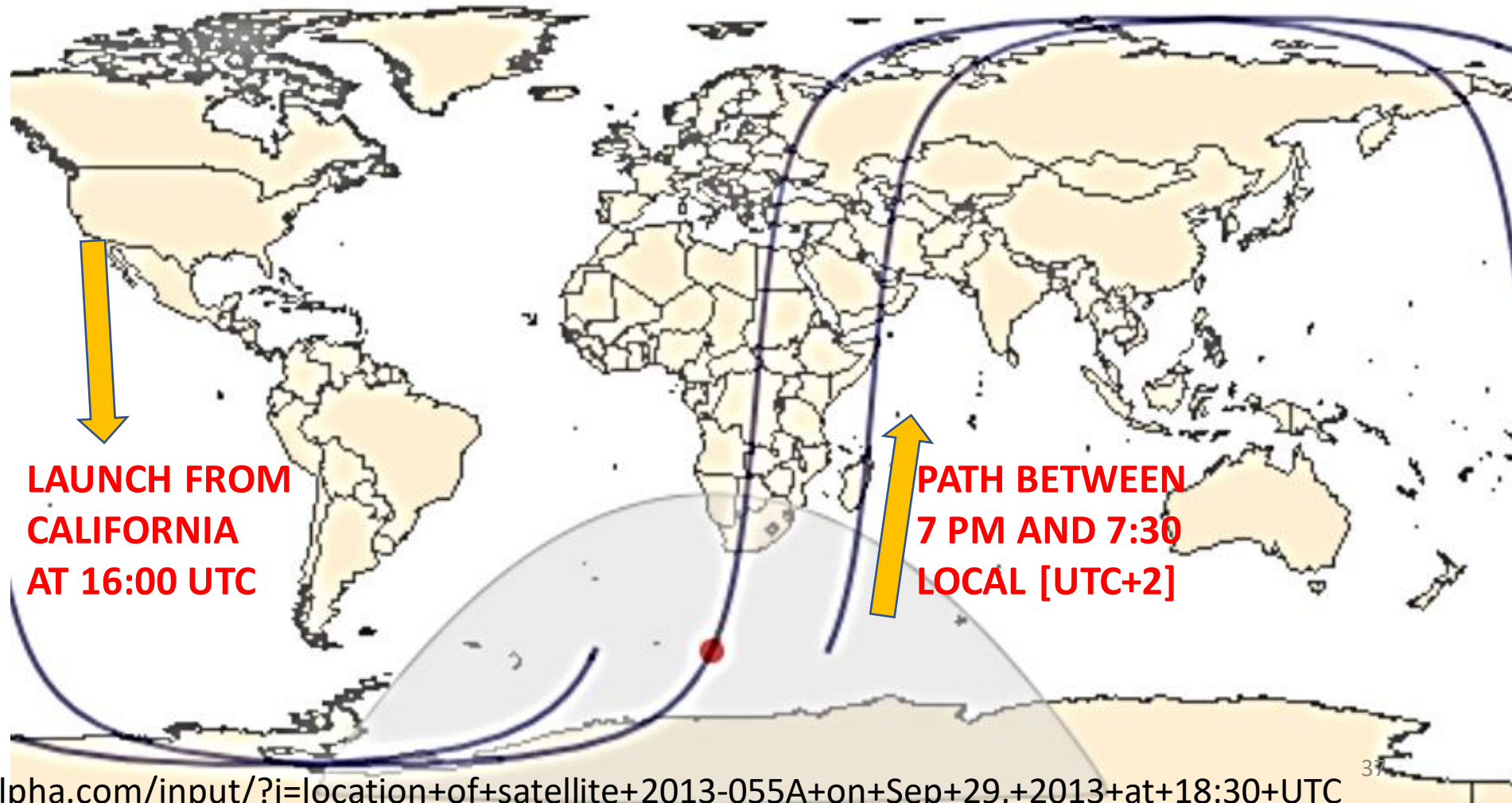
Sunday, September 29, 2013 at 6:30 pm UTC

GROUND TRACK OF CASSIOPE SATELLITE

Show DMS

Show 3D

Orthographic



cassiope

- Wikipedia
- SpaceX also ran a post-mission test on the second stage. While a number of the new capabilities were successfully tested on the September 29, 2013, CASSIOPE flight, there was an issue with the second stage restart test. The test to reignite the second stage Merlin 1D vacuum engine once the rocket had deployed its primary payload (CASSIOPE) and all of its nanosat secondary payloads was unsuccessful. The engine failed to restart while the second stage was coasting in low Earth orbit.
- The Falcon 9 upper stage used to launch CASSIOPE was left derelict in a decaying elliptical low Earth orbit that, as of January 20, 2016, had a perigee of 317 km (197 mi) and an apogee of 1,283 km (797 mi).¹

2013-055 2013 Sep 29 1600:13 2013-055A CASSIOPE

<http://planet4589.org/space/log/launchlog.txt>

Reunion Island

Sep 29, 2013 fuel dump
over Madagascar.... [SpaceX]



Sep 29, 2013

Moon-like UFO 'was rocket fuel'



HARARE



text

<http://www.newzimbabwe.com/news-12503-Moon-like+UFO+was+rocket+fuel/news.aspx>

UFO or Comet Ison? 15,435 views

S. Africa // Sep 29, 2013

[CE-5 Academy](#) = Mass U.F.O sighting Over South Africa and Mauritius tonight of what appears to be the same "object". It is unclear at this stage whether this could be a comet or a legitimate UFO . All reports states a few similarities that are confirmed in this video . The individuals in this video are speaking Mauritian Creol . The man and woman clearly state at at (0.55) how the object grew larger in size and that it looked like it was somehow walking.

Jason Wedlake = I can't believe this is a comet, I saw it with my own eyes this evening, and there was no trail that is normally left by a comet when it passes that close to earth. Another theory is that it is a the Falcon 9 dumping fuel over Africa but I watched it for over 10mins and I can't believe a rocket can dump THAT MUCH fuel and still have enough to complete it's mission.

Johan Botha = Seen by many from Buffelspoort ATKV close to Rustenburg, South Africa, including my daughter, 9 yrs. She confirms this video shows exactly what she saw. According to witnesses this pale blue anomaly grew in size in the Eastern sky, **while maintaining it's position between 2 trees, and then shot across the sky in a West North Westerly direction...** Fuel-dump? Maybe, but what about the sudden movement across the sky and the other little lights floating around the object in this video?

Bloemfontein (South Africa) Sighted on Sunday 29. September 2013

Shape: Circle | Duration: 10 min

- I was on my way to gym at 19:00, as I was driving I saw a light in the sky that looked like a star, I thought it was a helicopter with a spotlight. There was a smoke light ring around the bright light which almost looked like something was being burned. **The object was hovering and made zig zag movements.** I quickly phoned my parents who live in Bethulie +-180 km from Bloemfontein and they could also see this strange object. Strange circle beams came out of the object. As I was looking at the object I saw smaller lights which rotated clock-wise around the object and I saw smaller objects coming out moving into the opposite direction. The bigger light or object suddenly disappeared from a standing still position to the North East.
- Nick -- So glad to find that something online about this. I'm a game ranger in Limpopo and was out on a night drive when I spotted this same thing. At first we thought it was the moon behind some cloud, but then we noticed the 'star' at the center of the haze and also that it was moving. I radioed other rangers and everyone could see it but no-one had any explanation. I wondered whether it was an exploding satellite or something of that nature, but I haven't seen any news. Hopefully something will turn up.
- Luigi -- My Fiance and I also saw it around 7 pm in Klerksdorp. It looked like a star with mist all around it, completely round **until the star vanished and the mist "faded" away**. I managed to get a photo on my I phone

ComorosMan -- We saw it at about the same time from **Comoros Islands** (around 8pm). I was on my way home. I also phoned friends of mine to check if they could see it - and they did.

- [http://www.ufo-hunters.com/sightings/search/524878083c024d5ed6000010/UFO%20Sighting%20in%20Bloemfontein%20\(South%20Africa\)%20on%20Sunday%2029%20September%202013](http://www.ufo-hunters.com/sightings/search/524878083c024d5ed6000010/UFO%20Sighting%20in%20Bloemfontein%20(South%20Africa)%20on%20Sunday%2029%20September%202013)

The Zimbabwe Mail News states

- :
- HARARE, Zimbabwe - There are reports of an unusual moon shaped object that flew across the sky between 7 and 7.15pm on Sunday evening. Zimbabwe State media says it received calls from people in Karoi, Mashonaland West; Mt Darwin in Mashonaland Central and Mutoko in Mashonaland East provinces, all confirming they have seen the object, which they described as bigger than the moon and moving from the east to the north. People confirmed having seen the object from as far as in Botswana, South Africa and Malawi. When contacted for comment, an official from the Meteorological Services Department said they can only comment after liaising with their officers in the respective places.

Sunday 'UFO' was a rocket // SOUTH AFRICA

Monday 30 September 2013 - 2:35pm

JOHANNESBURG - An object seen in the sky across the country on Sunday was a rocket and not a UFO as it was widely believed, a satellite tracking expert said on Monday. Retired astronomer from Cape Town, Greg Roberts said: "What happened was that at 6pm our time yesterday [Sunday] a rocket, called Falcon, was launched from Vandenberg Air Force Base in California and carrying several satellites." "The rocket was designed by a company called SpaceX which has former South African Elon Musk as founder and chief designer."

