

# Analysis of Observations of SpaceX Falcon-9 Launch October 7, 2018

REVIEW DRAFT 2 [INCOMPLETE]

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DECEMBER 8, 2018

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# WHY THIS REPORT?

- Launch of the SpaceX Falcon9 from Vandenberg AFB, California, at 7:30 PM local time on October 7, 2018, created probably **the most visually complex ascent sequence in spaceflight history**.
- The first-for-California first stage return to launch site, plus fairing recovery motors, combined with observationally **optimal illumination conditions after sunset**, created both a very large deliberate observers attendance plus even more numerous accidental observers across California and NW Mexico, and as far away as Idaho and west Texas.
- The maneuvers after first staging created an immense and asymmetric bright effluent cloud that, with both stages briefly firing simo, was **unprecedented to all viewers**, and also gave a strikingly different profile depending on observer location.
- High quality of imagery allowed more detailed technical analysis of plume shape and motion, to test new methodologies of extracting vehicle performance data from images alone, validating such techniques for application to OTHER vehicle imagery from less well documented launches.
- Even moreso than with previous missile/space activity off California, the event exposed not just the **unfamiliarity with spaceflight principles of much of the US public**, but the dismaying scale of their **misunderstanding and misinformation** about such a vital national activity.
- For others, the event served as a 'rocket Rorschach test' **to reconfirm existing ideological, conspiratorial, and religious passions**, some of them potentially worrisome. See separate report.
- The launch also by timing accident created a viewing opportunity for **the deorbit burn over Scandinavia**, and it was widely seen and imaged in the predawn twilight. See separate report.

# DEDICATION

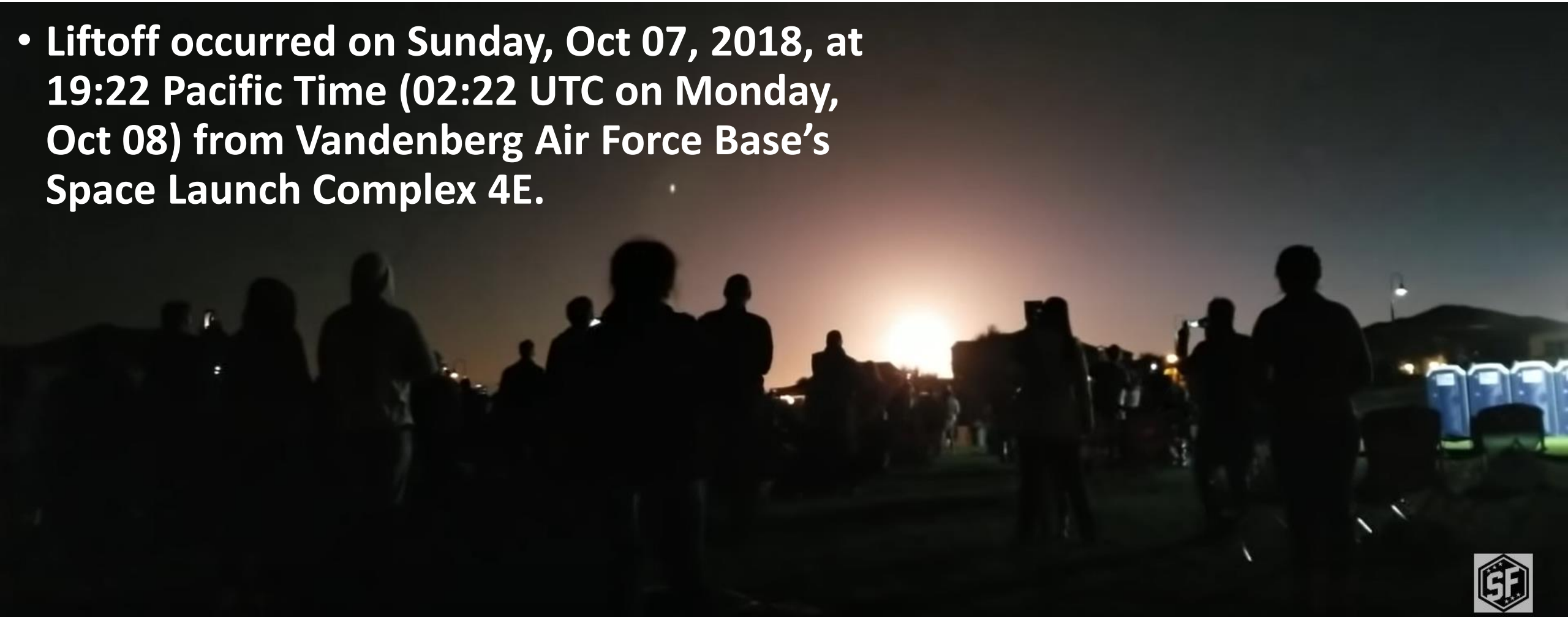
- This report is dedicated to four very different groups of people.
- First, to the SpaceX team that has disruptively pulled off the most astonishing advance in rocket propulsion in a generation and made the ‘impossible’ into just other trick of the spaceflight trade;
- Second, to the legions of spaceflight enthusiasts around the world who have welcomed and exulted in this advance and who came by the thousands to watch this year’s achievements from Falcon-Heavy in Florida to this California return-to-launch-site, anticipating the impending next step on the parade of breakthroughs, the renewed American human access to orbit and beyond;
- Third, to the witnesses literally worldwide who shared their experiences, searched their automatic records [such as all sky cameras], and gave permission for use of their imagery;
- Fourth, to the families and friends of the legions of observers and commentators who have in a dozen different ways completely misunderstood both the basic facts and the far-reaching significance of these events, and who may be able to rescue their loved ones from these dead-ended delusions, internet deceptions, and wasted brainpower [not to overlook social embarrassment and mockery] by using the exposition and explanation in these three reports to persuade them of the most wonderful feature of these accomplishments – the launches are genuine, are nothing to fear, and are fully in keeping with American traditions of exploration and invention.
- Salute!

# Report Organization

- 1 BASIC VISUAL FEATURES OF THE EVENT
- 2 FUNDAMENTAL ANALYSIS METHODOLOGY
- 3 UNUSUAL ASYMMETRIC 3-D SHAPE OF DYNAMIC PLUMES
- 4 OVERVIEW OF BEST VIDEOS
- 5 SELECTED EXAMPLES OF PUBLIC DISCUSSIONS
- 6 TECHNIQUES OF AZIMUTH/ELEVATION DETERMINATION
- 7 DETAILED MISSION DESCRIPTION
- 8 WIDER RANGE OF WITNESS DESCRIPTIONS
- 9 CONCLUSIONS
- 10 APPENDICES

# Space X's Falcon 9 Rocket Launch in California

- **Liftoff occurred on Sunday, Oct 07, 2018, at 19:22 Pacific Time (02:22 UTC on Monday, Oct 08) from Vandenberg Air Force Base's Space Launch Complex 4E.**



<https://www.youtube.com/watch?v=6Bw1xd8tAko>

SpaceX rocket launch



[BRIGHTENED IMAGE]  
PRE-ALERTED VIEWERS  
GATHERED TO OBSERVE  
LAUNCH AND LANDING AT  
VANDENBERG AFB, CA.



abc.com

SPACEX LAUNCH MESMERIZES ONLOOKERS



0:59 / 1:53





# IMAGE OF DEPARTING STAGE2 FROM NORTH OF TRACK SHOWS DIFFERENT PROFILE WHEN VIEWED FROM EAST OR WEST OF TRACK



Jerome Dawson @JeromeDawson3  
Oct 7  
Nice shot! Opposite angle from what  
we saw down the coast.



<https://1063word.radio.com/articles/ap-news/spacex-satellite-launch-lights-night-sky-social-media>  
10/07/2018

[http://spaceweathergallery.com/full\\_image.php?image\\_name=Matt-Bologna-IMG\\_7107\\_1538970752.jpg](http://spaceweathergallery.com/full_image.php?image_name=Matt-Bologna-IMG_7107_1538970752.jpg)  
SpaceX First California Stage1 RTLS

Wave of light from  
the first stage  
steering thrusters  
sparked bizarre  
theories of what  
caused them....

Photo by sternback



“And here's the booster-thruster pic with the contrast and color adjusted.  
More like what I saw through the viewfinder (or a tiny bit brighter).”





LIVE DOWNLINK  
TV SHOWS FIRST  
STAGE FALLING  
BEHIND FIRING  
THRUSTERS  
<https://youtu.be/xhs2VrgFcCc>

A close-up view of the first stage of a SpaceX Falcon Heavy rocket as it descends towards Earth. The stage is dark and cylindrical, with a large black circular nozzle at the bottom. A bright white plume of exhaust is visible from the nozzle. The background shows the blue and white horizon of the Earth from space. In the top right corner, there is a small white square with a black letter 'F'.

FIRST STAGE  
FALLS AWAY,  
THRUSTERS  
FIRE TO TURN  
IT AROUND  
FOR LANDING

The light show continued as the **first-stage rocket booster** landed back on Earth, **1/4 mile away from the launch pad**



2:05 / 3:10

<https://www.youtube.com/watch?v=6KhR-z9Nbxc>



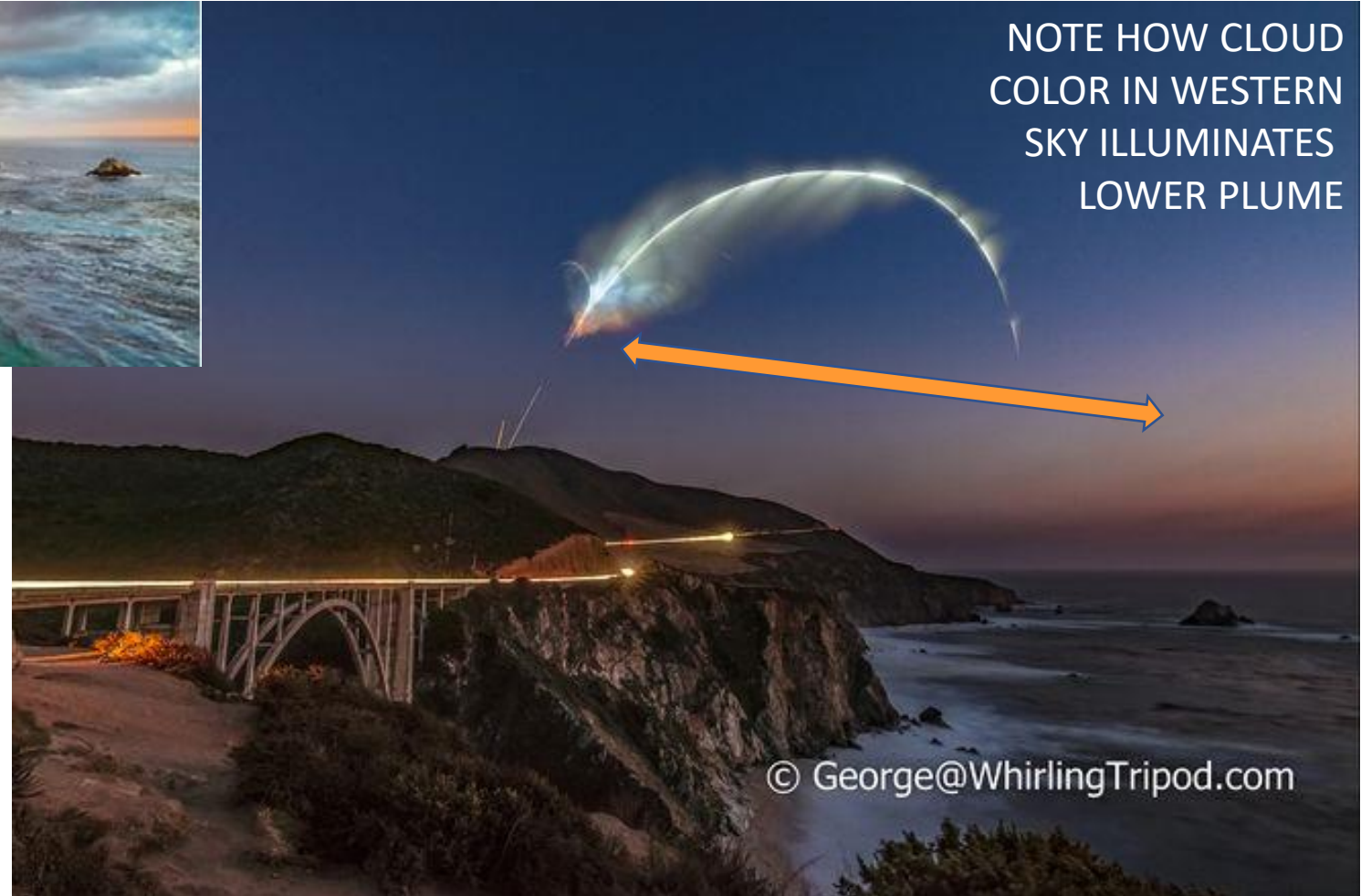
# WOW: Best SpaceX rocket images shot from Central Coast

<https://www.ksbw.com/article/spacex-rocket-mistaken-as-aliens-ufo/23652537>



<https://www.bing.com/th?id=ABT2FA1EE33687B6501AABAD7152759177AFAA1991E7907799B3026C7B58376BFDC&w=608&h=200&c=2&rs=1&pid=SANGAM>

- "I was walking outside my condo this evening located in Monterey near MPC. There were bright lights, and coming from the light was rainbow colored dust being thrown into the sky. There was a flaming ball that was dropped from the lights," Melanie Pitnick said.



© George@WhirlingTripod.com

George Krieger  
SpaceX seen from Bixby Bridge



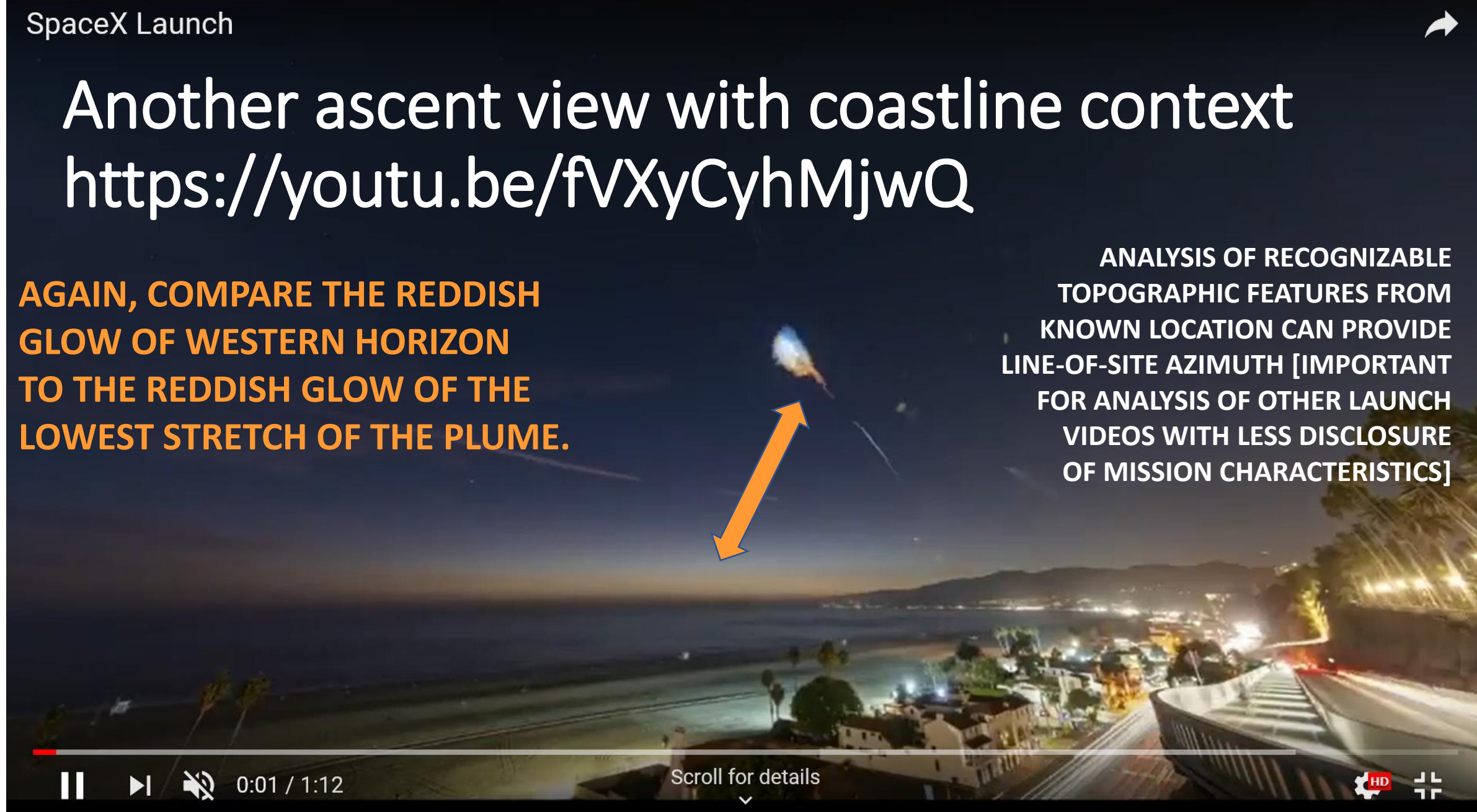


# Another ascent view with coastline context

<https://youtu.be/fVXyCyhMjwQ>

**AGAIN, COMPARE THE REDDISH GLOW OF WESTERN HORIZON TO THE REDDISH GLOW OF THE LOWEST STRETCH OF THE PLUME.**

ANALYSIS OF RECOGNIZABLE TOPOGRAPHIC FEATURES FROM KNOWN LOCATION CAN PROVIDE LINE-OF-SITE AZIMUTH [IMPORTANT FOR ANALYSIS OF OTHER LAUNCH VIDEOS WITH LESS DISCLOSURE OF MISSION CHARACTERISTICS]



# GREAT RED CLOUD

ASCENT VIDEOS SHOW  
RISE OUT OF SHADOW

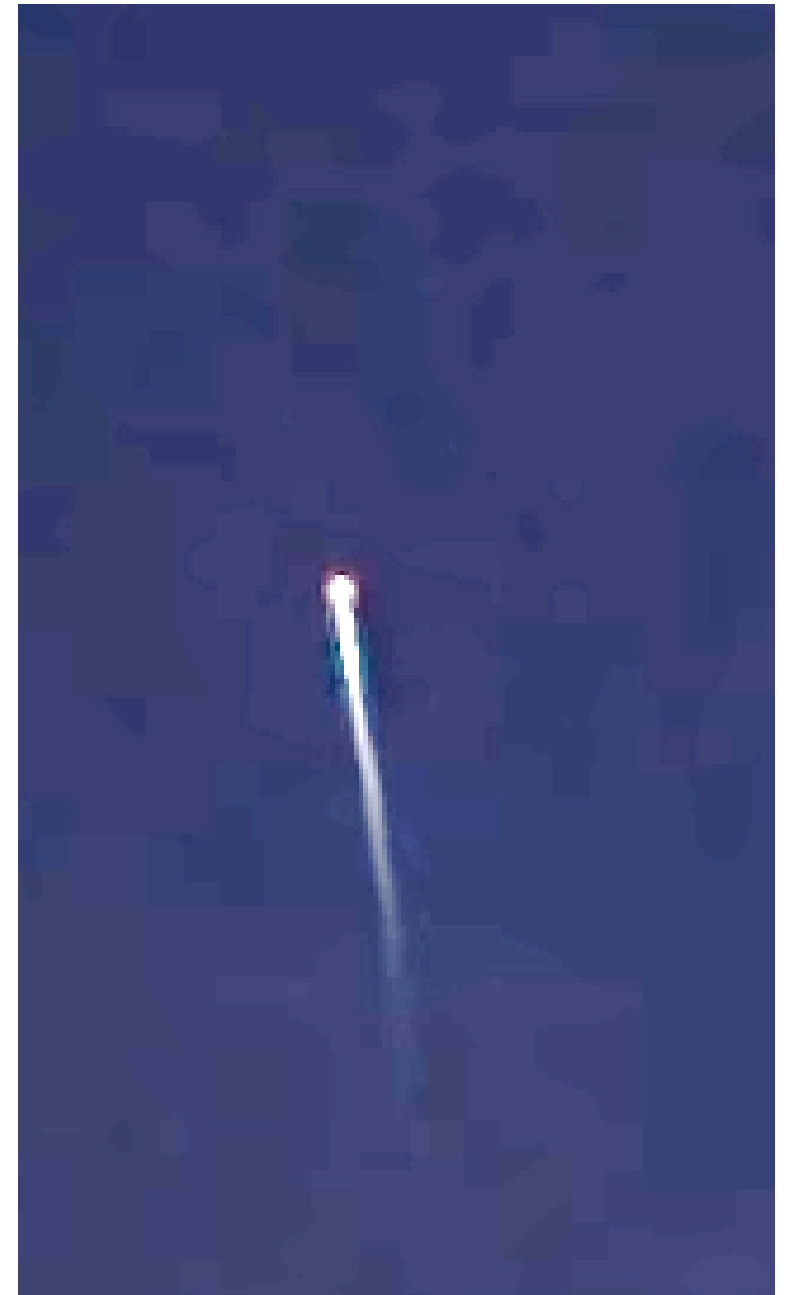
- Another great video showing it from a different angle  
<https://www.youtube.com/watch?v=HJy9mOGHsKU>



10/07/2018



SpaceX First California Stage1 RTLS

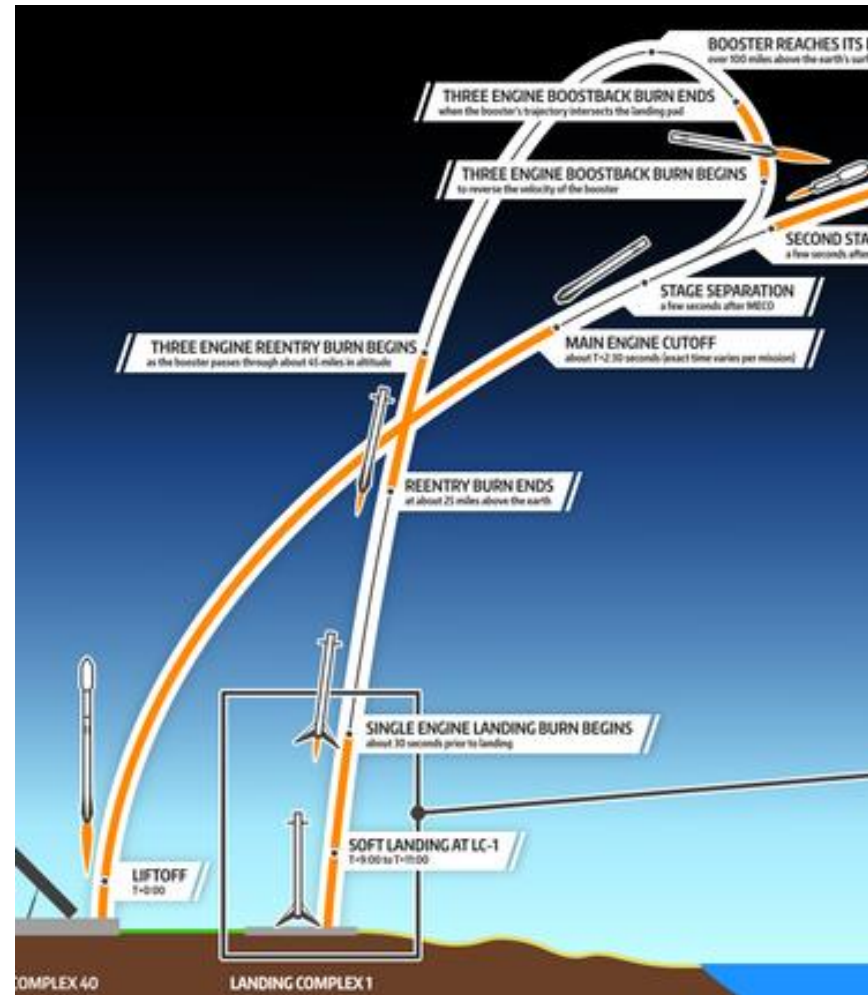


13



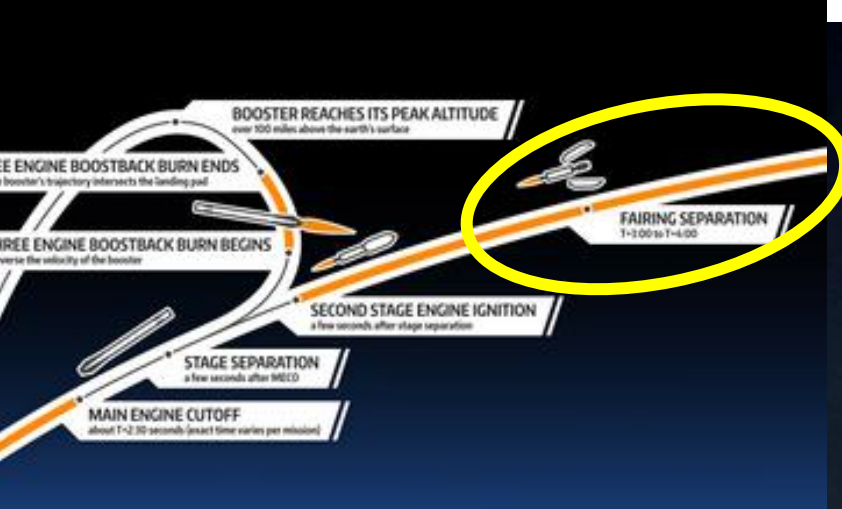


# TIME EXPOSURE SHOWS FIRST STAGE BOOSTBACK



- DISCUSSION

<https://pbs.twimg.com/media/DRGLVjSV4AAvFUo.jpg>



## HI-RES IMAGE CATCHES TRACK OF SHROUDS AS THEY STEER TO OCEAN IMPACT DOWNRANGE

A SpaceX launch of a Falcon 9 rocket from Vandenberg Air Force Base lights up the sky 250 miles north in a view from Mount Hamilton. (Karl Mondon/Bay Area News Group)

8:46 PM - Oct 7, 2018

[https://www.eastbaytimes.com/wp-content/uploads/2018/10/SpaceX\\_01.jpg?w=620](https://www.eastbaytimes.com/wp-content/uploads/2018/10/SpaceX_01.jpg?w=620)

**FROM JOSHUA  
TREE STATE PARK**

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**SECOND STAGE  
CROSSES KARMAN  
LINE [80-100 km]  
AND BROADENS IN  
VACUUM OF SPACE**



<https://twitter.com/seanparkerphoto/status/1049405040526483457>

10/07/2018

SpaceX First California Stage1 RTLS





[bay.photography](https://www.instagram.com/p/BoqSVc5BlaM/) Caught this goodie tonight. This is a very quick edit but just wanted to show you the goods from Aspendells. Unbelievable to catch this over some brilliant aspens. This is with my 50mm. 1 shot for the foreground one for the sky. Camera didn't move, so this is a true blend and the true position that it shot up.

*JO: Aspendell is north of launch site, near Nevada border, so this is a view from BEHIND the departing second stage*



<https://www.instagram.com/p/BoqSVc5BlaM/>

10/07/2018

SpaceX First California Stage1 RTLS



Second stage shows plume lit by ruddy horizon sun, then bright white light of unobstructed sunlight.

<http://www.supertopo.com/climbers-forum/3132305/Just-saw-a-UFO>



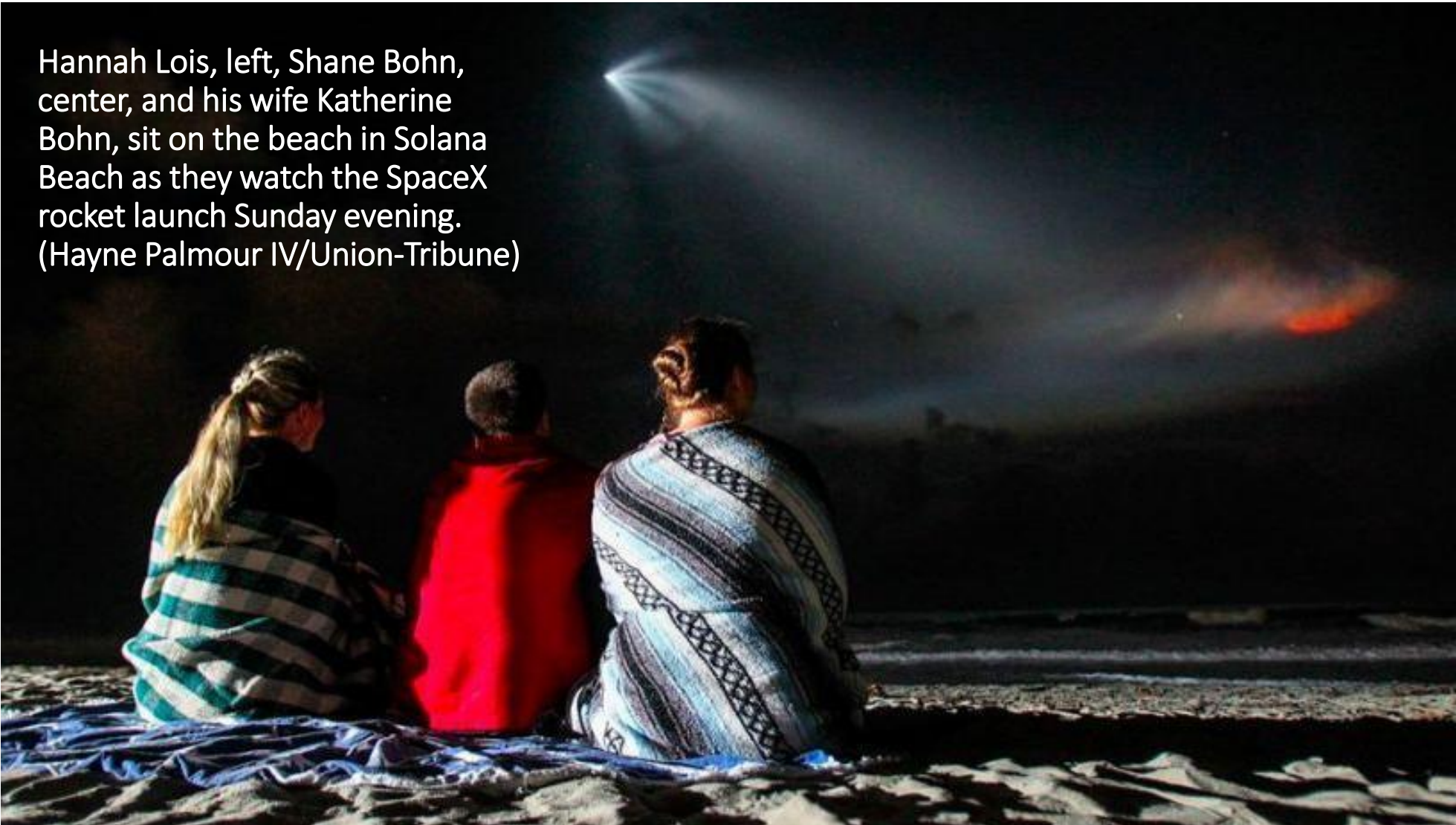
# San Diegans thrilled by sight of rocket lifting off from distant Vandenberg Air Force Base

<http://www.sandiegouniontribune.com/news/science/sd-me-launch-vandy-20181007-story.html>

Hannah Lois, left, Shane Bohn, center, and his wife Katherine Bohn, sit on the beach in Solana Beach as they watch the SpaceX rocket launch Sunday evening. (Hayne Palmour IV/Union-Tribune)

**By Gary Robbins**

From the flower fields in Carlsbad to the boardwalk in Pacific Beach to porches in El Cajon, people across San Diego County on Sunday marveled at the sight of a Falcon 9 rocket lifting off from distant Vandenberg Air Force Base in Lompoc.



<http://www.trbimg.com/img-5bbad37f/turbine/sd-1538970489-qxtqpicv6a-snap-image/824/824x464>

10/07/2018

SpaceX First California Stage1 RTLS



# Las Cruces, New Mexico

Use structures to  
estimate angular  
elevation



Alex



@alex35flores



Did anyone else see this object in the Las Cruces area just right now ?

10/07/2018  
9:47 PM - Oct 7, 2018

SpaceX First California Stage1 RTLS





<https://i.redd.it/e0xx5bwix0r11.jpg>

10/07/2018

SpaceX First California Stage1 RTLS

[Jackfusco](#) == Who else was out/saw the bright light in the sky tonight? It was the SpaceX Falcon 9 rocket launch! We took this in Solana Beach in San Diego, California! I have a bunch of other photos, but I loved this one of Rachel, Kona and I toward the end of the launch! Keep an eye out for more soon and tag me if you got some photos, too! [@SonyAlpha](#) A7RII - [@SigmaPhoto](#) 14mm f1.8 ART



I had two cameras set up.... One was shooting a brief time lapse and the second was shooting stills. I used a delay and then had it shoot a few frames so I could in to position



<https://i.redd.it/2xexyb8x0wq11.jpg>



PLUME PARTICLES ARE EJECTED AT ~3000 M/SEC WHILE ROCKET IS BUILDING SPEED TOWARD ORBITAL VELOCITY OF 8000 M/SEC. THEY FALL TOWARDS EARTH, IN THE FIRST MINUTE BY 2 KM AND BY THE THIRD MINUTE HIT THE UPPER ATMOSPHERE



## Launch of Space X surprises on the border

Several social network users, residents of the Baja California and Sonora Borderlands, were struck by a light trail in the sky that was a SpaceX Falcon 9 rocket that successfully launched yesterday in California.

Some users exchanged photos and videos about when the rocket went into orbit, although some who did not know about the introduction of this device speculated different versions, from a natural phenomenon to the possibility of a UFO.