Roberts said the rocket was launched southwards from California towards the south-polar regions, which it passed over. It started heading northwards again and just east of South Africa. "Shortly after 7pm it apparently either vented or released rocket fuel still in its fuel tanks as the basic mission of placing several satellites in orbit had been achieved while over the Antarctic region and this produced the large halo-like object that people saw." It was possible that the rocket could have been doing a rocket burn to slow down so that it would descend from orbit and burn up in earth's atmosphere later.

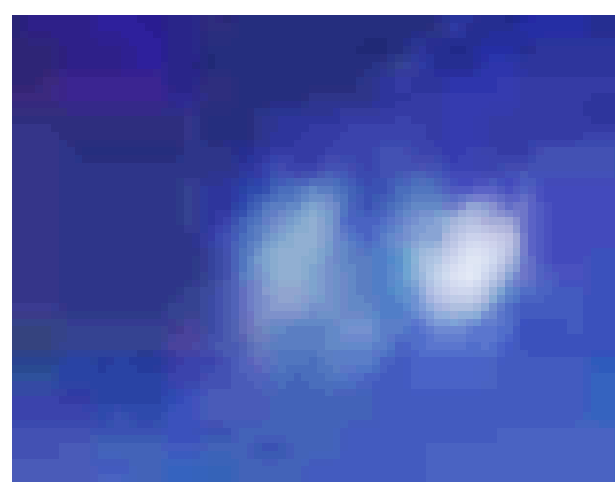
Roberts said this was standard practice to avoid producing too much debris or junk in orbit. "But in either case it was propellant or rocket fuel coming from the rocket itself." Roberts said the venting or firing occurred when the rocket was at its maximum altitude of around 1600 kilometres.

That had been widely seen as it passed east of Durban and then passed over Madagascar. "At about 7.04pm the event was basically over as the satellites and associated rocket entered earth's atmosphere [and] no longer reflected sunlight." Social networks were abuzz on Monday morning with people from KwaZulu-Natal, Limpopo, Free State, North West, and Gauteng claiming to have sighted the object.

<https://www.enca.com/south-africa-life/sunday-ufo-was-rocket>



Picture: Derek van Dam. Photo: eNCA / Derek van Dam
https://images.enca.com/enca/Sky_halo.jpg



February 19, 2017 –
Ground observations
of Falcon-9 second stage
deorbit burn over Persian Gulf
[for comparison to other missions]

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March 20, 2018

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FINAL DRAFT

Feb 19, 2017 – Falcon-9 deorbit burn over Persian Gulf


- SpaceX 'Falcon-9' launch from Kennedy Space Center
- 2017 Feb 19 // 15:11 GMT
- Mass sightings of 'cloud UFO' from Persian Gulf region, 22 min later
- 'Classic' popular speculations about weird explanations
- Illumination conditions – 'classic' for orbiting plumes & fuel clouds
- Bright Venus in field-of-view anchored azimuth reference
- Brief rocket burn revealed new method to obtain absolute scale
- Opportunistic near-real-time pursuit of witness reports


<https://www.youtube.com/watch?v=RiFB1RQLbo>

YouTube




ufo iran



Mass Sighting Of UFO Over Iran & Kuwait
02/19/2017

 The Hidden Underbelly 2.0

 547

140 views

 Add to  Share  More

 6  0

Published on Feb 20, 2017

Mass Sighting Of UFO Over Iran & Kuwait 02/19/2017

Hey guys....Just wanna share with you'll something that I have seen with my own eyes something like I have never seen before which may look like a UFO. Well there was even something so strange that it gives out some kind smoke which goes in a circular motion and then the object suddenly disappeared. This is not at all edited ,but I used the Viva Video app to show like a slow motion so that u see the smoke. That's all . But I can assure you that this video is not done with any camera tricks

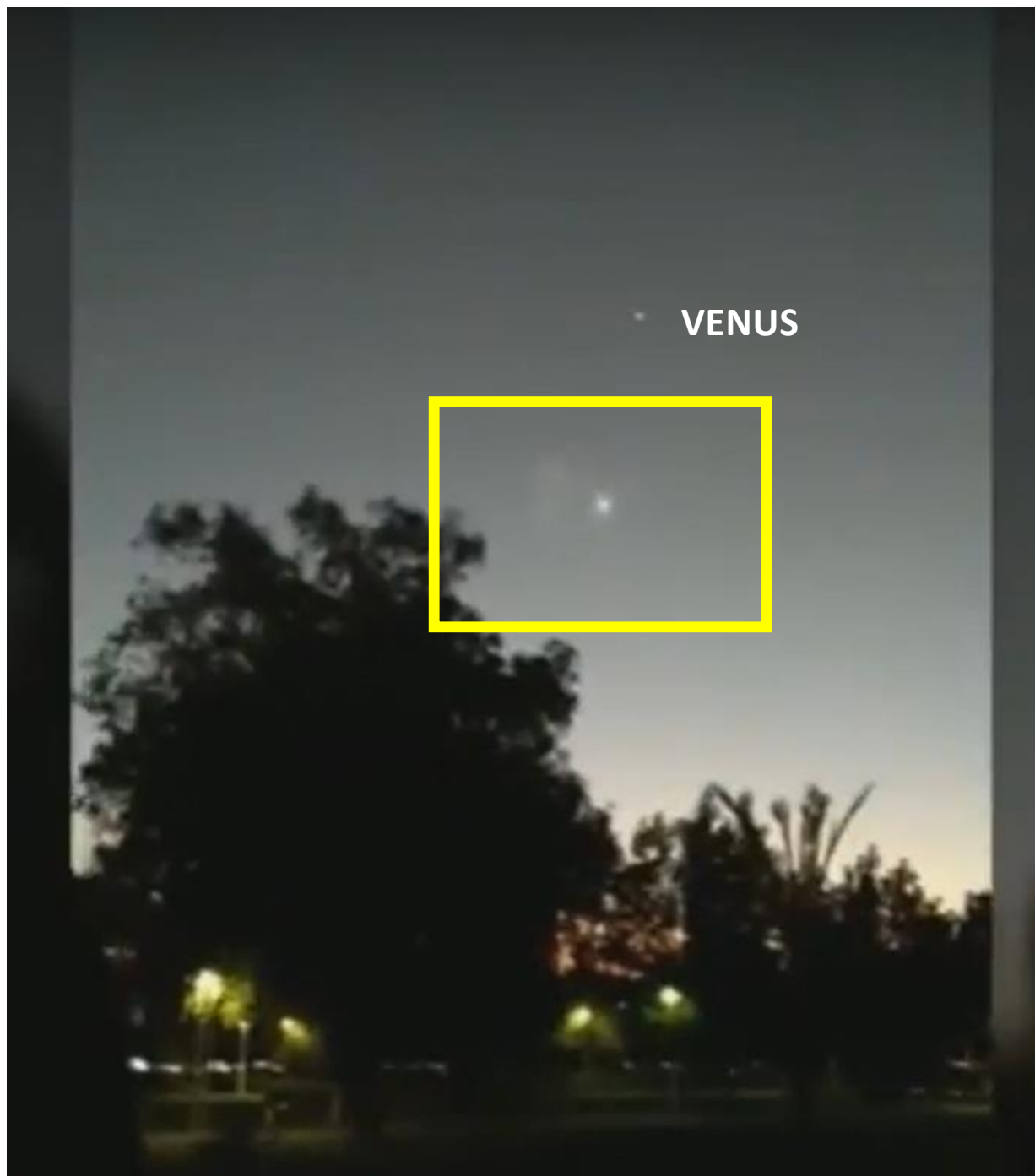
**Persian Gulf
Feb 19, 2017**

Initial typical comments on youtube videos

- Mass UFO sighting over Kuwait and Iran? There are several videos shared on YouTube by many witnesses about a strange object filmed on February 19, 2017. A possible explanation to check: launch of a rocket or missile (military exercises or other test).
- Abraxas Mullins == I believe its ufo because of the orb effect if it was man made it would look to fake plus to me there's no rocket or missile signs there would be trails from both objects
- Ammad Khan -- Ufo i believe
- Beyond Embers == wonder if it's a cloaking tech we are seeing
- GreenMachine == I was wondering that too. Especially with the shot showing **it project some cone in its path then it flies into it** and begins to vanish. A cloak or a portal?
- s Harold == Beyond Embers you wonder if its cloaking Tech we're seeing do you even hear yourself I think I just saw something invisible
- Get a grip, kids – it was the SpaceX rocket launched a few minutes earlier to the space station, dumping surplus fuel. It happens a lot and the UFO media freaks out every time.