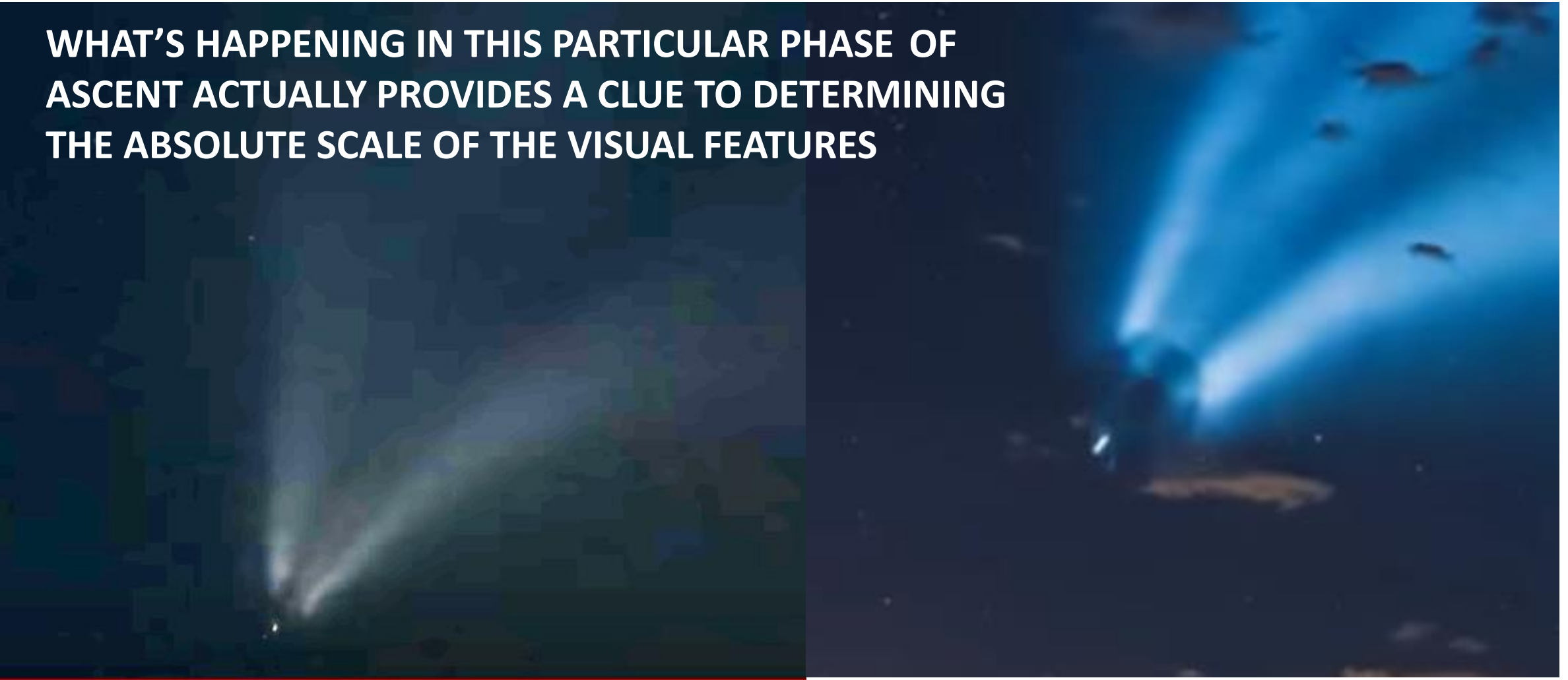
<https://newsbeezer.com/mexicoeng/launch-of-space-x-surprises-on-the-border/>



# DEPARTING SECOND STAGE AT SHUTDOWN

<https://youtu.be/1Tx6jrvCCd4>

**WHAT'S HAPPENING IN THIS PARTICULAR PHASE OF ASCENT ACTUALLY PROVIDES A CLUE TO DETERMINING THE ABSOLUTE SCALE OF THE VISUAL FEATURES**



# DETECTING THE 'EPHEMERAL YARDSTICK'

- Determining ABSOLUTE SCALE [AND DISTANCE] of 'lights in the night sky' is difficult
- Rocket launches provide one hitherto unrecognized clue – the velocity of ejected combustion products in the plume combined with a stopwatch
- Velocity = engine specific impulse times 'g', the acceleration of gravity.
- Example: Isp of 300 sec, times 32.2 ft/sec/sec, gives  $V = 9660$  ft/sec
- The observed velocity is most clearly seen at engine cutoff as the plume boundary moves away from the vehicle
- Using videos, the plume trailing boundary can be observed for several seconds before it disperses and fades
- Distance = velocity x time, assuming 'aspect angle' is from the side
- When flight path is at an angle to line-of-sight [determined from known line-of-sight azimuth and known vehicle launch azimuth], divide measured distance by cosine[angle off from straight on] to adjust for skewed trajectory
- With true scale, other unknown vehicle parameters can be derived or verified.
- **Missions like this validate methodology applicable to more secretive launches**

**FIRST STAGE TURNS TAIL FORWARD AND MAKES BRIEF BRAKING THRUSTS TO HEAD BACK TO LAUNCH SITE -- START-STOP PULSE DEPARTS QUICKLY TO THE LEFT OF SCREEN. TIMING THE START/STOP OF THE BURN PROVIDES LENGTH OF THE PLUME SEGMENT SINCE VELOCITY IS KNOWN.**



SPACEX LAUNCH MESMERIZES ONLOOKERS



1:39 / 1:53





# RARE OCCURRENCE OF A LAUNCH WITH MULTIPLE SEPARATED OBJECTS THAT PROVIDE 3-D ASPECTS

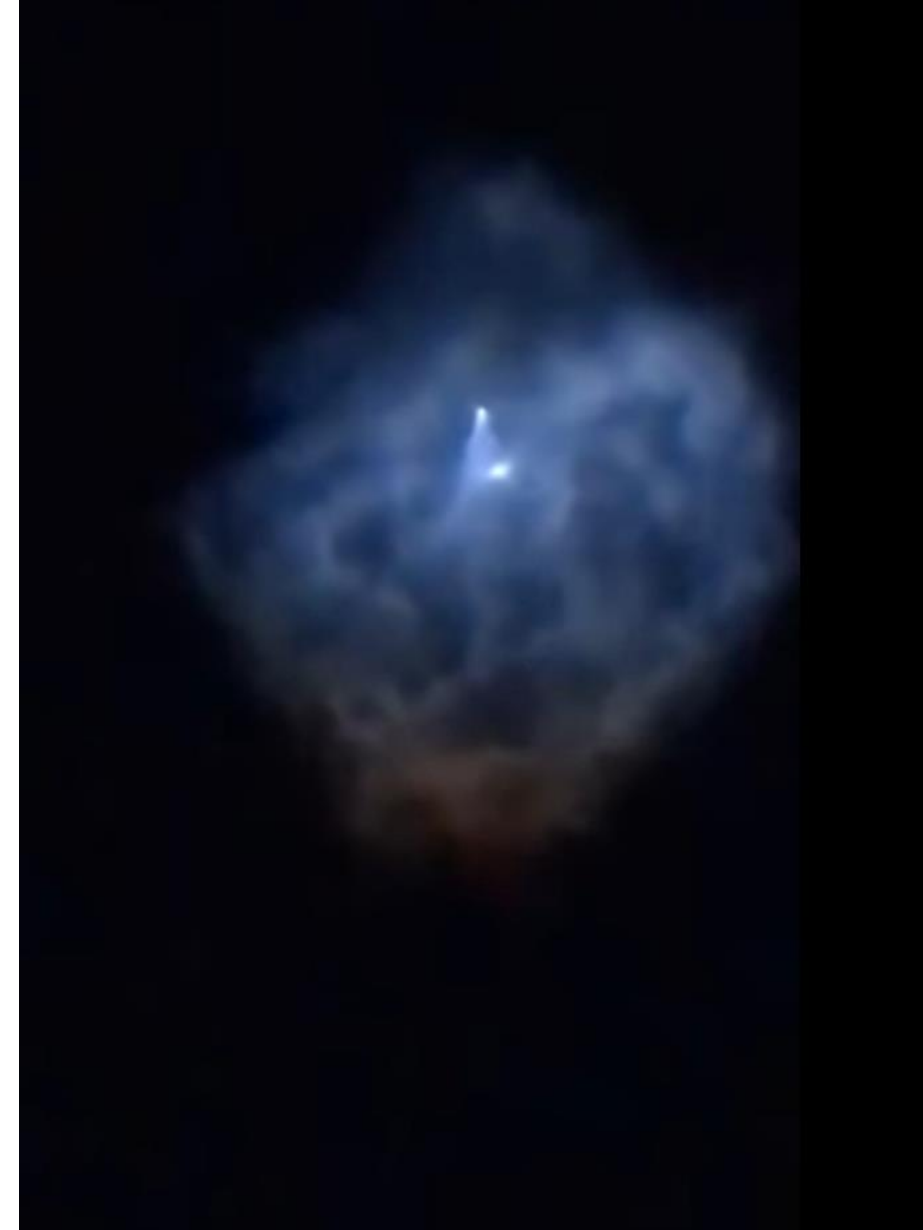
- **THE CLOUD'S APPEARANCE DIFFERENCES BASED ON ANGLE-OFF UNDERSCORES THE DYNAMIC THREE-DIMENSIONAL FORM OF THE IMMENSE BUT VERY SHORT-LIVED SWARM OF MOLECULE-SIZED COMBUSTION PRODUCTS**
- **ALL COMPONENTS OF THE CLOUD SPRAY ARE INDIVIDUALLY FOLLOWING BALLISTIC PATHS UNDER THE INFLUENCE ONLY OF GRAVITY UNTIL ENCOUNTERING SENSIBLE ATMOSPHERE IN THE 80-100 KM RANGE**
- **THE MOLECULES ARE SUFFICIENTLY SEPARATED THAT COLLISIONS WOULD BE RARE, AND ON INSTRUMENTS THEY WOULD NOT BE NOTICEABLY DIFFERENT FROM A VACUUM**
- **DYNAMICALLY THESE SPRAY STRUCTURES, IN VACUUM AND ZERO-G, ARE NOT 'CLOUDS' IN ANY EARTH-SIDE SENSE AND DO NOT BEHAVE LIKE THEM**
- **VISIBILITY OF THESE STRUCTURES IS HEAVILY DEPENDENT ON MASS FLOW, SOLAR BACK-LIGHTING, AND OBSERVER IN SHADOW**
- **TBS**



# UFO Over Central Valley 10/7/18 Connor Paden [Oct 7, 2018]

Crazy ufo just spotted of Hanford CA. Not sure what it is.

**JO: VIEW IS ALMOST PERFECTLY UP TAIL OF ASCENDING STAGE-2 AND NOSE-ON TO THE RETURNING STAGE-1**



- <https://www.youtube.com/watch?v=Njtsc2dM6-Y>

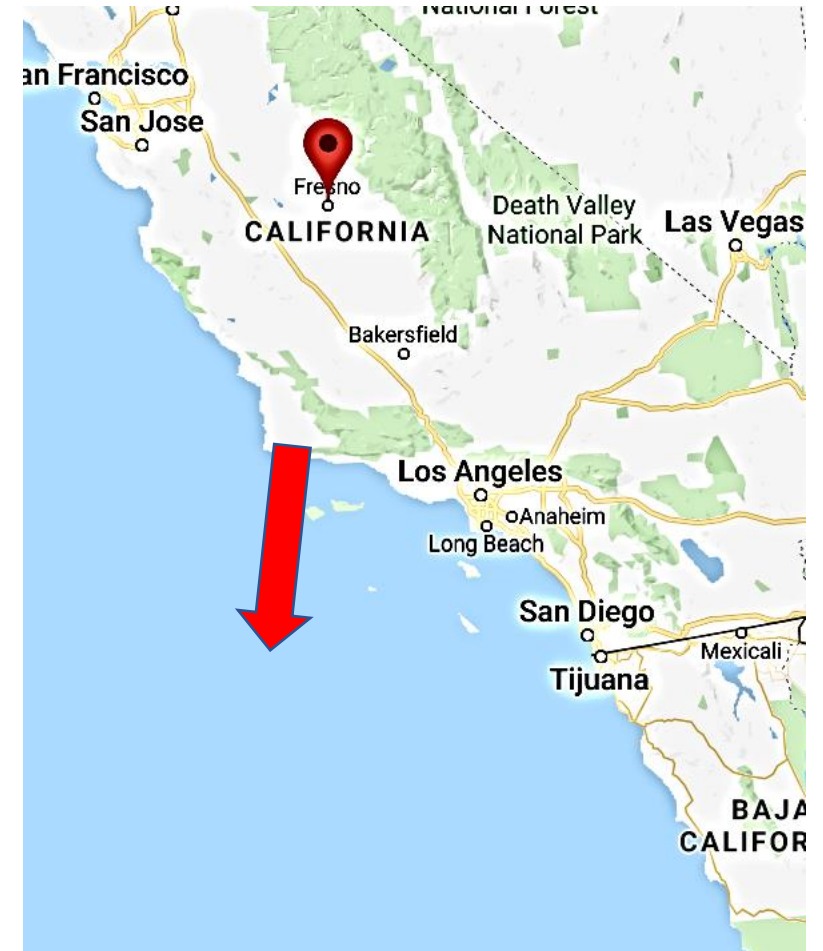
VIEWED FROM ALMOST DIRECTLY BEHIND, THE  
BOTH-FIRING FALCON9 FIRST AND SECOND  
STAGES ARE ALMOST PERFCTLY IN LINE



10/07/2018

SpaceX First California Stage1 RTLS

Neutrino Burst over Fresno sky ???  
Jeremiah Marbysr  
<https://youtu.be/zAwAxXqDOAI>



29



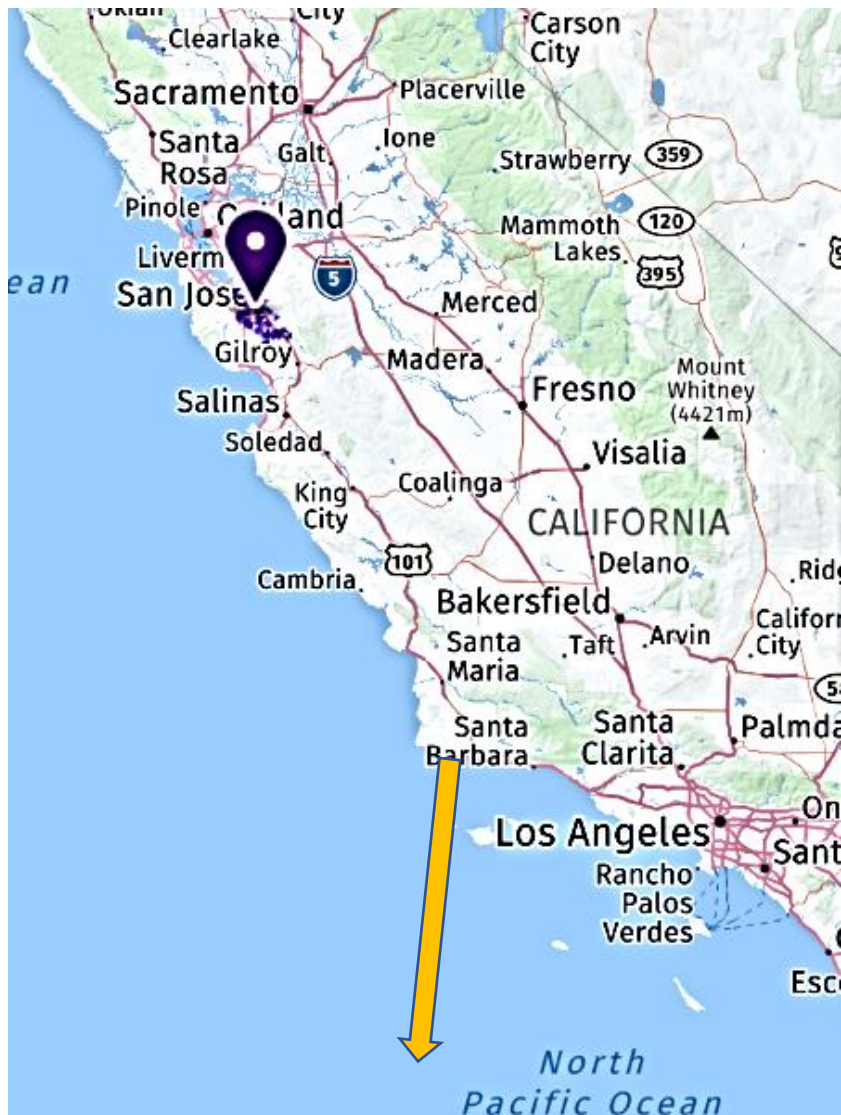


# UFO IN CALIFORNIA BAKERSFIELD 10/7/18

*VIEWED FROM LEFT OF THE  
LINE-OF-FLIGHT, THE BOTH-  
FIRING FALCON9 FIRST AND  
SECOND STAGES ARE OUT  
OF LINE WITH THE CLOSER  
FIRST STAGE [LOWER],  
APPROACHING OBSERVER,  
DISPLACED TO THE RIGHT  
OF DEPARTING STAGE 2  
[TOP].*



<https://youtu.be/bArC7ZDqk2k>

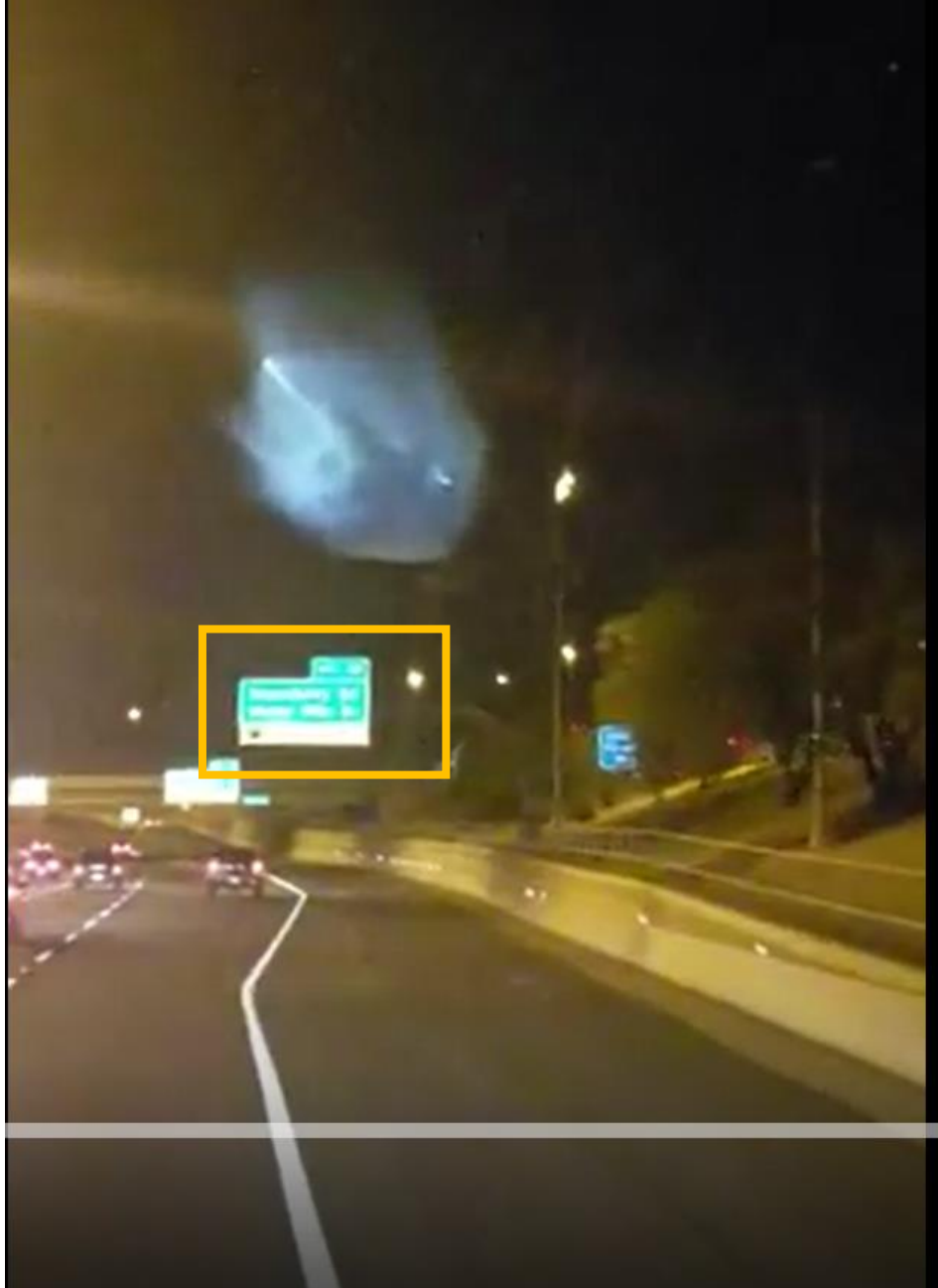


UFO ?! SPACE X ?!  
..October 7,2018  
.! SAN JOSE

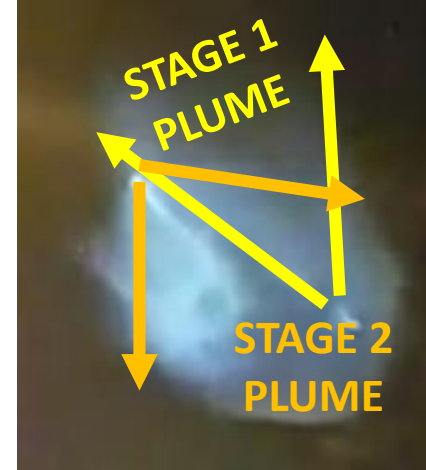
*VIEWED FROM RIGHT OF  
THE LINE-OF-FLIGHT,  
THE BOTH-FIRING  
FALCON9 FIRST AND  
SECOND STAGES ARE  
OUT OF LINE, WITH THE  
CLOSER, APPROACHING  
FIRST STAGE [LOWER]  
DISPLACED TO THE LEFT  
OF THE DEPARTING  
STAGE 2 [TOP].*



<https://youtu.be/s2DCuRaOnyM>



VIEW FROM FAR TO THE EAST, NEARLY PERPENDICULAR TO FLIGHT PATH, SHOWS STAGE 2 HIGH AND AT FORWARD EDGE OF CLOUD, STAGE 1 AT LOWER RIGHT, EACH MAKING THEIR OWN PLUMES AND MOVING IN OPPOSITE DIRECTIONS



## Ufo spacex nasa. Wtf is that

A Mianaby == Driving through AZ Phoenix oct7 2018 730pm we saw this my friend 1000 miles away saw it too from east bay nor cal.



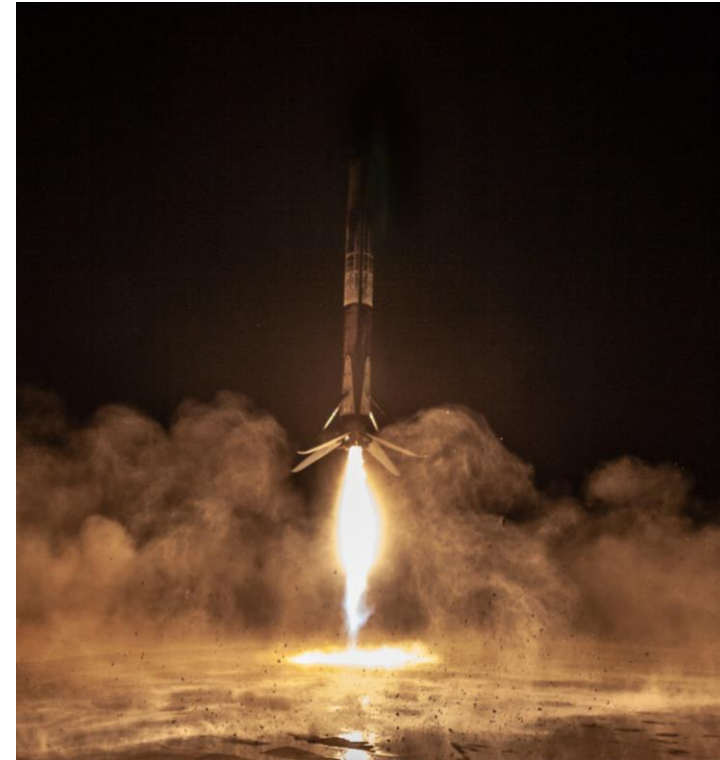
DETERMINATION OF PRECISE LOCATION ON PHOENIX HIGHWAY ALLOWS DERIVING THE VIEWING AZIMUTH TO OBJECT

- <https://www.youtube.com/watch?v=juq39WGAp7I>



# RETURN-TO-LAUNCH-SITE

- ADD TEXT



# UNEXPECTED INSIGHTS FROM FIRST STAGE RECOVERY IMAGES

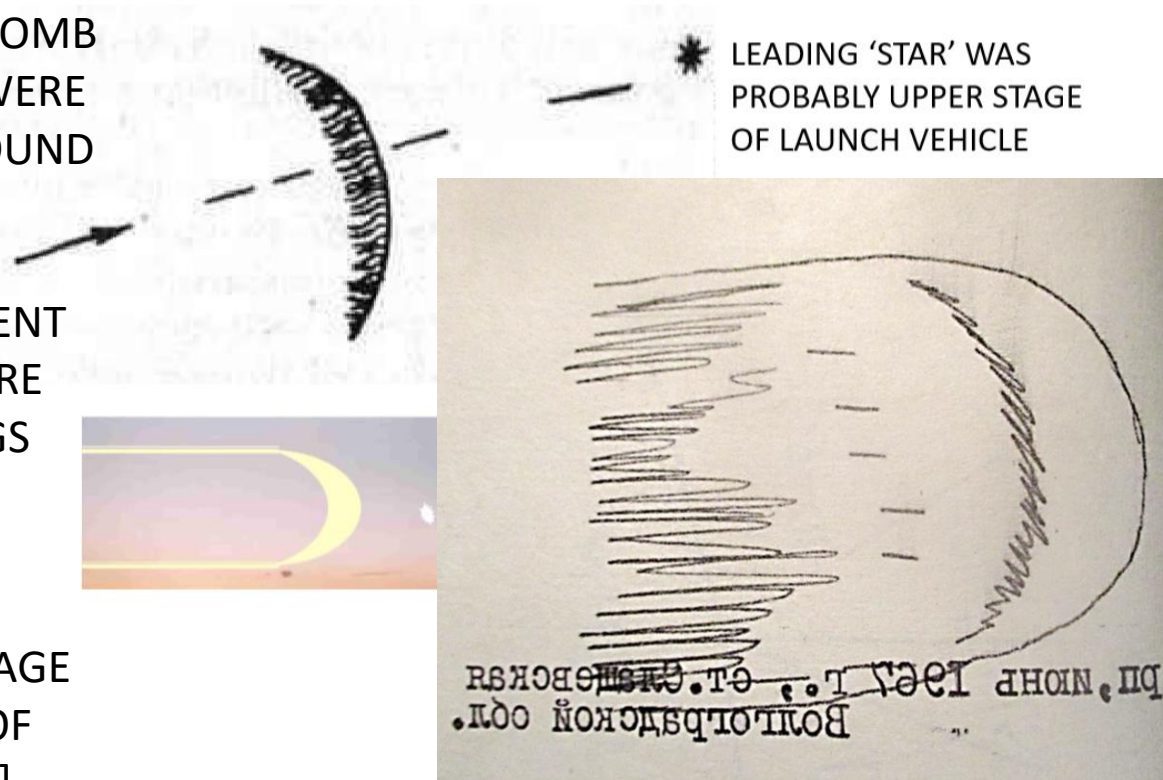
## DISCUSSION

A FAST-MOVING ROCKET FIRING ITS ENGINE FORWARD FOR BRAKING WAS A FEATURE OF A SECRET SOVIET ORBIT-TO-GROUND NUCLEAR BOMB IN 1967-8 TEST FLIGHTS THAT WERE WIDELY SEEN BY STARTLED GROUND WITNESSES WHO PERCEIVED THE AIR-IMPACTING ENGINE PLUME AS A 'SICKLE' OR CRESCENT MOON. NO PHOTOGRAPHS WERE MADE BUT HERE ARE DRAWINGS FROM WITNESS DESCRIPTIONS. FIFTY YEARS LATER, A BRAKING FALCON9 RETURNING TO CAPE CANAVERAL CAUSED THE IR IMAGE AT FAR RIGHT [PLUS CONCEPT OF SHUTTLE RTLS BURN, BELOW IT]

10/07/2018

**OPEN QUESTION: THE DESCENT BURN PROFILE THIS TIME DID NOT APPEAR TO PRODUCE 'CRESCENT MOON' EFFECT**

- Ground observations of Soviet FOBS warhead tests in 1967:
- [http://satobs.org/seesat\\_ref/misc/soviet\\_1967\\_wave.pdf](http://satobs.org/seesat_ref/misc/soviet_1967_wave.pdf)



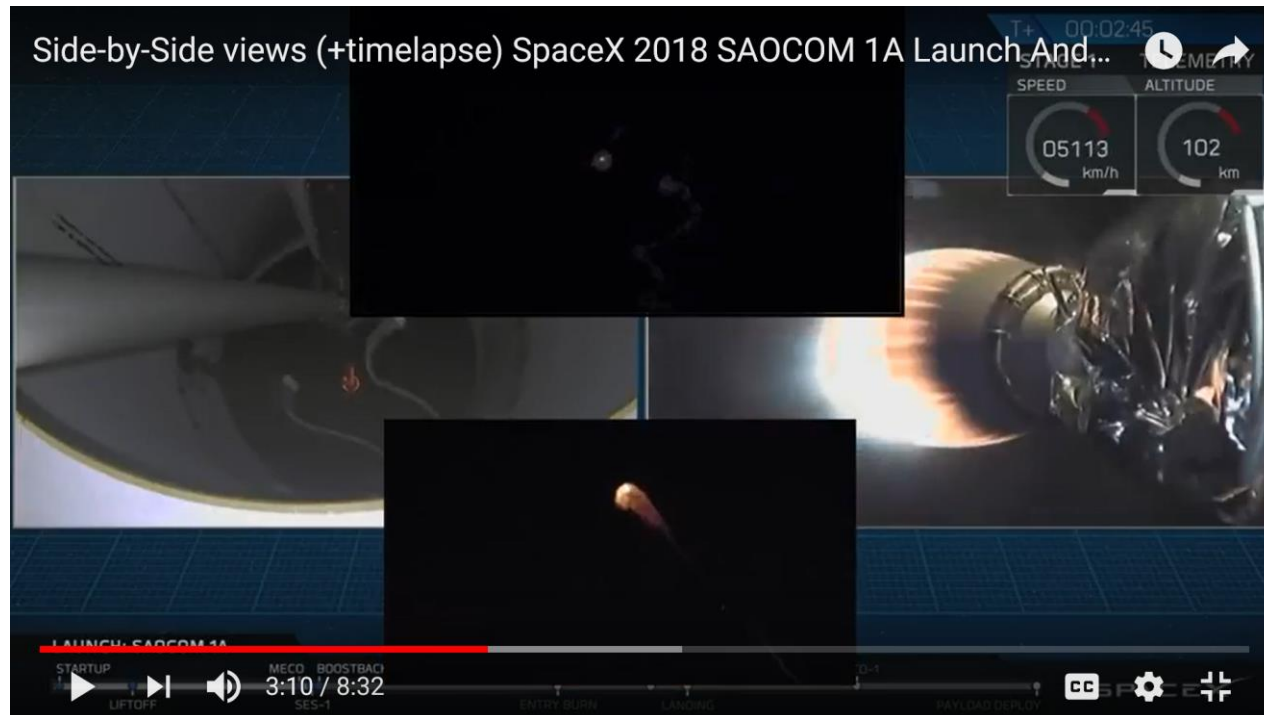
# ONBOARD IMAGERY

- TBS



# Side-by-Side views (+timelapse) SpaceX 2018 SAOCOM 1A Launch And Landing [Oct 15, 2018]

Paper Dragon = Two ground perspectives overlaid and matched to the SpaceX Live feed. Also added a timelapse at the start then a replay at normal speed.



<https://www.youtube.com/watch?v=bkCiz4BKlFo&feature=youtu.be>

# ONBOARD VIEW JUST AFTER SECOND STAGE CUTOFF SHOWS SIDEWAYS OPPOSITE SYMMETRICAL 'DOUBLE PLUME' INVOLVING GAS DUMP FOR THERMAL CONDITIONING



# My favorite videos – description TBS

- Staging <https://youtu.be/sEaTe38-l4Y>
- <https://www.youtube.com/watch?v=bUSkRDEHptU>
- <https://www.youtube.com/watch?v=1Tx6jrvCCd4>
- <https://www.youtube.com/watch?v=-x7ruR5Vygc>
- Landing <https://youtu.be/jsLZJZxmtul>
- <https://www.youtube.com/watch?v=bNUVH3ynIGw>
- <https://www.youtube.com/watch?v=nrTXGIkyPNc>
- <https://www.youtube.com/watch?v=6KhR-z9Nbxc>
- <https://www.youtube.com/watch?v=rN8gceUElqo>
- Behind clouds <https://youtu.be/1Tx6jrvCCd4>
- Best end of stage2 burn [https://youtu.be/NWRikQiio\\_M](https://youtu.be/NWRikQiio_M)
- FAMILY REACTION <https://youtu.be/0LlDs8dmAPM>
- IR cam on Santa Cruz I. <https://www.youtube.com/watch?v=SZPAsUx-Eyw>



**IN-DEPTH DISCUSSIONS  
OF TECHNICAL ASPECTS  
OF VISUAL PHENOMENON**

# “SAOCOM 1A Mission”

[https://youtu.be/vr\\_C6LQ7mHc](https://youtu.be/vr_C6LQ7mHc)

- DickNickle == Can anyone confirm what we just saw at 28:00 min... What looks to be a leak ?? You can see Ice forming around the escaping gas. Tell me that this has happened before, on previous launches ? If you watch closely before the 28 min mark, It seems as if it has a very small hole and gas is escaping, but then its full blow leakage just at the payload deployment.
- How Does it Really Work == Yes, it always works this way -- even during engine testing on the ground. This is **a part of the engine shutdown sequence**, and what we see is liquid oxygen being blown out of the engine plumbing to prevent it from boiling inside and causing trouble. The "ice" is solid oxygen which forms when liquid oxygen evaporates into vacuum and thus cools down to the freezing point. **During the engine startup, a similar process occurs for several minutes before the ignition** -- liquid oxygen is allowed to slowly drain through the plumbing to chill it down to the working temperature. **You can always see it before the second engine burn in the missions to the geostationary transfer orbit.**

# FLYBACK/LANDING, described by GreenWinterSky

<https://www.youtube.com/watch?v=9cTVXPAlAno>

- it was amazing i will remember it for my entire life the best thing ever especially the ending. You don't see it entirely but at the end right at the sonic boom there was a straight shadow that appears in the center of all the light that was the engines kicking in last minute and the shadow was created by the rest of the craft.
- when the gas appeared it kinda looked like at first as if it was hurdleing down towards us and the rocket even before it flew up you could see in the horizon the small flashes of light from the ignition whichs was really soft until it lifted up off the platform i assume
- when the gas spread it was like looking up at a exsploding star with less violet purple in it and more of a nice blue and then a while after a nice exsplusive color to the center like after a bomb going off but it wasnt as potent as a actual bomb going off not in color at least it was simpley a amazeing event

... and many more like that.