Persian Gulf Feb 19, 2017

Iran video with inset
brightness enhanced



Absolutely BEST image of cloud dispersal “strange light in the sky in IRAQ” [1:30 duration] Mukhtar Agha // **Published on Feb 20, 2017**

19 Feb 2017 watched strange light in sky over south of Iraq , was moving from west to south and like **some smoke came from it**, after that I found its a space rocket belong to space x company has been launched yesterday from USA in a successful mission



<https://www.youtube.com/watch?v=FK4rbolK-7k>

BRIEF ENGINE PLUME, SEPARATES, FUEL DUMP STARTS



Persian Gulf Feb 19, 2017

Satellite

OBJECT A (17051.046: 9 hours 54 min)

TIME	Sun, 19/02/2017 20:41:36	Latitude [deg]	26.94	Altitude [km]	293.9	DEC J2000 [d.m.s]	-22:33:40	Sun El [deg]	-8.5 (Twilight)
(UTC)	Sun, 19/02/2017 15:11:36	Longitude [deg]	43.69	Azimuth [deg]	226.8	RA J2000 [h.m.s]	01:11:50	Loaded SAT :	3
Time Off.	-22h 21m 34s (Past)	2457804.13305 JD		Elevation [deg]	19.3	Magnitude	Undefined	Observer (registered)	10566

Persian Gulf
Feb 19, 2017

Lifted off from KSC pad LC-39A
19th February 2017, 14:38:58 UTC

(UTC) Sun, 19/02/2017 15:11:36
Azimuth [deg] 226.8
Elevation [deg] 19.3

Khoozestan
sighting 15:11 UTC

NIGHT
SIDE

Falcon-9 launch of supply craft to
International Space Station

- **Having sent the Dragon on its way, the Falcon 9 second stage was set for a very brief re-start of its engine for a retrograde deorbit maneuver, placing it on a sub-orbital arc intercepting the dense atmosphere over the Indian Ocean, south west of Australia.**
- **After crossing the Atlantic, the second stage passed over the English Channel, flew north of Paris and traversed Europe in just six minutes. The 12.6-meter long rocket stage then passed over Lebanon and Syria, heading to the south east over Saudi Arabia still bathed in sunlight before entering orbital night over the Arabian Sea east of Somalia.**
- **Visibility of the rocket stage extended as far north as the Caspian Sea with favorable nighttime viewing for much of Iraq, Kuwait, Iran and the United Arab Emirates.**



Falcon 9 Second Stage Ground Track – Image: Spaceflight101/Google Earth *Item 3 of 4*

Comments on the video witness comments

Persian Gulf
Feb 19, 2017

- Macy B -- The channel named Jinan Valshayatyn Lourdes from Kuwait with the kid narrating in Arabic, translates roughly to The Crazy Devils of Lourdes, as there are Spanish and Arabic words. Lourdes is a Spanish name. Jinan is the craziness of and Valshayatyn has the word Devils and possibly the Devils I don't know what the v at the beginning is there for unless there's a reason for it in the Spanish language's grammar, since it's a mix of both Arabic and Spanish, the channel's name that is... I'm going to do the English captions for the kid talking in Arabic once I'm home. I guess all the Arabic parts in Kuwait.
- UFOhunter -- @8:05 he say "Ahmed, flying saucer.. Flying saucer" with a Kurdish accent. They know this shit over there too!! Most likely filmed near the city of Ahvaz or Abadan, which is just on the border of Iraq, and a stone throw away from Kuwait. It looks as if the top object is lazing the atmosphere beneath it. I think they are analyzing the atmosphere. The ring around the craft, is all its sensor array. It sure as shit is scanning for something! For what? Not a clue....
- khalid filali -- The kid in Kuwait said **theres smoke**
- Jeffrey Perkins -- he also mentioned **some kind of smoke like spiral**. ? then this orb like craft coming out of of this smoke like ring.? wormhole...
- Amir Mirali -- On all videos uploaded from Iran they all share the same experience.. What they are commenting on what they are seeing. One screaming "flying saucer flying saucer" Other video the individual who is filming saying "Something that looks like a flying frees be glowing floating in the skies at 7:15 Sunday night and we don't know what it is!!"
- Fuhikie Waie -- he says : look look! **it spitted out smoke!** look, em.. whatever ur name is, dude look! come come. some kind of craft spits out dust/smoke. come look look! it moves! and the older guy says like : it became dust/smoke, look it became dust/smoke. its gone kid.

Observed by US military personnel in Kuwait

Camp Buehring (29 41 52 N, 47 25 35 E) is a staging post for US troops in the northwestern region of Kuwait. From its founding in January 2003 to present date, the base was used for military troops heading north into Iraq.

**Persian Gulf
Feb 19, 2017**



- Dale St. Hilaire -- well I can say one of my soldiers said he saw it to and had to go make a ufo report. In kuwait
- Jim oberg -- Please share details!
- Dale St.Hilaire -- well we are in camp buehring and he said he saw a ufo. same day as this. He said they confirmed space x falcon 9 was reentering from space station. but a rocket reentering from orbit doesn't look like this.
- Jim oberg -- THANK you for following up. Actually, it WAS the Falcon=9 upper stage making a brief rocket firing to slow down -- it reentered half an hour later south of Australia [they had already filed a NOTAMS advisory of that area]. ...
- Dale St.Hilaire == well that's about all the info I really have that's relevant. he did say it was around 630 pm here and if the rocket was silver and reflective it could explain the "light ball" image it put off from reflecting the light. **kind of like looking at a street light on a humid night. it has a light "aura" around it.**
- <https://www.youtube.com/watch?v=To9DXDzTCRU&t=444s>

2-SEC BURST FROM SAUDI ARABIA

Persian Gulf Feb 19, 2017

UFO IN SAUDI ARAB



satti408



February 19, 2017

5 views



Add to



Share



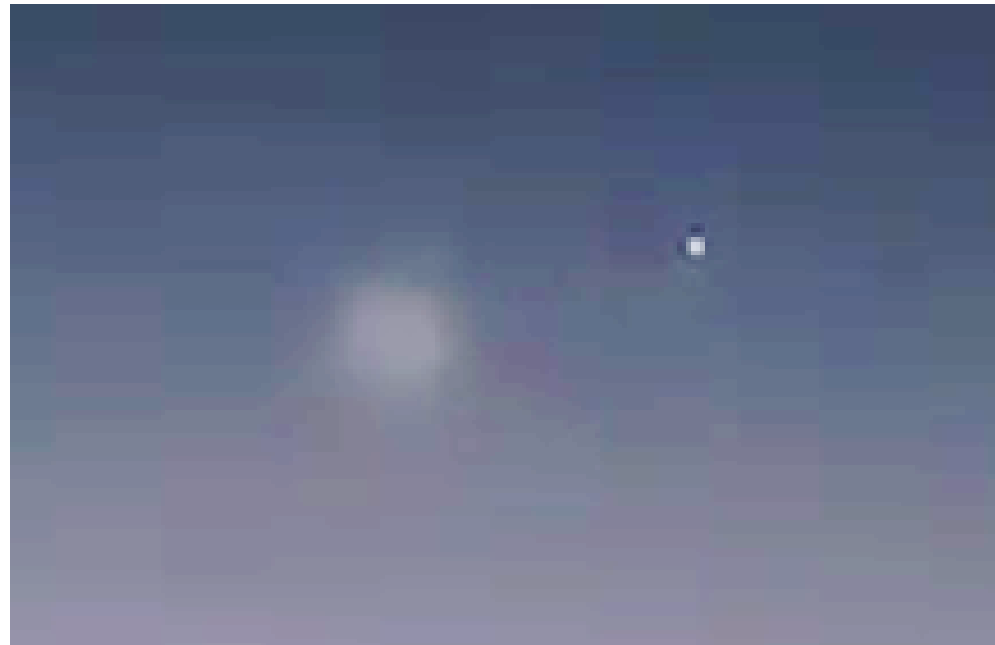
More



1

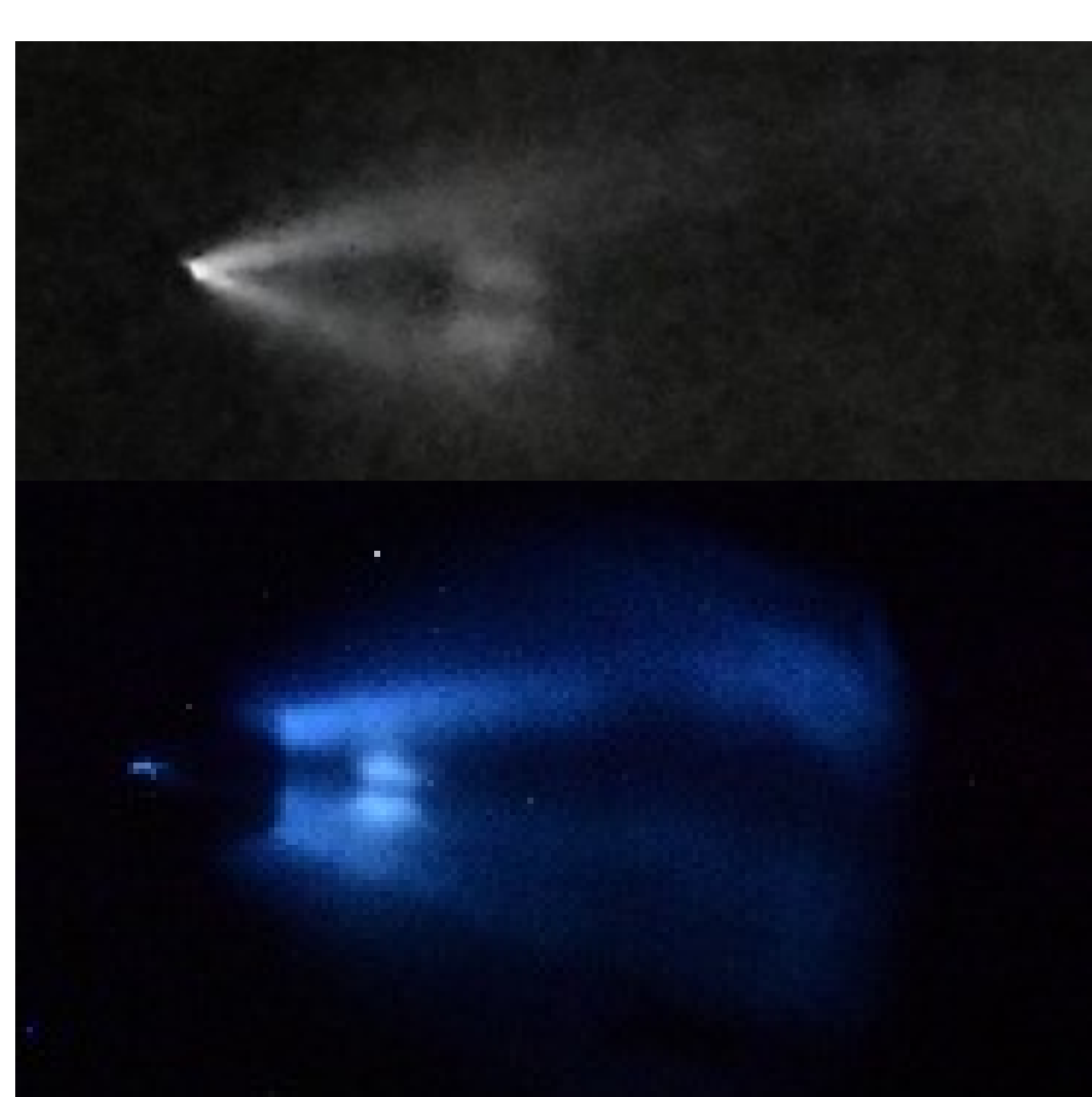


0



NOTE HOW POSITION OF CLOUD RELATIVE TO VENUS IS HIGHER THAN IN VIDEOS FROM MORE NORTHERLY LOCATIONS, PROBABLY DUE TO PURE GEOMETRIC FACTORS OF OBSERVER BEING CLOSER TO OBJECT, HENCE ELEVATION ANGLE WAS GREATER