- tbs

# REFINEMENT OF ANALYSIS TECHNIQUES

- Challenge to analyst is determination of line-of-sight azimuth from known locations, in order to allow triangulation with either another line-of-sight, or with a known vehicle ground track
- Short of the on-scene observer using a compass [in real-time or on subsequent site return visit], the preferred azimuth determination methods rely on environmental/contextual factors in the imagery.
- The most precise method involves using starfield background, but this requires particularly high-quality imagery that is rare.
- Often, recognizable natural or manmade landmarks can [with knowledge of observer's position relative to them] provide usable insight into the approximate azimuth.
- Further advances in these and as-yet unimagined azimuthizing methodologies are bound to appear as new observations are made.



SpaceX Falcon 9 Rocket Launch from Vandenberg AFB ~ 10-7-18



EXAMPLE OF AZIMUTH DETERMINATION  
FROM SERENDIPITOUS VIDEO COMPARED TO  
'GOOGLE EARTH' STREET-VIEW FEATURE

US 101 and Killion St.,  
Encino, CA  
[courtesy Jeff Allen]



10/07/2018



0:52 / 10:56

SpaceX First Earth-orbiting mission

Scroll for <https://youtu.be/nrTXGIkyPNc>



34°10'17.22" N 118°30'41.78" W

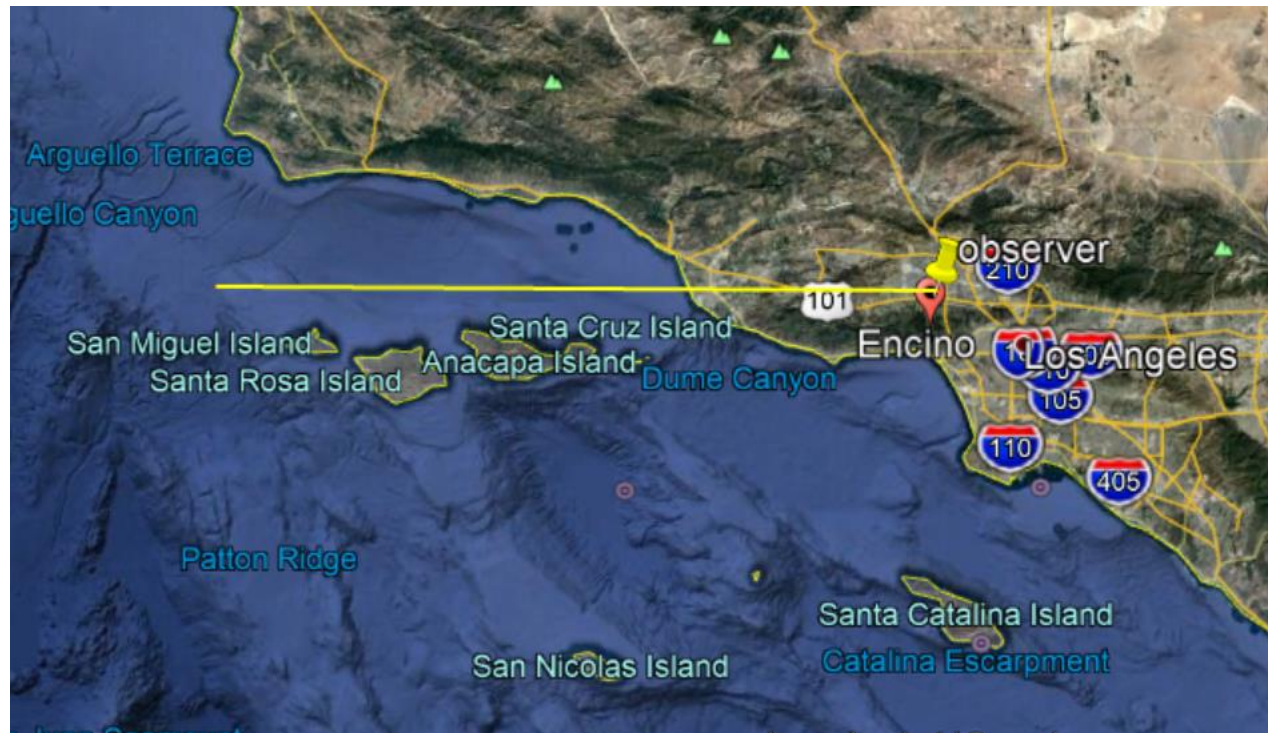
©2018 Google

Google street view, looking west

10/07/2018

SpaceX First California Stage1 RTLS

# Azimuth 270 degrees, range 120 miles

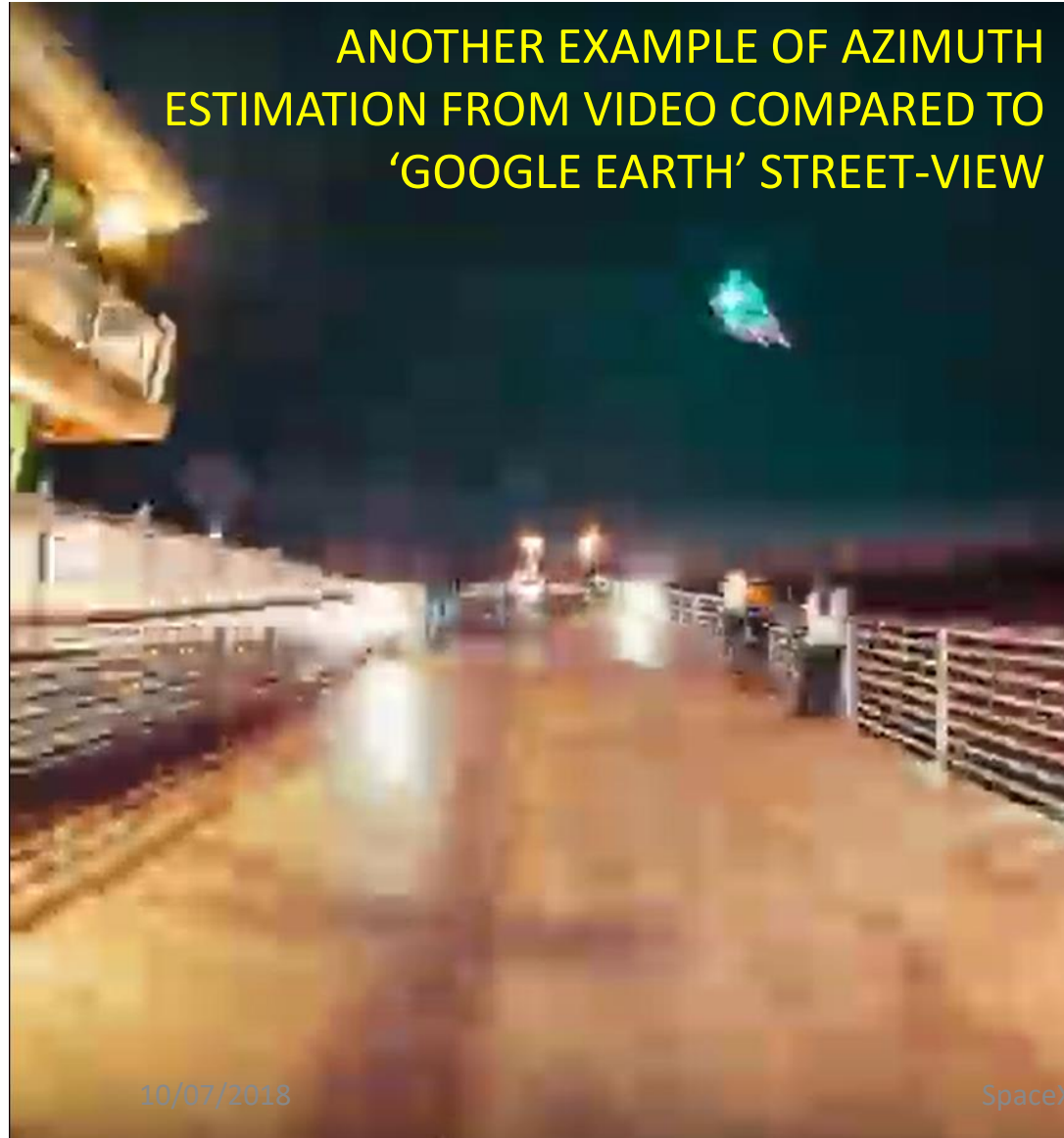


Google-Earth



# Space X Falcon 9 Taking Off Above Hermosa Beach At Sunset

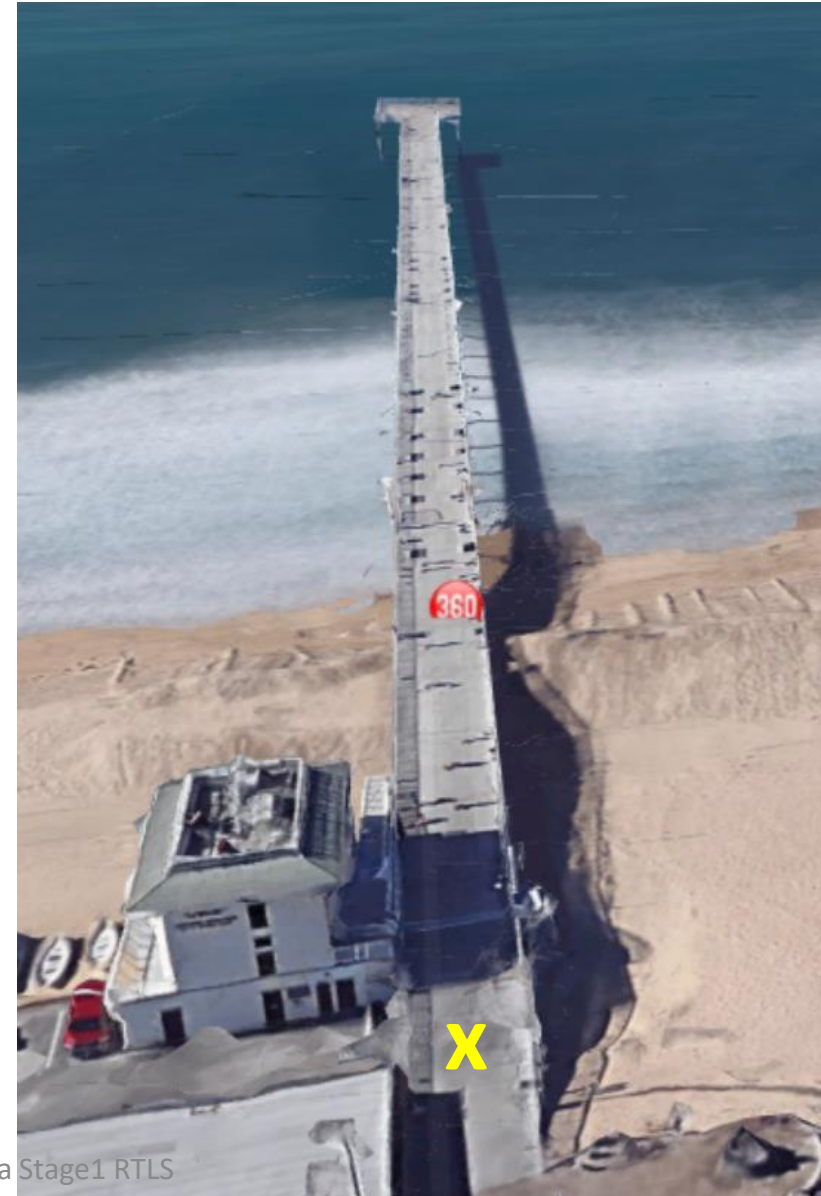
<https://youtu.be/4KDHifGnHqo>



- [SamShapiroMedia](https://youtu.be/4KDHifGnHqo)
- Published on Oct 8, 2018
- Hyperlapse taken from 6pm-8:15pm on Hermosa Pier, California. Keep an eye on that rocket!!
- Pier orientation 258 degrees



# Pier provides perfect line-of-sight azimuth

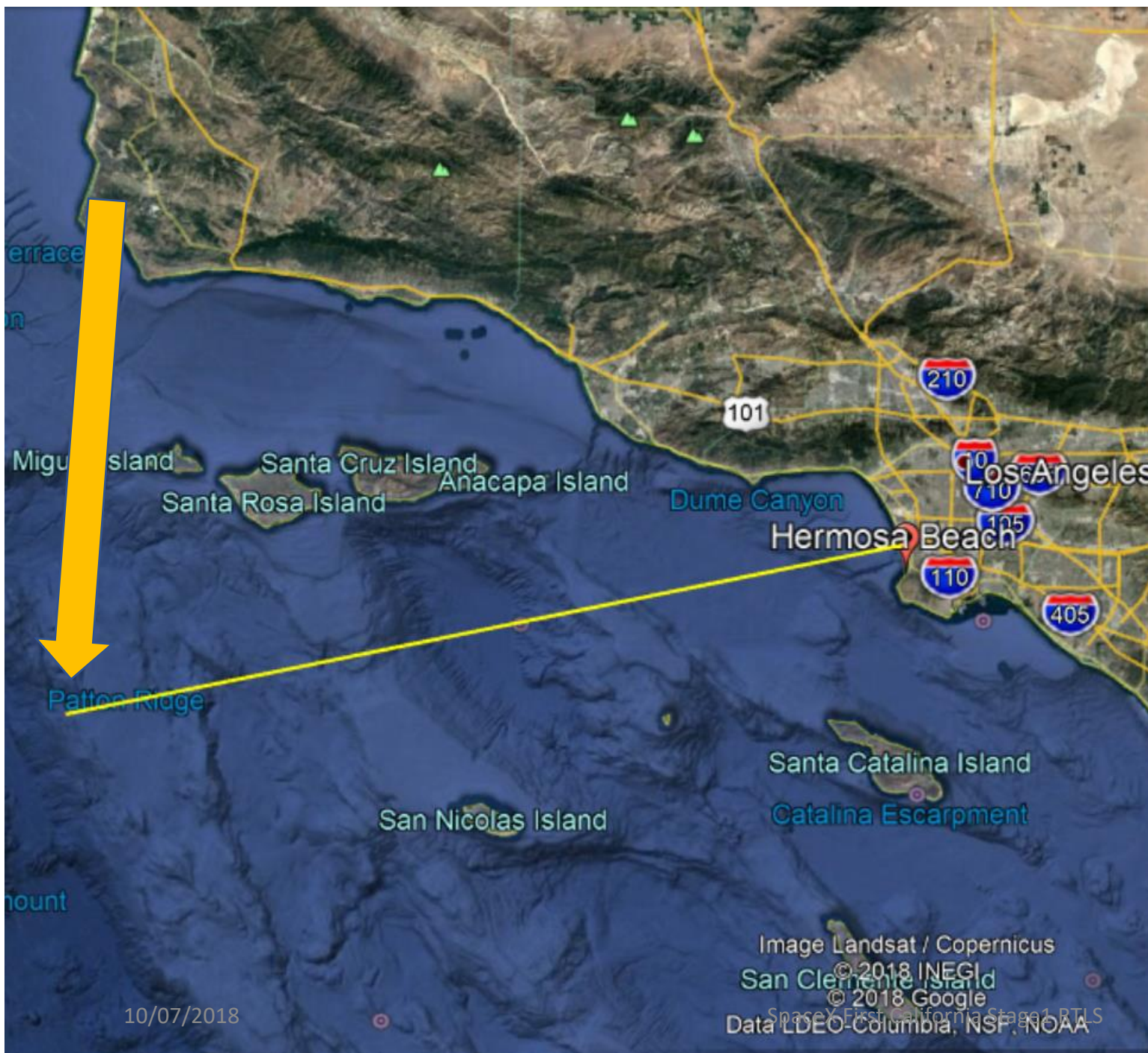


Google-Earth

PARALLAX ON  
STRUCTURE  
SHOWS WHERE  
OBSERVATION  
MADE FROM

# Pier line-of-sight

- 133 miles,
- "west by south"





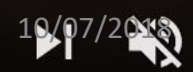
CRAZY TIMELAPSE of SPACEX FALCON 9 LAUNCH - LUCKY SHOT! - OCTOBER 7, 2018



EXAMPLE OF AZIMUTH DETERMINATION  
FROM SERENDIPITOUS VIDEO COMPARED TO  
IDENTIFIABLE STAR BACKGROUND AND  
DATE/TIME POSITION AS CALCULATED BY  
WWW.HEAVENS-ABOVE.COM 'SKY VIEW'

THE REAL  
WAR PICTURE

By Chris O'Neal



10/07/2018 0:00 / 0:31

SpaceX Scroll for details 1 RTL5

<https://youtu.be/jq9-KTSut-8>



CRAZY TIMELAPSE of SPACEX FALCON 9 LAUNCH - LUCKY SHOT!  
<https://youtu.be/jq9-KTSut-8>

- [The Real Big Picture](#) // [chris.oneal@therealbigpicture.com](mailto:chris.oneal@therealbigpicture.com)
- CRAZY TIMELAPSE of SPACEX FALCON 9 LAUNCH - LUCKY SHOT! - OCTOBER 7, 2018. View from 6,000 feet in the San Bernardino, California, Mountains.
- For licensing, please call (760)532-1525.

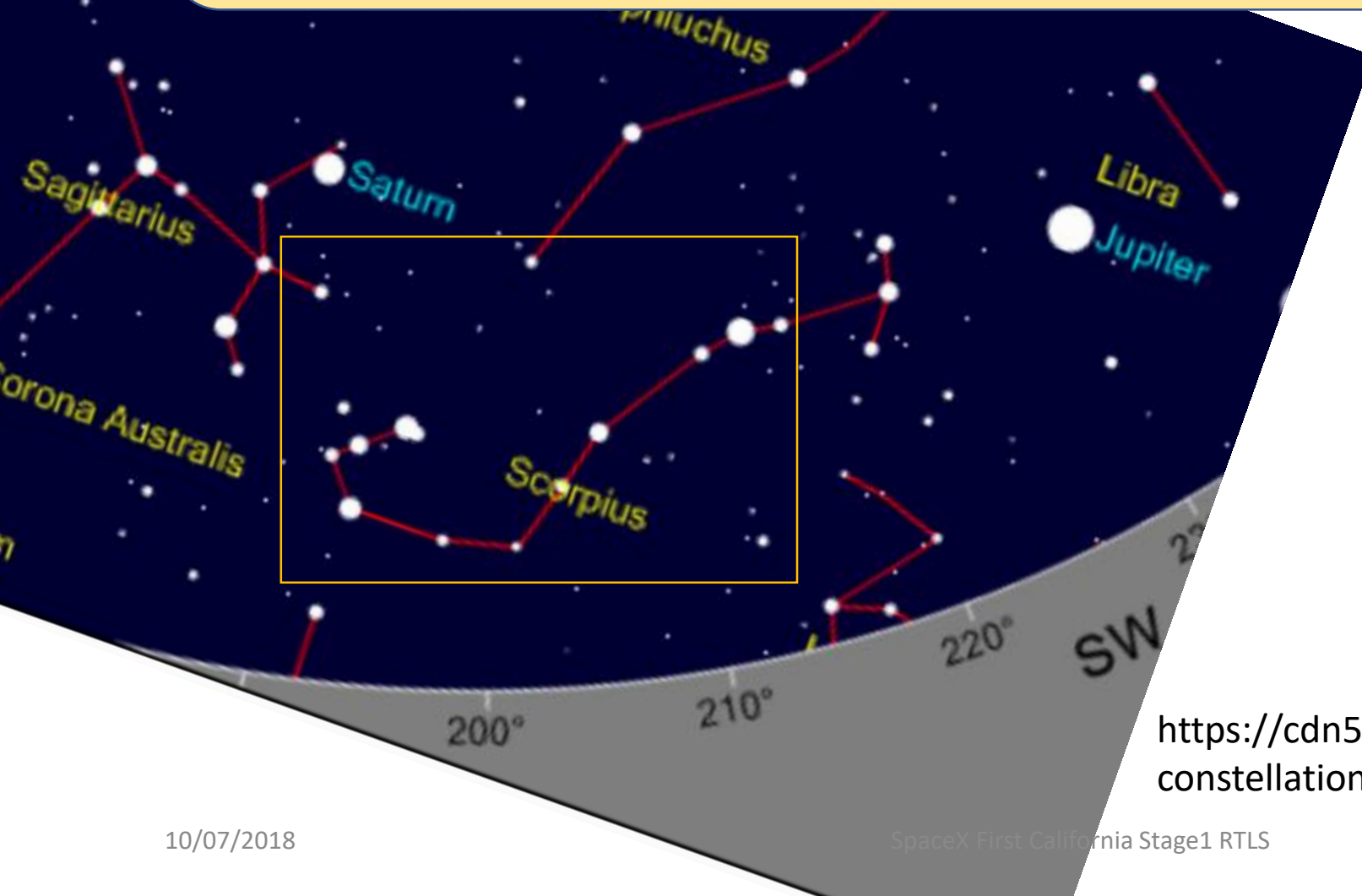


**OVERBRIGHT THE IMAGE TO BRING OUT BACKGROUND STARS  
[AND USE KNOWN CONSTELLATION SIZE TO DETERMINE SCALE]**

**O'NEAL**

← 25 degrees →

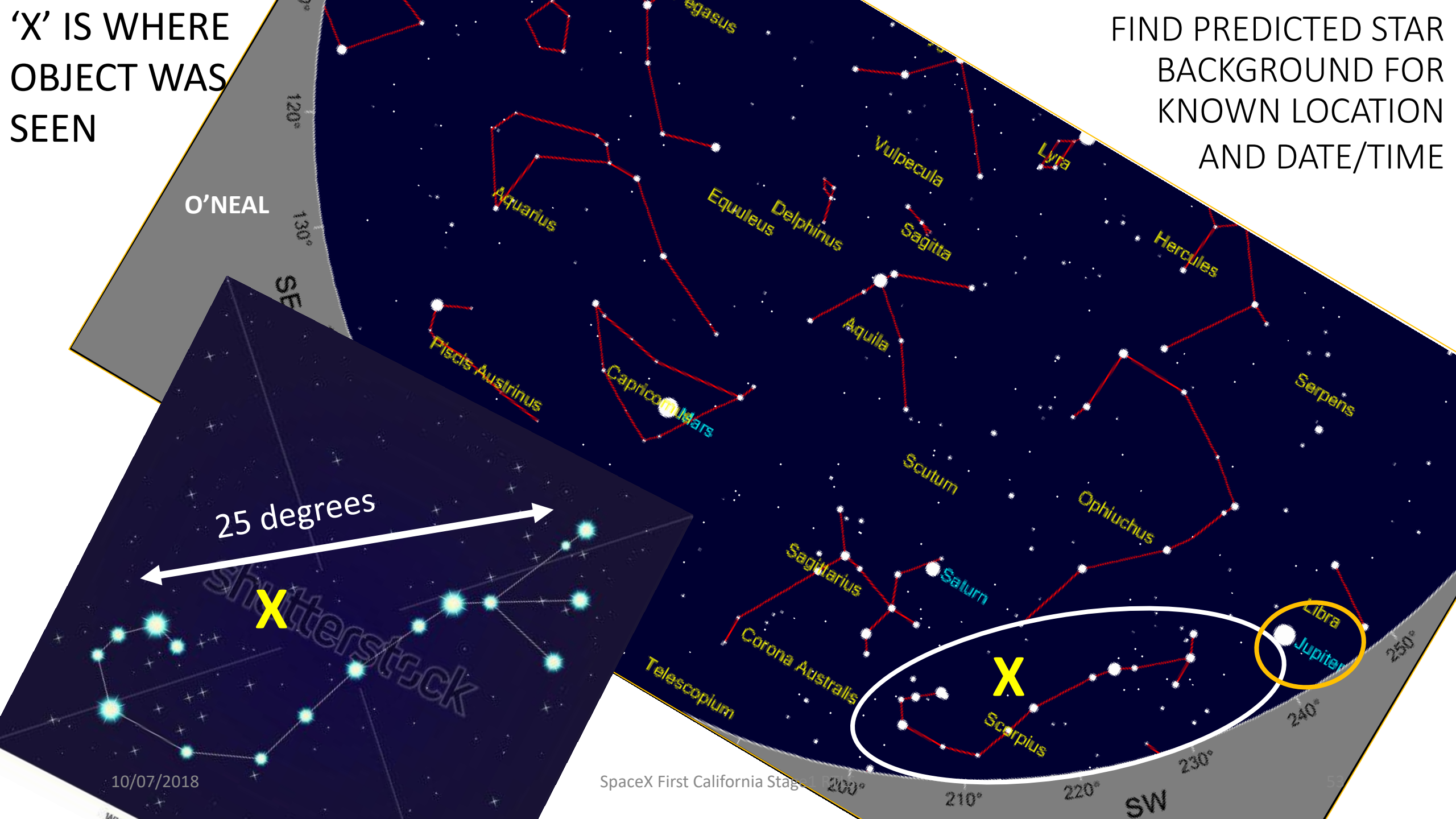
CONSTELLATION 'SCORPIO' IN SOUTHWESTERN SKY,  
DISTINCTIVE FEATURE IS THE 'STINGER'  
AT THE END OF THE SCORPION'S TAIL



<https://cdn5.vectorstock.com/i/1000x1000/38/19/scorpio-constellation-hand-draw-vector-19123819.jpg>

'X' IS WHERE  
OBJECT WAS  
SEEN

FIND PREDICTED STAR  
BACKGROUND FOR  
KNOWN LOCATION  
AND DATE/TIME



SECOND STAR-BACKGROUND IMAGE FROM SAME AREA  
SpaceX Falcon 9 from Joshua Tree National Park  
<https://youtu.be/xaWbSWXApek>

- Photographed by Tony Prince during Sean Parker's Joshua Tree National Park Photo Workshop Oct 7th, 2018.
- For Licensing contact [Sean@Sean-Parker.com](mailto:Sean@Sean-Parker.com)
- In response to question, he specified (33.9997628, -116.0865279)





by Tony Prince

JUPITER -- 0

# Falcon 9 Rocket Launch viewed from Joshua Tree National Park 10/7/18



Tony Prince



10/07/2018



0:52 / 1:00

<https://www.youtube.com/watch?v=N4j7OmUvwtI>



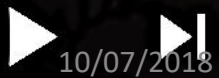
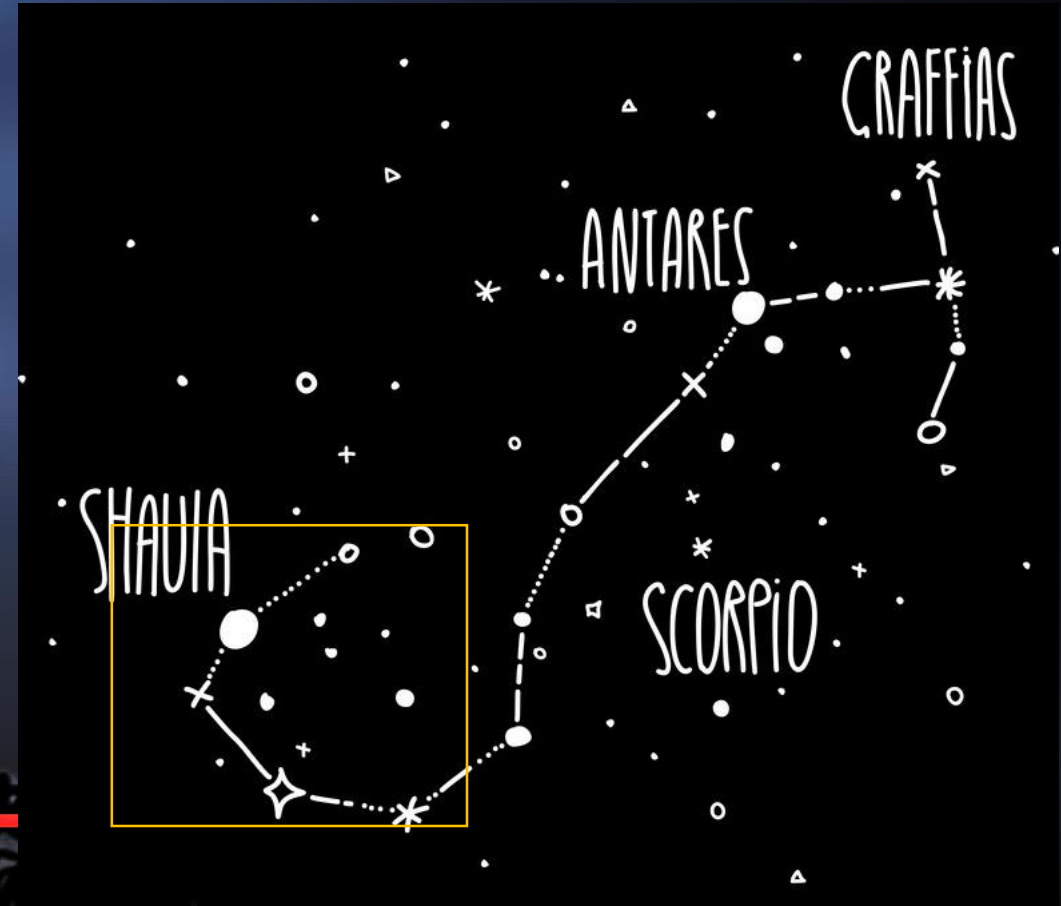
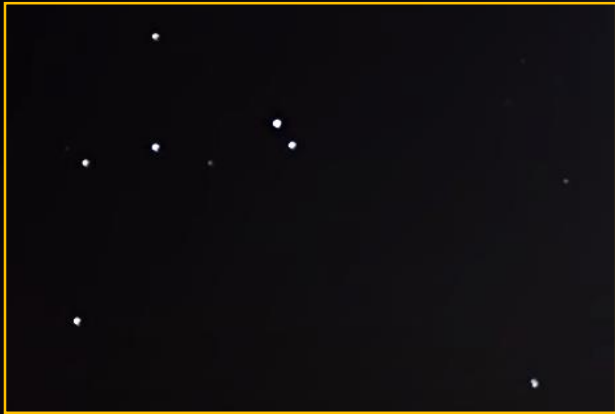
SpaceX First California Stage1 RTL

56

# Falcon 9 Rocket Launch viewed from Joshua Tree National Park 10/7/18



Tony Prince



0:52 / 1:00

SpaceX First California Stage1 RTLS



A photograph of a SpaceX Falcon Heavy rocket launch at night. The rocket is ascending from the bottom left, leaving a large, billowing white plume of smoke and fire. The background is a dark sky filled with stars. In the lower right, a bright, glowing horizon line suggests the presence of Jupiter. The text "JUPITER -- O" is overlaid in large white letters.