<https://www.youtube.com/watch?v=nvhjFRP8H14>



GROUND OBSERVATIONS OF FIRST FALCON HEAVY STAGE-2 EARTH-ESCAPE BURN ON FEB 6, 2018 == PRELIMINARY ANALYSIS

James E. Oberg

www.jamesoberg.com

Final Draft

March 20, 2018

Annotated image of post-burn cloud with suggested explanations

SPACECRAFT WHICH
HAS ACCELERATED OUT
OF ORIGINAL POSITION
BETWEEN TWIN LOBES



TWIN LOBES OF PRE-BURN
'BUTTERFLY' FUEL PURGE
EXPELLED SIDEWAYS AT
LOW VELOCITY



SLIGHT BEND
AT AFT END
OF PLUME
SUGGESTS
A MINOR
IGNITION
ATTITUDE
ERROR THAT
WAS QUICKLY
CORRECTED

APPROX 55 SEC BURN AT 3.5 KM/SEC
WITH ROCKET GAINING SPEED GIVES
END-TO-END PLUME LENGTH >> 200 KM



FORWARD END OF ENGINE PLUME
REPRESENTING SHARP SHUTDOWN



AFT END OF ENGINE PLUME
[3500 M/S RELATIVE VELOCITY]

WHY THE THIRD SPECTACLE WAS THE CHARM

- The actual location of the burn was never specified in advance in terms of precise geographic area and planned time of ignition
- Several random factors combined to create an unplanned bonus
- Actual liftoff occurred after several hours of delays, shifting all subsequent flight events equally later
- Cloud cover was minimal throughout regions below the maneuver
- The burn-to-escape lit up the evening twilight sky across western regions of the United States and Mexico, and was seen by thousands
- A handful of them had realized the opportunity just in time, and rapidly prepared to observe it
- Many of the surprised witnesses reacted quickly with cameras, and soon circulated detailed descriptions of what they had seen across the Internet

FEB 6, 2018

WHAT THEY SAW

The show consisted of two distinctly different acts

Stage-2 first became visible as a fuzzy white blob moving slowly from northwest to southeast

The shape was of two opposing fan-like structures, one on top and one on the bottom, which lasted about two minutes

Suddenly a bright fan-like structure grew from the trailing side of the object, its farther portions gradually fading out

Twin clouds were observed in the engine plume, initially of uncertain origin until analyzed.

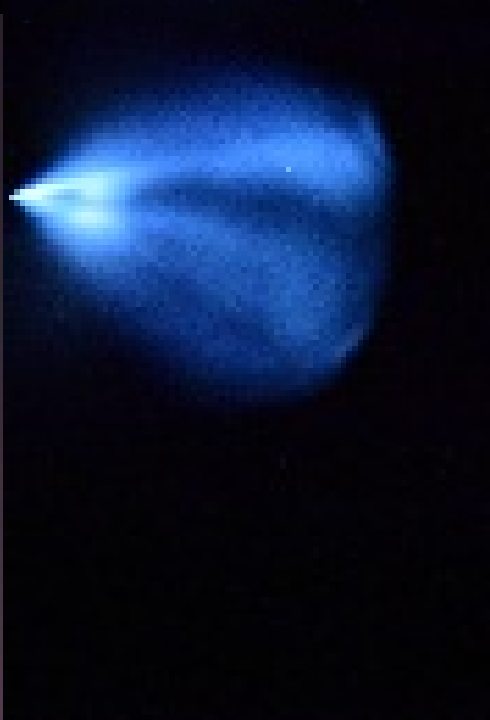
Then the apex of the fan detached from the object [now only small star] and within seconds fell behind and dissipated [burn duration approx. 55 seconds]

FEB 6, 2018

June 4, 2010



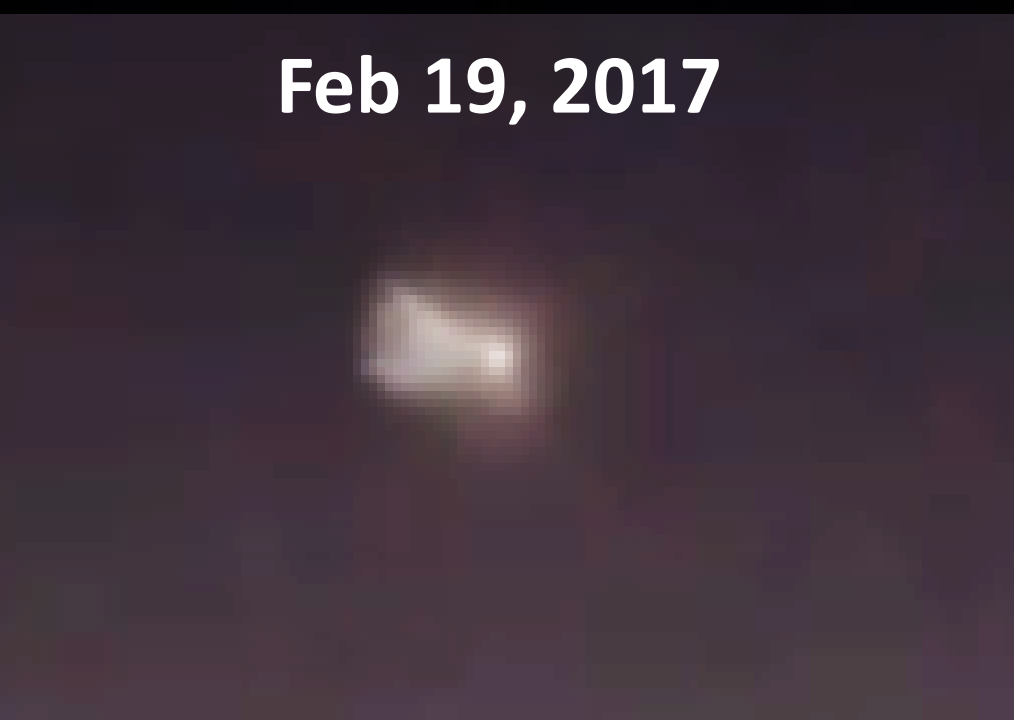
BELOW: PHASE-1
AND PHASE-2 OF
FEB 6, 2018



Sep 29, 2013



Feb 19, 2017



Jan 08, 2018



TIMELINE

- LAUNCH WINDOW OPEN 2018 FEB 06 // 18:30 GMT
- ACTUAL LAUNCH 2018 FEB 06 // 20:45 GMT
- SECOND STAGE RESTART 2018 FEB 07 // 02:31 GMT
- Press kit
- http://www.spacex.com/sites/spacex/files/falconheavypresskit_v1.pdf

<https://www.azcentral.com/story/news/local/arizona-breaking/2018/02/06/rocket-seen-over-arizona-skies-most-likely-latest-spacex/313928002/>

FEB 6, 2018

TWICE AROUND, THEN OUTWARD BOUND [source...]



FEB 6, 2018

https://1.bp.blogspot.com/-ICPodGVz2O8/WnxJr4YZ_mI/AAAAAAAAAE7A/PckZvpiH9Llaaexr1MII1HCu5kjmej9nwCLcBGAs/s1600/kaart_Falcon_Heavy_150dpi_DEF_anot.png

Natalie Wells == Also
seen over Las Cruces, NM!



FEB 6, 2018

<https://pbs.twimg.com/media/DVZsxLzUMAAkdY1.jpg>

Space artist Don Davis in LA, watching the sky....

“A missile launch has just taken place that appeared as a cometlike light appearing almost like a light in a fog. I rushed in to get binocs, through them the presumed missile, moving more like a satellite in its speed, had symmetrical rays, when I first saw it to the SW appearing over the mountains it was about the full Moon wide, $1/2$ degree.

“It expanded and brightened and became more of a 'cone' shape as it reached its nearest point almost due south, roughly 40 degrees high. I took long exposure photos hand held as it passes, and when it reached SSE the engine cut off and a vaguely loop shaped faint expanding cloud dissipated.”



FEB 6, 2018

Don Davis photo 1



Davis: "Maybe a minute after the exposures began at 6:53 PM the plume grew and spread into a brighter cone shape. Here it is caught in the act of growing, with an initially sharp trailing edge.



FEB 6, 2018

Davis: "This is the best image I got of the developed final plume. A faint expanding 'puff' surrounds this, just visible in the original picture. An unexpected local angle to today's space spectacular!"