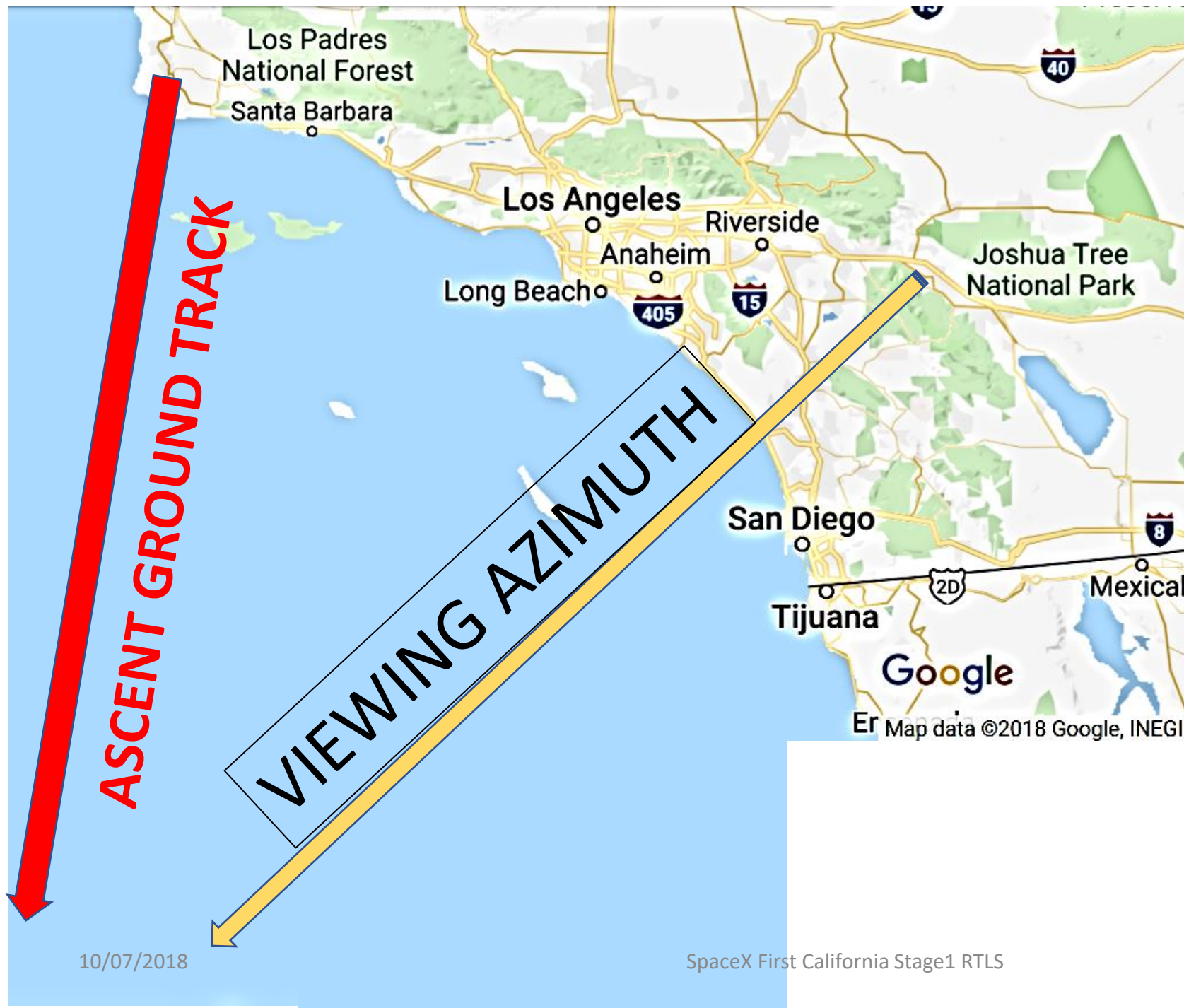
# JUPITER -- O

By Chris O'Neal  
10/07/2018

SpaceX First California Stage1 RTLS



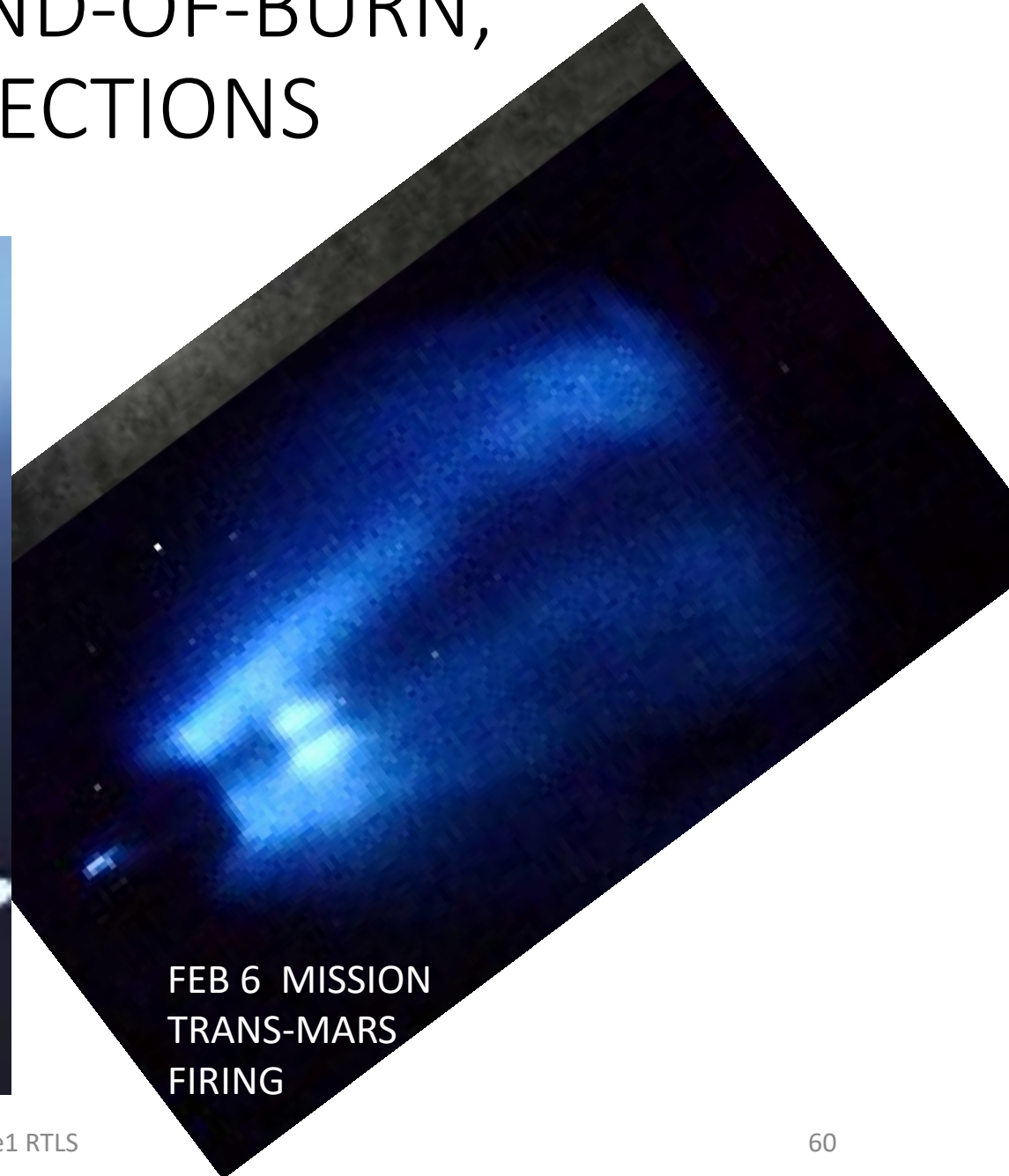
CC



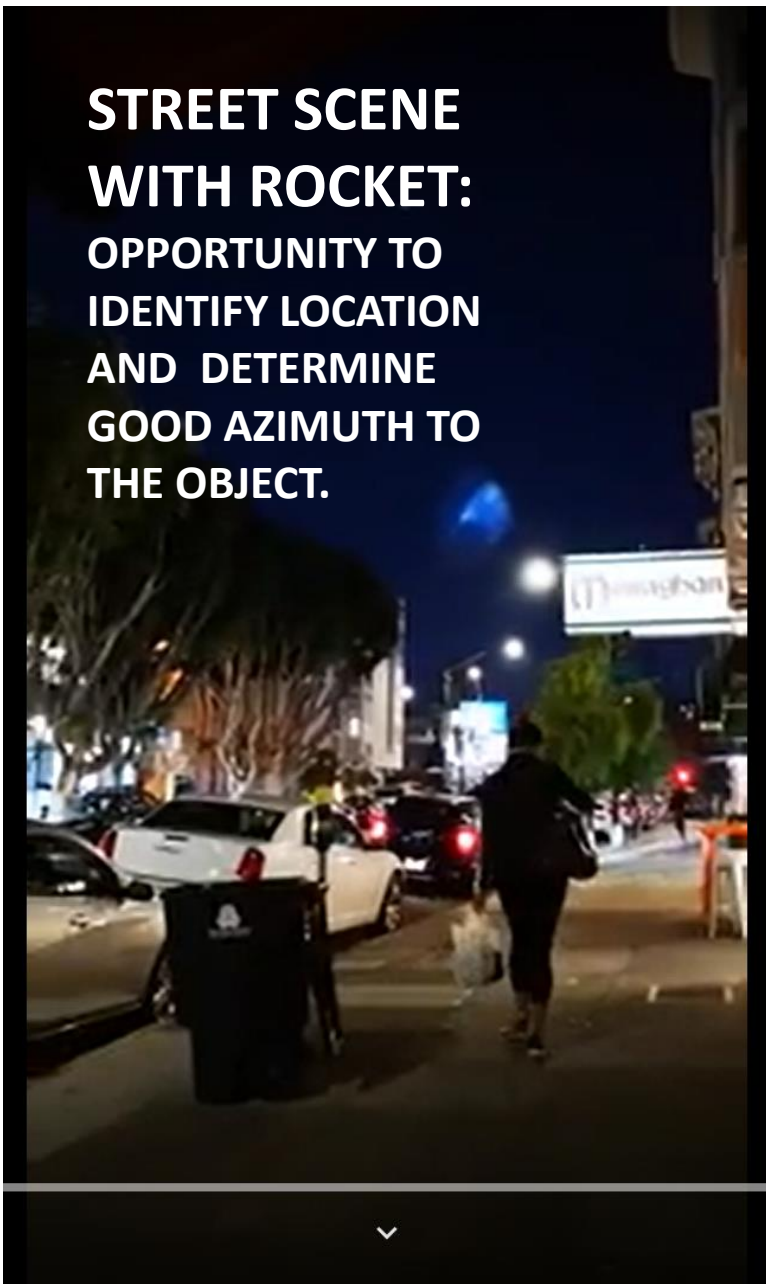
# JOSHUA TREE NATIONAL PARK

range is about 550 miles

# INTERESTING FEATURE OF END-OF-BURN, TWIN LOW-SPEED PLUME EJECTIONS



**STREET SCENE  
WITH ROCKET:  
OPPORTUNITY TO  
IDENTIFY LOCATION  
AND DETERMINE  
GOOD AZIMUTH TO  
THE OBJECT.**

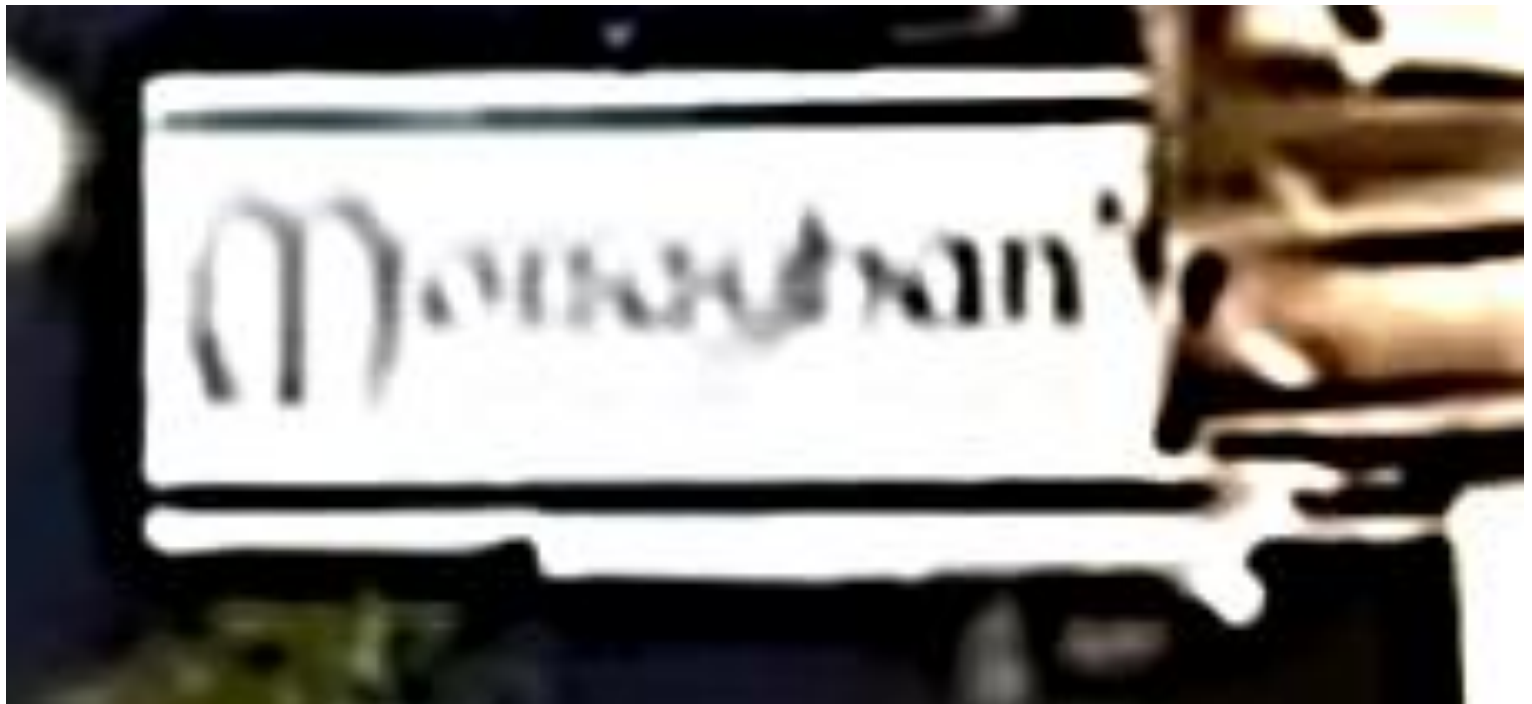


**ANALYSIS CHALLENGE: DETERMINE AZIMUTH TO OBJECT**

Ufo in San Francisco

Erika Repáňová

<https://youtu.be/l-q7ylOymy0>





# ANALYSIS CHALLENGE: DETERMINE AZIMUTH TO OBJECT

UFO OVER DISNEYLAND CALIFORNIA (HD) 10-7-18

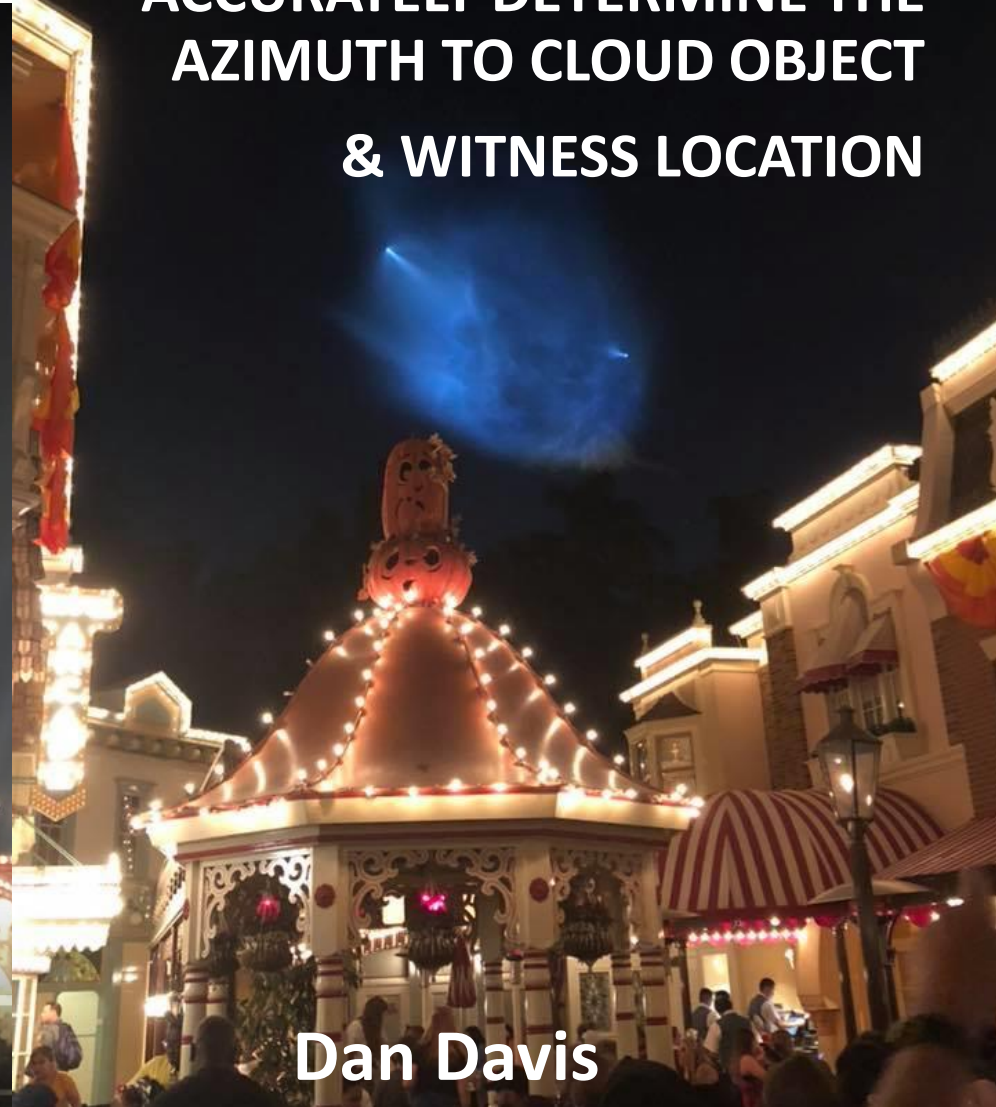
<https://www.youtube.com/watch?v=JNGxVlqLAWI>

## UFO OVER DISNEYLAND

Dez Van Buren 4200 views



EASILY-IDENTIFIED LANDMARKS  
CAN ALLOW THE ANALYST TO  
ACCURATELY DETERMINE THE  
AZIMUTH TO CLOUD OBJECT  
& WITNESS LOCATION



Dan Davis



SpaceX rocket launch



**ANALYSIS CHALLENGE: DETERMINE  
ELEVATION ANGLE TO OBJECT**

**BRIGHTENED VIDEO IMAGE  
OF OBSERVER WHO CAME  
DELIBERATELY TO WATCH.**

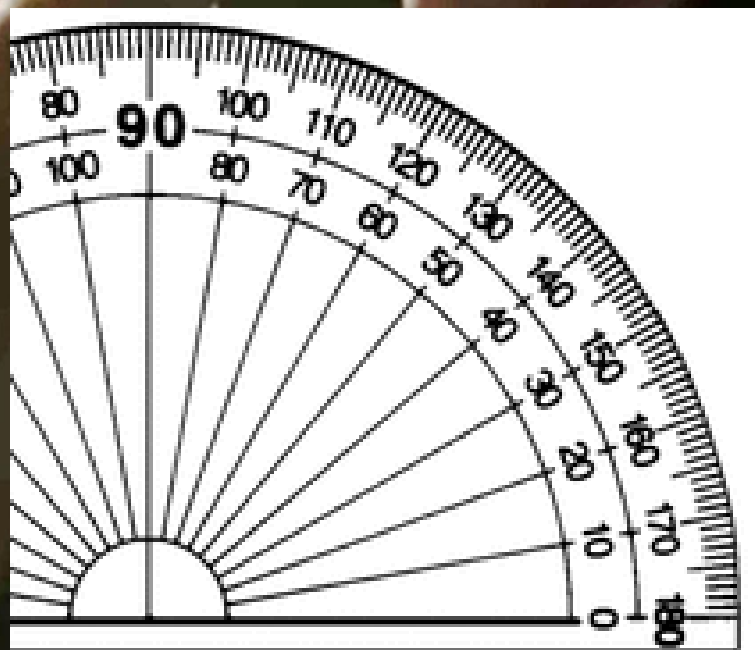


**SPACEX LAUNCH MESMERIZES ONLOOKERS**



0:44 / 1:53





ANALYSIS OF ANGLES ON  
BRIGHTENED VIDEO IMAGE  
OF OBSERVER CAN PROVIDE  
ELEVATION ANGLE OF LINE-  
OF-SIGHT TO TARGET OBJECT.