FEB 6, 2018

Davis: “And lastly, this very grainy view showing the dissipating conical cloud and the lesser glow of the rocket proceeding on its way to its left.”



Falcon Heavy orbit transfer burn as seen from San Diego!

Falcon Heavy orbit transfer burn as seen from San Diego!



PyroForge
Published on
Feb 6, 2018

0:07 / 1:33



FEB 6, 2018

<https://www.youtube.com/watch?v=H9LXhHVzdF4>

It's a Bird! It's an Angel! No, It's Falcon Heavy!



FEBRUARY 7, 2018

by Steve Jess

Mars-bound rocket
gives Southwest a
sky spectacle.

<https://media.azpm.org/master/image/2018/2/7/view-larger/3-falcon-3.jpg>

FEB 6, 2018

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

PAUL MALEY via Seesat-I

- Date: Wed, 7 Feb 2018 05:13:32 +0000 (UTC)
- I was in the field when I first sent an email and was simultaneously working on a minor planet occultation when I unexpectedly saw the object. I was actually sitting in my car with no glasses on and saw what appeared to be an out of focus Moon through the windshield. I jumped out, put on my glasses, and immediately recognized the sight since I have seen venting before, but not in perhaps 15 years. The core was about 2nd magnitude in the west and was distended with two wings (one above and one below) in a short cone shape. As the object moved, I was so shocked I failed to grab a camcorder and instead used an iPhone to attempt poor images.
- Because I receive just one SEESAT concatenated set of messages per day, I did not see any of the predictions about southern USA visibility until moments after I sent the email. That is when the single SEESAT email arrived. By then it was too late. The object rose to about 1st magnitude then expanded into standard classic "fuzzy contrails" on either side about 10 degrees in length. All of this became diffuse into one large cloud which faded out. The whole thing took about 8 or 9 minutes. I first caught sight of it at 0226UT Feb 7 and lost it at around 0236UT.
- Paul D. Maley email: pdmaley@yahoo.com

FEB 6, 2018

<http://satobs.org/seesat/Feb-2018/0061.html>

FH escape burn, MMT site [Mt. Hopkins, AZ]

<http://satobs.org/seesat/Feb-2018/0056.html>

- Date: Tue, 6 Feb 2018 22:17:23 -0600
- Tim Pickering pulled out a complete time-lapse of the FH burn as seen with the all-sky camera at the MMT Observatory on Mt Hopkins, Arizona, and posted it on Twitter:
<https://twitter.com/twitter/statuses/961080240389832706>
- This might be detailed enough to narrow down the orbital parameters a bit, if that really is engine shutdown seen at the end.
-
- Bill Keel wkeel@ua.edu or wkeel@as.ua.edu

FEB 6, 2018

SkywatchTeam-1



FEB 6, 2018

http://spaceweathergallery.com/full_image.php?image_name=SkywatchTam-DSC_9601_1517998316.jpg&PHPSESSID=pcg8j44p5pr8ih8edtluhrmdn2

SkywatchTeam-2, 3



http://www.spaceweather.com/images2018/07feb18/3rdstage_strip.jpg



FEB 6, 2018



FEB 6, 2018



FEB 6, 2018

<https://www.space.com/39620-skywatchers-see-spacex-falcon-heavy-third-burn.html>



FEB 6, 2018

<https://i.stack.imgur.com/28q7H.jpg>

Elon Musk SpaceX - Final Thrust To Mars

[EXCELLENT CLEAR VIEW OF IGNITION, FULL BURN]

Victor Valley News Inc. // Published on Feb 6, 2018

6:30 p.m. February 6, 2018 from the City of Victorville [CA]

**TWO SECONDS
AFTER IGNITION**

One of the BEST full
videos of engine ignition

OVERBRIGHT [NOTE 'BUTTERFLY']

FEB 6, 2018

<https://www.youtube.com/watch?v=BJ446VfBIHE>

A photo the Canadian pro [golfer Graham DeLaet] posted to his Twitter account Tuesday night showed a light in the night sky. "Just saw a UFO in Ixtapa, Mexico," he wrote. "No other explanation. Freakiest thing I've ever seen."

- Joan Lake @JoanLakeGolf == Seriously just saw this SW of Rancho Murieta CA about an hr ago! Moving slowly south & and as it got low on horizon, it formed a giant plume. Awesome!
- Melissa Bellomo @missbell512 == Around 8:30 PM in #scottsdale #arizona we spotted a cloudy light in a clear sky, as it was moving it fanned out and then disappeared. We think it was a #meteor but not sure. It was beautiful
- <http://www.golf.com/extra-spin/2018/02/07/graham-delaet-reports-ufo-sighting-freakiest-thing-ive-ever-seen>
- Russian press reports his sighting -- <https://vistanews.ru/science/209944>

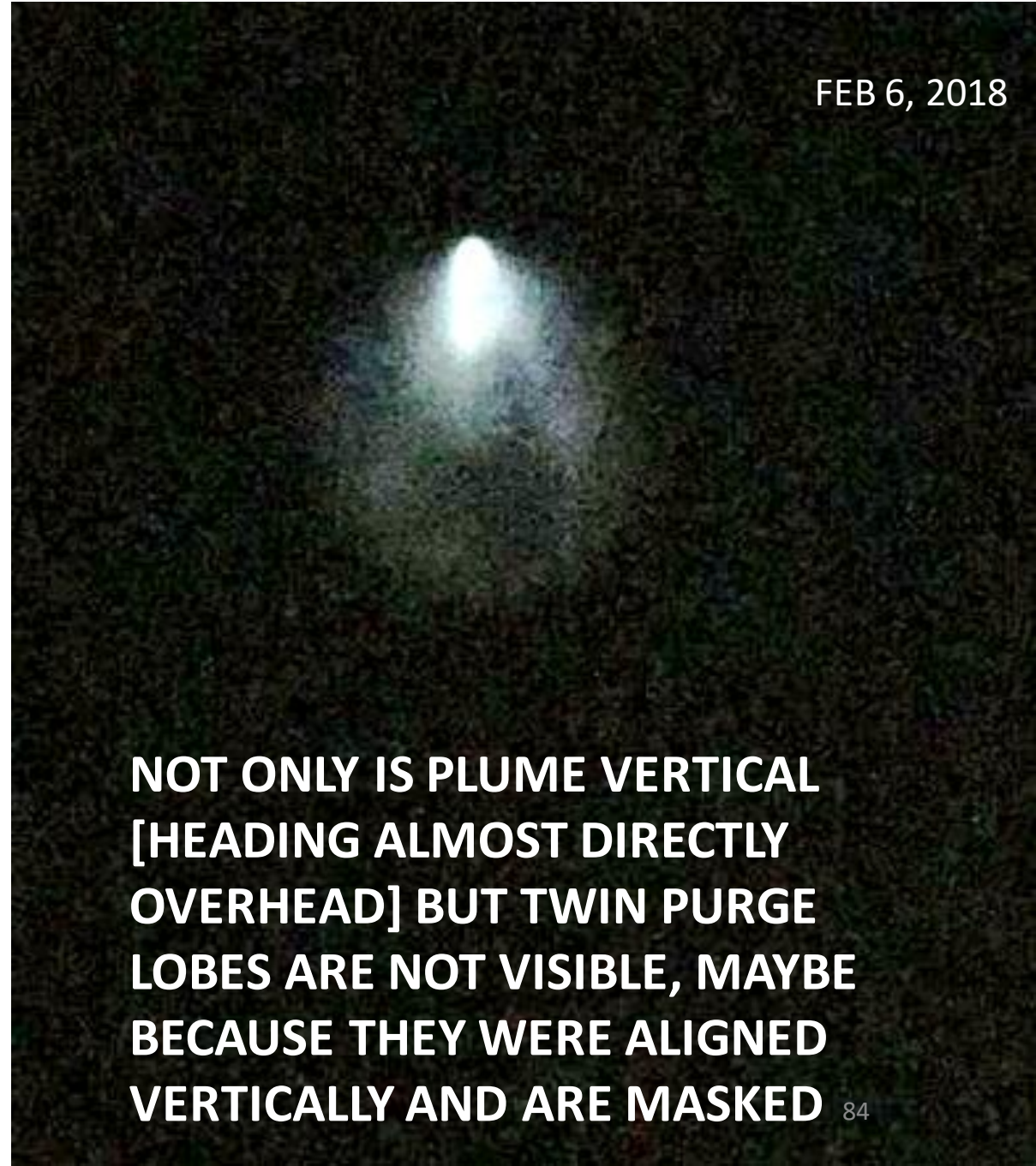


Golfer reports spotting it from tournament in Mexico, and the photo he tweeted had the rocket's orientation **very different.**

FEB 6, 2018



FEB 6, 2018



**NOT ONLY IS PLUME VERTICAL
[HEADING ALMOST DIRECTLY
OVERHEAD] BUT TWIN PURGE
LOBES ARE NOT VISIBLE, MAYBE
BECAUSE THEY WERE ALIGNED
VERTICALLY AND ARE MASKED**

ALL US OBSERVERS WERE LOOKING SOUTH

ROCKET
BURN



**SO FOR EVEN BETTER VIEWS
FROM MORE DIRECTLY
UNDER THE FLIGHT PATH,
WE SHOULD LOOK SOUTH.**

SPANISH FOR 'UFO' IS 'OVNI'.

FEB 6, 2018

OVNI visto en MAZATLÁN resultó ser el FALCON HEAVY de SpaceX

OVNI visto en MAZATLÁN resultó ser el FALCON HEAVY de SpaceX



**ORIENTATION OF
DIRECTION SHOWS
OBSERVER MUCH
CLOSER TO UNDER
THE TRACK**



FEB 6, 2018

<https://www.youtube.com/watch?v=fX7EYxRQPW0>

¿Qué fue lo que se vio ayer en los cielos de México? 2018

¿Qué fue lo que se vio ayer en los cielos de México? 2018



// Gabehash //
159,820 views
943 comments

ALMOST
DIRECTLY
UNDER
ORBITAL
TRACK

GABE  HASH

WWW.GABEHASH.COM



1:43 / 4:32



FEB 6, 2018

https://www.youtube.com/watch?v=PT_KmUmChIM

WHY THE REFERENCES TO SOMETHING 'GROWING DOWN'?



PERHAPS BECAUSE
ANY LOCATION NEAR
GROUND TRACK MADE
THE ROCKET PLUME
NEARLY VERTICAL AND
WHEN FIRST FORMED IT
VISIBLY EXTENDS DOWN
TOWARDS THE HORIZON

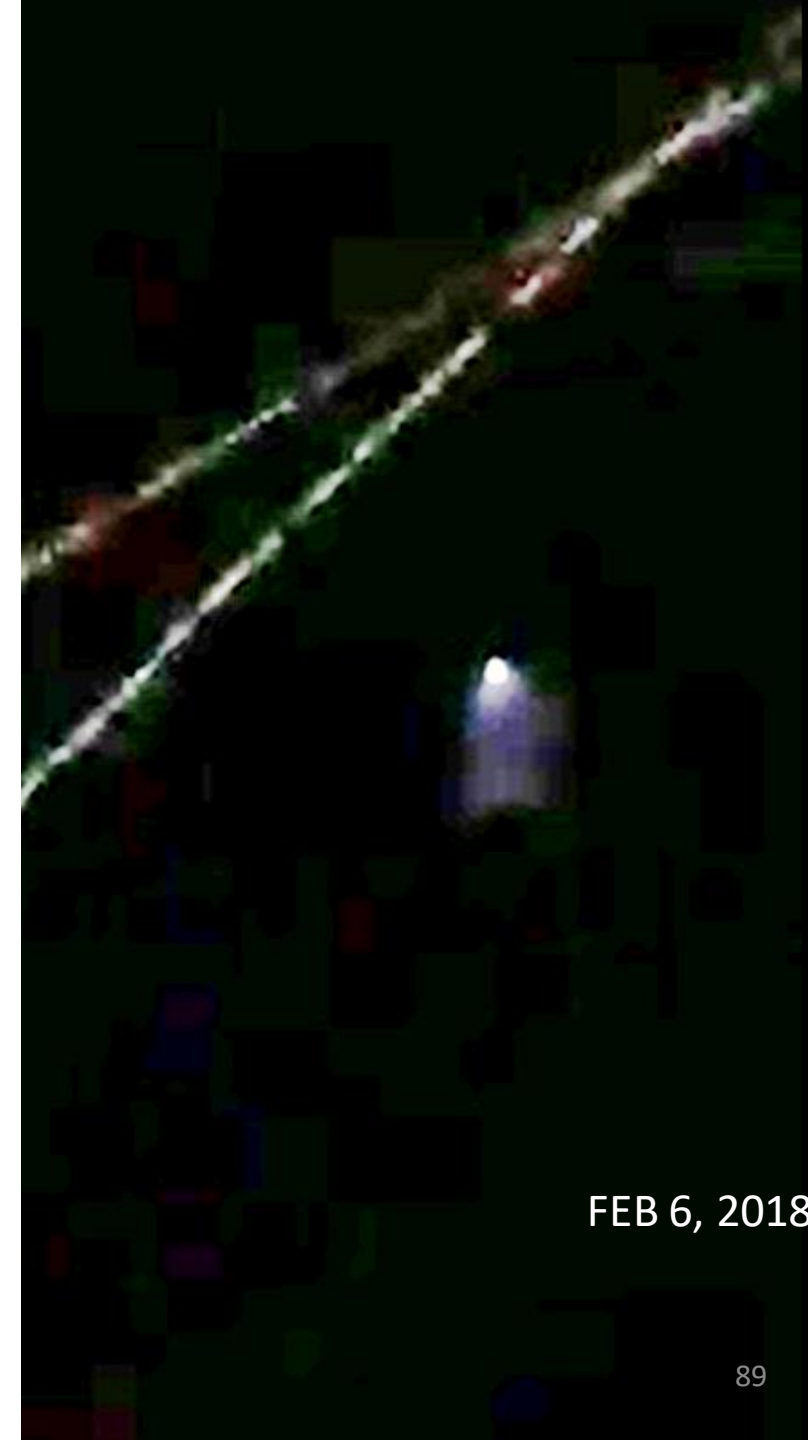
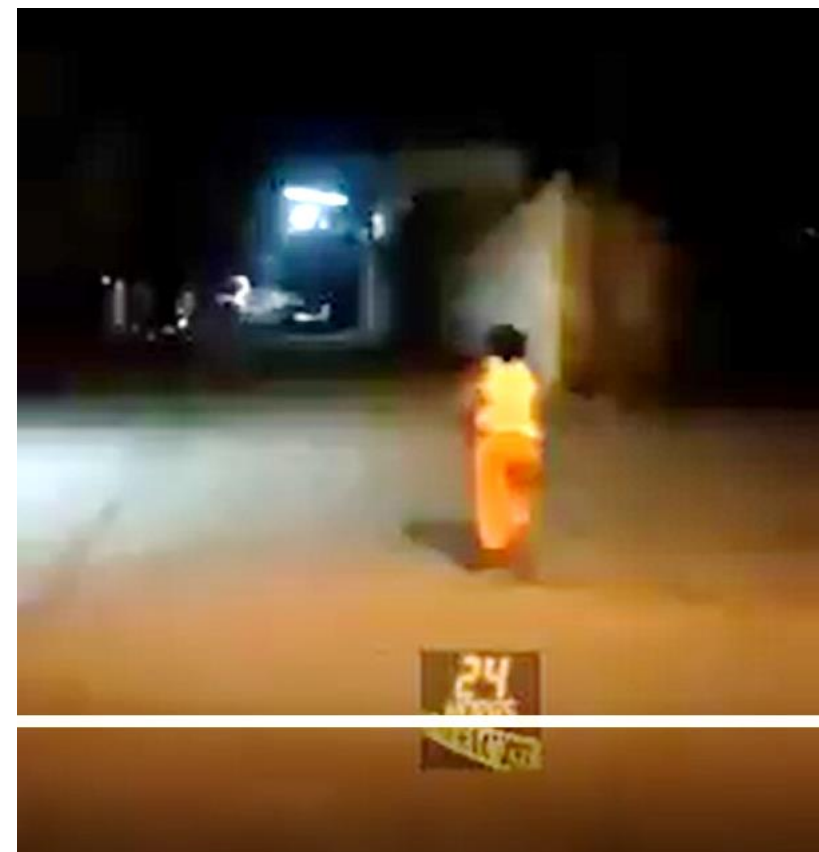
FEB 6, 2018

Objeto no Identificado en Iguala y Chilpancingo México

24 HORAS NICARAGUA Feb 6, 2018

Un objeto no identificado que se logró ver en Iguala y Chilpancingo, provoca asombro y miedo en los pobladores que presenciaron este inusual caso en los cielos de esta zona del estado de Guerrero en el país Azteca.

STREET VIEW [LEFT] PANS UP TO DIRECT OVERHEAD PASS OF ROCKET [RIGHT]



FEB 6, 2018

<https://www.youtube.com/watch?v=jGilq52F2nY>

SUMMATION

- 1 FIRST-RECOGNIZED LONG-DURATION UPPER STAGE ON-ORBIT BURN
- 2 CLEAR SEQUENCE OF TWIN-LOBED PLUMING PRE-BURN
- 3 GEOGRAPHIC DISPERSION OF WITNESSES GAVE VIEWS FROM OFF-TO-SIDE AND FROM BELOW, ALLOWING 3-D MAPPING OF PLUME STRUCTURE
- 4 PLUME LENGTH WITH KNOWN EJECTION VELOCITY GIVES SCALE YARDSTICK
- 5 TWIN-PLUME 'BURN START' MARKER WITH DISPLACEMENT THROUGH BURN STOP GIVES UPPER STAGE ACCELERATION
- 6 ACCELERATION WITH KNOWN THRUST GIVES VEHICLE MASS
- 7. OTHER PERFORMANCE PARAMETERS ALSO DERIVABLE
- 8. MOST OBSERVERS PERCEIVED AND REPORTED APPARITION AS A 'UFO'
- 9. CLASSIC RANGE OF MISPERCEPTION/MISINTERPRETATION ERRORS
- 10. NEVERTHELESS, SIGNIFICANT VALUE CAN BE EXTRACTED FOR ANALYSIS

FEB 6, 2018



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



FINAL DRAFT
JAMES E. OBERG
MARCH 22, 2018
jamesEoberg@comcast.net

SIGNIFICANCE OF THIS EVENT

FEB 21, 2018

- 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

FEB 21, 2018

- 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.

FEB 21, 2018

NORWAY CAMP-OUT SEES FUEL DUMP LOW IN WESTERN SKY



LAUNCH WAS NOMINAL, AND ORBITAL DATA FOLLOWED FEB 21, 2018

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?

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

FEB 21, 2018

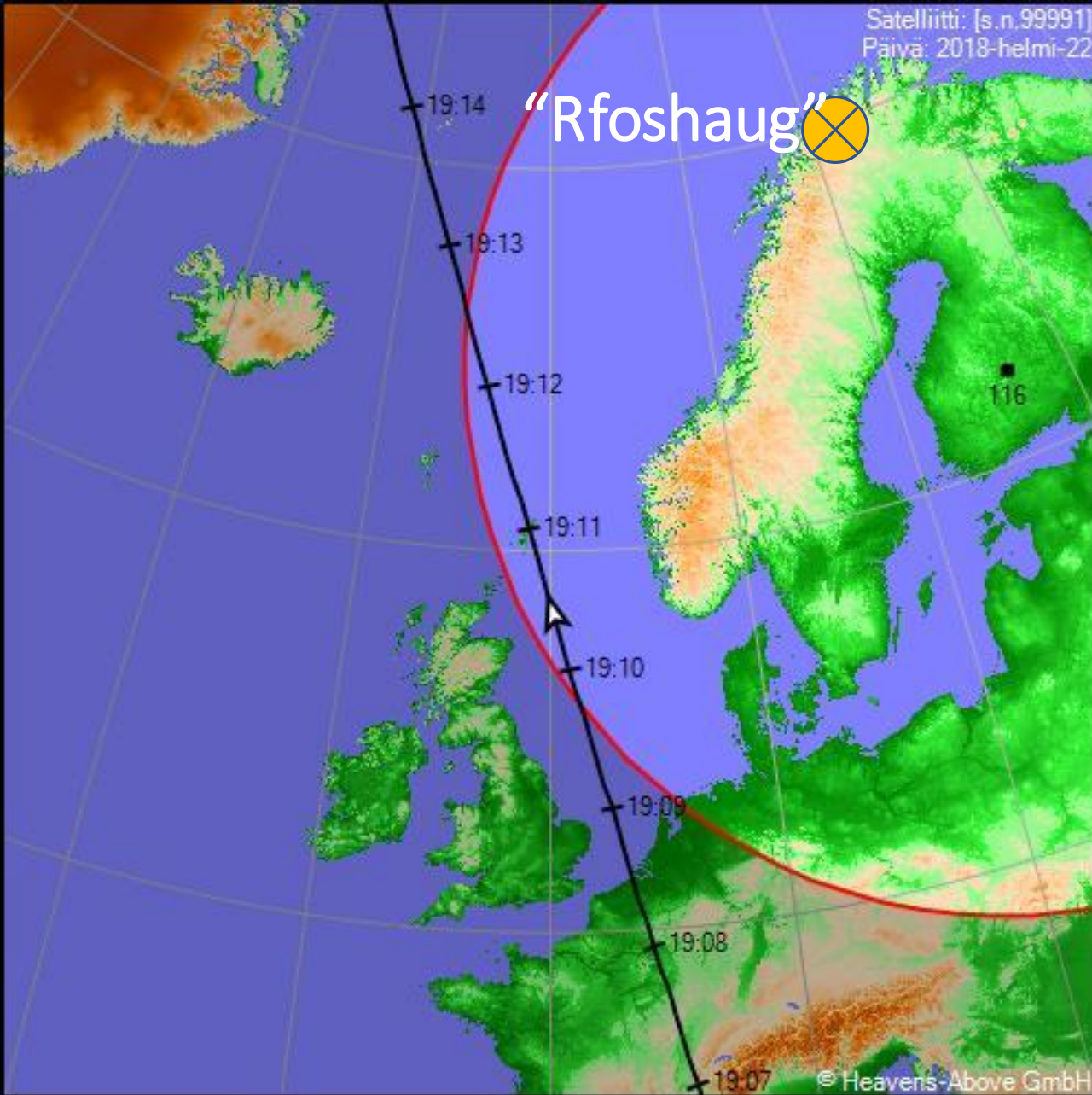
Steve Jess photo, Feb 6, 2018 from California

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/>



FEB 21, 2018

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)

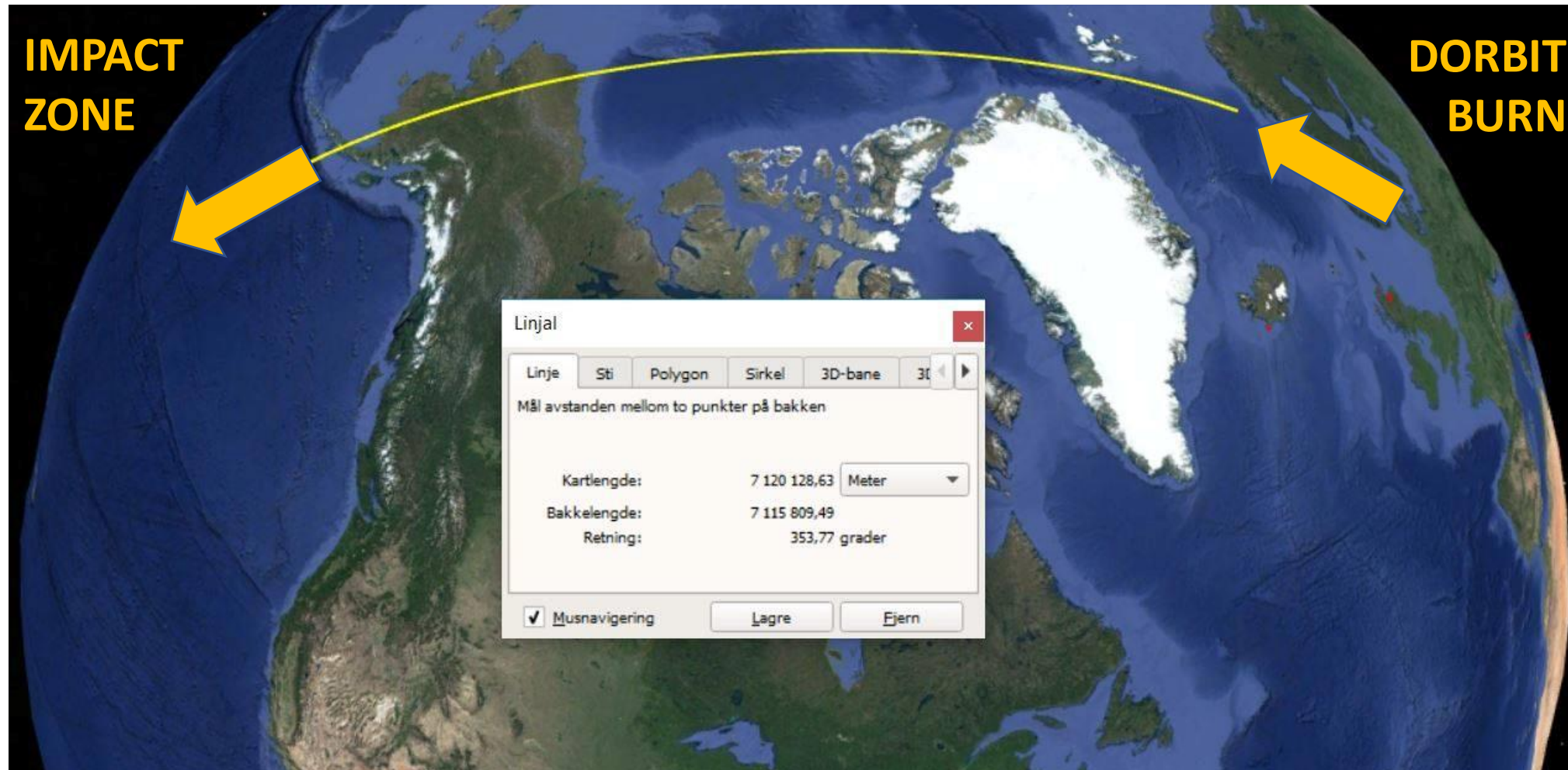
17:05-17:10 UT:

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

[Copyright © 2018 Arto Oksanen. All rights reserved](#)

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

PATH FROM DEORBIT BURN TO IMPACT ZONE



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

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.

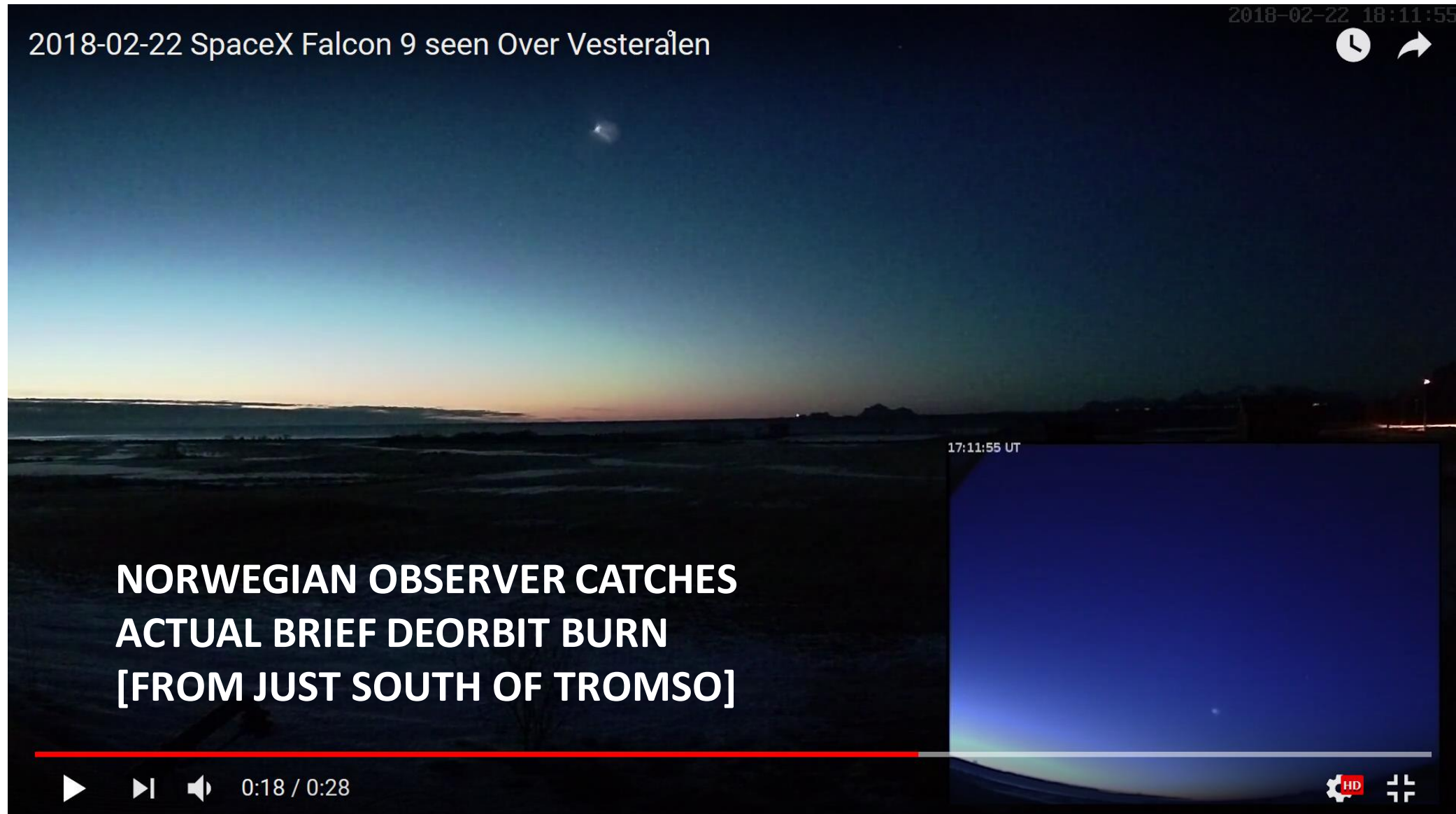
<https://www.facebook.com/photo.php?fbid=1746250745431793&set=p.1746250745431793&type=3&theater>

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

FEB 21, 2018

2018-02-22 SpaceX Falcon 9 seen Over Vesterålen

FEB 21,
2018



https://www.youtube.com/watch?v=_0BiOlnlxAc&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>

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



FEB 21, 2018

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. 104

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

Murmansk region sightings [1710 UTC]

FEB 21, 2018

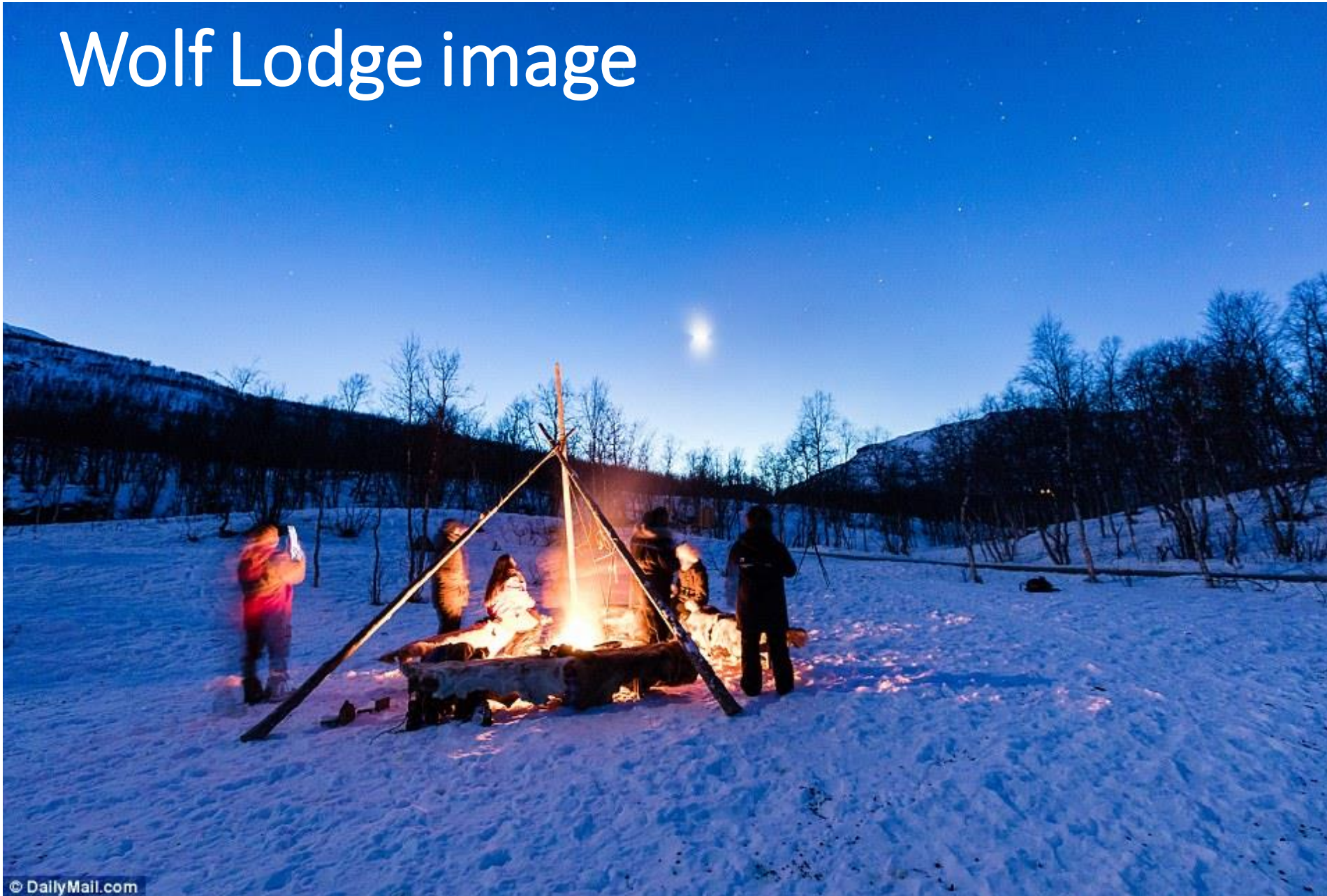
Several reports from Murmansk-Khibiny & from Pushnoy, on the west coast of the White Sea in Karelia, south of Murmansk. Very low on western horizon. Farthest east of any known observations.

 = other reports



Wolf Lodge image

FEB 21, 2018



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http://i.dailymail.co.uk/i/newpix/2018/02/23/20/4985156F00000578-5428285-image-a-9_1519416487925.jpg

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

ON RIGHT, ZUMA F9S2 'SPINNING SPIRAL' OVER KHARTOUM [LOW IN SW SKY MOVING RT-TO-LEFT] VERSUS STARMAN FHS2 ON LEFT [FROM S. CALIFORNIA IN SW SKY MOVING RT-TO-LEFT] TWIN COOL-DOWN DUMP; F9S2 PREPARING BRIEF RETROGRADE BURN, FHS2 PREPARING MAJOR POSIGRADE BURN

CAN THE FH MISSION PROVIDE
THE KEY TO UNLOCKING THE
MYSTERIES OF SOME PREVIOUS
UNEXPLAINED MISSION EVENTS?

SIGNIFICANCE OF STAGE-2 PLUME OBSERVATIONS

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Summary of six observed plume events

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INSIGHTS INTO ZUMA EVENT

- 1 SPIRAL IN PAST WAS SIGN OF MISSION ANOMALY
- 2 NOT OBSERVED ON NOMINAL DEORBIT OR HIGH-ORBIT INSERTIONS
- 3 TIMING RELATIONSHIP OF SPIRAL TO NOMINAL DEORBIT IS UNKNOWN
- 4 ACTUAL DEORBIT BURN IS SO BRIEFLY VISIBLE THAT IT COULD EASILY BE OVERLOOKED OR DISREGARDED

NEXT STEPS

- MISSION INFORMATION CUSTOMARILLY AVAILABLE FROM NASA NO LONGER RELEASED
- SERENDIPITOUS AMATEUR SIGHTINGS AND IMAGES OFFER VAGUE HINTS OF NOMINAL AND OFF-NOMINAL VEHICLE PERFORMANCE
- FINDING, RECOGNIZING AND INTERPRETING THE UNEARTHLY HINTS IS NOT AN OBVIOUS SKILL
- SIGHTINGS CAN OCCUR LITERALLY ALL OVER THE WORLD, LIMITED TO TWILIGHT PERIODS
- POTENTIAL FOR OBSERVATIONS FROM ISS NEEDS TO BE RECOGNIZED [OTHER SATS, TOO]
- INQUIRIES TO SPACEX FOR ROUTINE MISSION EVENT EXPLANATION COULD BE FRUITFUL
- PAST FALCON9 MISSIONS CAN BE EXAMINED TO SEEK UNRECOGNIZED OPPORTUNITIES
- TRAJECTORY MODELING WITH ON-LINE SHAREWARE CAN BE FRUITFUL
- REDUCING RANDOM 2-D PHOTOS TO 3-D STATE VECTORS IS AS MUCH ART AS SCIENCE
- THERE'S LOTS OF ROOM FOR [AND NEED FOR] ENTHUSIASTIC WORLDWIDE AMATEURS ONTO THE GROUND FLOOR OF NEW 'SPACE SECRETS SLEUTHING' ENTERPRISE ENABLED BY MASS POCKETCAMs
- LINGUISTIC ASSISTENCE WITH ARABIC, FARSI, AND CHINESE IS BECOMING CRITICAL

Conclusions & Suggestions

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