SPACEX LAUNCH MESMERIZES ONLOOKERS



# MISSION

- UNDERSTAND WHAT WE ARE SEEING
- INTERPRET WHAT IT MEANS
- REFINE PROCEDURES FOR NEXT VIEWING OPPORTUNITY
- APPLY OBSERVED PATTERNS TO OTHER SPACEX MISSIONS BOTH SUCCESSFUL OR POSSIBLY ANOMALOUS
- APPLY VALIDATED METHODOLOGIES TO OTHER WORLDWIDE MISSIONS WITH EVEN MORE LIMITED INFORMATION RELEASES
- PERFORM ARCHIVAL SEARCH FOR PAST VIDEOS THAT MAY YIELD HITHERTO-UNRECOGNIZED INFORMATION VIA NEW METHODS



# NASASPACEFLIGHT.COM Threads for SAOCOM 1A : [private/commercial website for enthusiasts]

- EVENT UPDATES  
<https://forum.nasaspaceflight.com/index.php?topic=46471.0>
- **MISSION DISCUSSION**
- <https://forum.nasaspaceflight.com/index.php?topic=44715.0>
- **NSF Articles for SAOCOM 1A :**  
<https://www.nasaspaceflight.com/?s=SAOCOM>
- PARTY <https://forum.nasaspaceflight.com/index.php?topic=42585.0>
- Launch viewing
- <https://forum.nasaspaceflight.com/index.php?topic=41995.0>



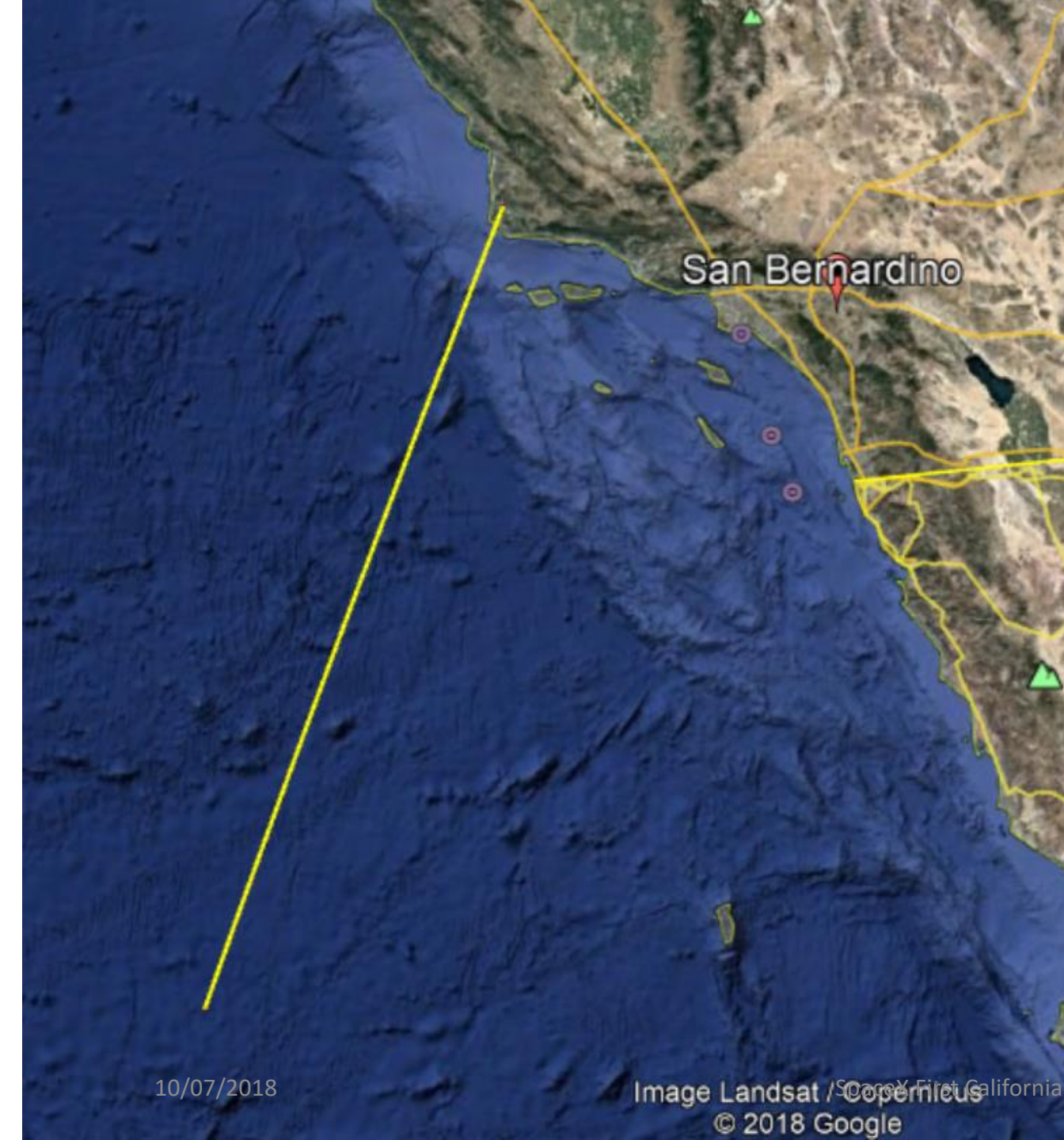
# SpaceX contact info

- SpaceX Contact |
- Eva Behrend, Sr. Communications Manager, 310-363-6247, [media@spacex.com](mailto:media@spacex.com)
- <https://www.spacex.com/sites/spacex/files/saocom1apresskit.pdf>
- launch azimuth of 199 degrees -- See the azimuth discussion from the Jason-3 thread about allowable azimuths from VAFB:

<https://forum.nasaspaceflight.com/index.php?topic=29457.msg1393254#msg1393254>

# Press kit timeline

- 00:00:00 launch azimuth of 199 degrees – Oct 08, 2018 [UTC]
- 00:00:59 Max Q (moment of peak mechanical stress on the rocket)
- 00:02:20 1st stage main engine cutoff (MECO) [ALT=86km]
- 00:02:24 1st and 2nd stages separate
- 00:02:31 2nd stage engine starts [2:34] [ALT=88km]
- 00:02:36 Boostback burn
- 00:02:48 Fairing deployment
- 00:05:57 1st stage entry burn
- 00:07:46 1st stage landing
- 00:10:07 2nd stage engine cutoff (SECO-1) {10:24} [ALT=625km]
- 00:12:37 SAOCOM 1A satellite deployment



109deg  
launch  
azimuth



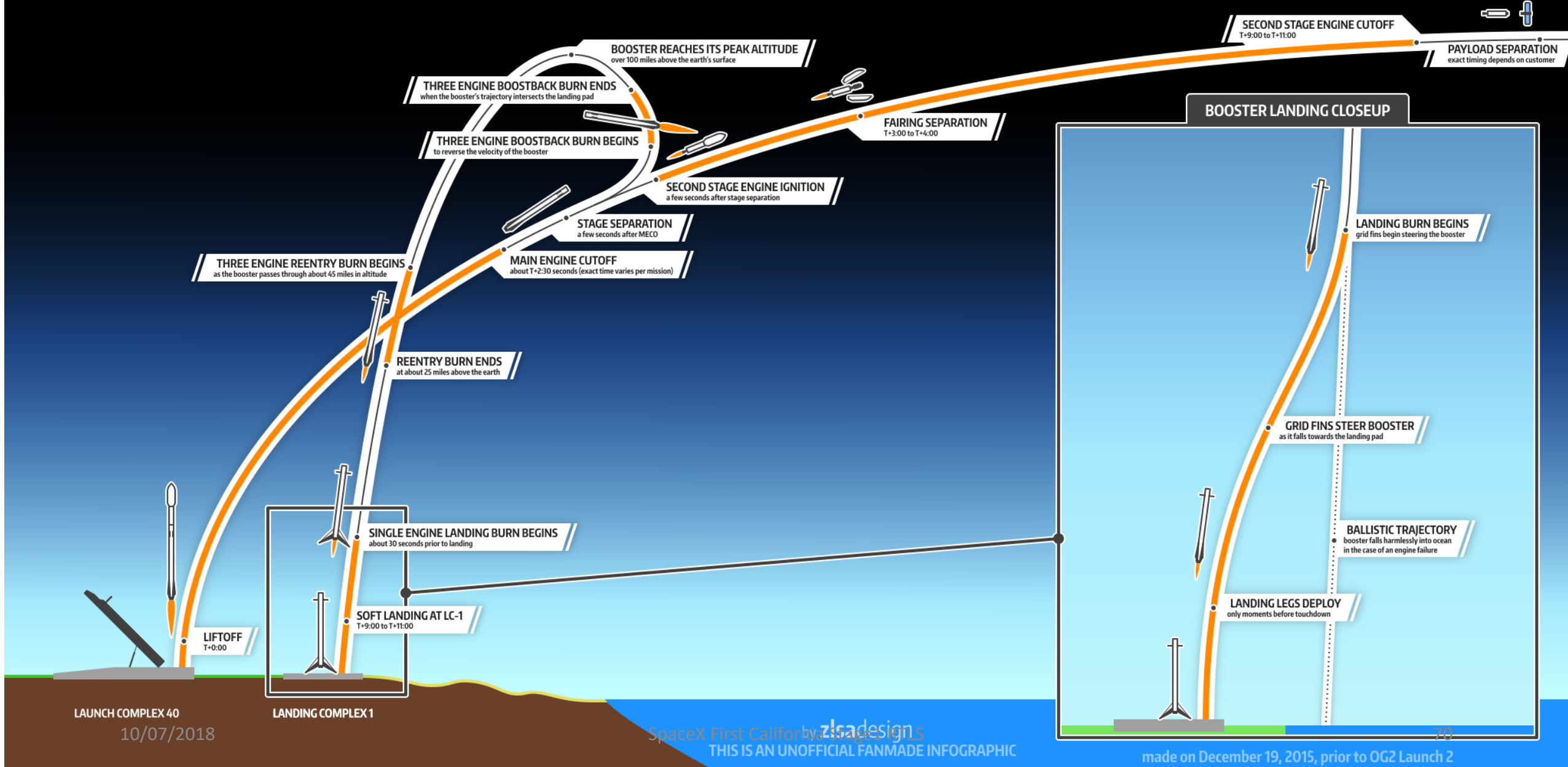
Vafb-obs 200 miles  
Smll angle 16  
 $\text{Tan} = 200/x$

From San Bernrdino  
700 miles

# SPACEX FALCON 9 LAUNCH AND LANDING PROFILE

NOTE: NOT TO SCALE/TRAJECTORY IS NOT EXACT

<https://i.imgur.com/D9BdO86.png>





# LAUNCH RESULTS

Argentina's CONAE space agency has its first radar imaging satellite in orbit, SAOCOM-1A (Satelite Argentino de Observacion Con Microondas). The 3000 kg satellite has a 10 x 2.5m L-band synthetic aperture radar antenna, and was built by the Argentine company INVAP SE. SAOCOM-1A was launched on Oct 8 by a SpaceX Falcon 9 from Vandenberg's Space Launch Complex 4-East (SLC-4E). The Falcon 9 first stage, B1048, became the first to return for a Vandenberg landing, at Landing Zone 4 (LZ-4) on the old SLC-4W. The second stage was deorbited at the end of its first orbit and reentered SE of Hawaii at about 0413 UTC.

## NORAD DESCRIPTORS

Oct 8 02:21 SAOCOM-1A Falcon 9 Vandenberg SLC4E  
Radar 76A S43641 607 x 634 x 97.9 1800LT 2018-076A

# More witness accounts

- 1
- 2
- 3
- 4

WITNESSES

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



[BRIGHTENED IMAGE] PRE-ALERTED  
VIEWERS GATHERED TO OBSERVE LAUNCH  
AND LANDING AT VANDENBERG AFB, CA.



SPACEX LAUNCH MESMERIZES ONLOOKERS



0:38 / 1:53



- kimmer6 == ... **I saw the whole thing** from Pismo Beach, maybe 25 miles from the launch site. It was fantastic. 7:21 on time just like they posted beforehand. The vapor cloud when the 2 stages separated was **miles in diameter** within 3 seconds. Whatever fuel they use **burns orange** in the lower air. The ascent was like a long orange arrowhead but when it returned, the exhaust looked like a **round orange ball with flames at the bottom**. It landed behind the hill at the North end of the airbase. You could see the orange lit up sky until the engines shut down. About 90 seconds later we were hit with a strong double sonic boom... BA-BOOM! and you could feel it. There's plenty of video out now. The best part was seeing those **cold gas thrusters orient the booster** to fall backwards. Wow! It looked like pulses radiating from the rocket. We got to our view point 45 minutes early to watch the sunset. The really cool thing was watching commercial airliners heading South turn inland over San Luis Obispo to avoid the launch site. **The airliners were lit up orange from the sun which had just gone down for us. They left short contrails, orange as well,** very easy to see. ...



<https://www.youtube.com/watch?v=jsLZJZxmtul&t=225s>

- Stephen McLendon == I shot from W Betteravia Ave in Santa Maria, almost **inline with the trajectory and up the rear-end**. The foothill didn't concern me. I had a clear shot of everything except the actual launch: launch glow before rising above foothill including 1st stage back-burn and landing. Launch and return looked the same. The return was not noticed by many videographers who have posted because they weren't aware of the second major reason the rocket was launched in the first place from VAFB; to land the 1st stage back on land less than a 1/4 mi from the launch pad. THAT WAS A FIRST! Any explosion from a unsuccessful landing, I could have seen when the explosion lit up the sky. My only regret is I forgot my tripod and several very spectacular gas vapor clouds have light streaks from my movement. I will be ready the next time! I also shot video which shows the return of the 1st stage making trajectory adjustments using its vector adjusters shooting momentary gases that the sun made turquoise blue. From my perspective, **the most interesting part for me was when the 1st stage appeared above the down-range 2nd stage and as it fell, it passed over the 2nd stage**. The 1st stage gases were orange with a smoke trail and the 2nd stage looked blue and reminiscent of Comet Hale-Bopp, which I photographed back on April 11, 1997.



**STORIES  
THAT  
MATTER**

**SPACEX LAUNCH MESMERIZES ONLOOKERS**



1:50 / 1:53



# [OOPS!! WRONG ROCKET GRAPHIC]



<https://youtu.be/YLgOSd-HA6k>

1:23 segment



# SpaceX Launches Satellite Into Orbit, Landing Back On West Coast For First Time



SOURCE: SPACEX



<https://youtu.be/slGY7DGpDSQ>

CUL-DE-SAC BECAME A IMPROMPTU

SpaceX Launch Lights Up the Sky  
VANDENBERG AIR FORCE BASE





# Weird light in the night sky over Napa Valley

<https://youtu.be/FLXJ6CLo5Nw>

- Tara Harris == I saw it in Fontana CA, it was like **light in some fog beanie down and moving real slow.**
- Elizabeth Marks-Graham == Published on Oct 7, 2018 == transcript of real-time conversation while car is driving along a road, then pulls over to better watch the light.
- transcript NEXT PAGE



# transcript

- [00:00] that's like **something blew up**. send me this. okay it's still like moving
- [00:14] what is that? is it.. ? it was **like a rocket** going on.
- [00:22] **we don't shoot rockets up here**.
- [00:24] what is that ?
- [00:30] and it was like it **exploded**. Look at how big that thin is.
- [00:33] .. All right, we'll be away from trees in a minute.
- [00:50] it's **so bright look at that** -- Sun [?] of all
- [00:53]] oh my god it's pretty. it's still moving
- [00:57] what the hell is that it's still moving
- [01:04] I see it's **like a rocket** hopefully not
- [01:06] nothing new there . look **how bright** it is . I'm gonna get out and take a picture.
- [car stops]
- [01:19 ] only it's kind of scary and **there's this orange thing** up in the sky. what is right?
- [01:42] that **has to be some sort of rocket** I did they launch a satellite?
- [01:49] don't know, that's freaking.

# witnesses

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

chad bierbaum == do you have the rest ? did it go out of your eye sight? I saw it in SD CA im by mexico border by tacate i saw the red in the sky than the rocket above but headed out over to my south west direction it was flat on its side headed out to the south west and went out of my eye sight . ... I lost the rocket behind a dark cloud . from where i was it looked like it was flat headed south west out to the ocean . I was thinking that i would have had to be in mexico to see the thing good . i could see the trail of the rocket curve than flatten out an was headed over mexico is what it looked like to me

[https://youtu.be/-UTQ4qCm\\_qM](https://youtu.be/-UTQ4qCm_qM)

Astro Andrew == Beautiful!! I'm lucky to have saw this last night and was amazed by that awesome cloud it left behind. I was getting on the freeway when I saw an oddly bright red dot in the sky and then a line of fire as in the boosters were pushing that rocket... then it looked like a comet the next second. This is one of the most memorable things I've ever seen that I won't forget! Really made my day a whole lot better.

# SpaceX SAOCOM 1A Launch & RTLS!

<https://youtu.be/oOeGp2wLjos>

- Ergzay == Awesome! I wish you had more dynamic range on that camera. **Tons of details in the flame plume** that didn't get shown in this video.
- K Space Academy == Yeah, I'm always learning and it's hard to practice. Probably more the fault of the operator than the camera! And to get direct line of sight to the pad at 5 miles, I had to be down in the marine layer myself, so I fought it for a little longer. Really rough to get through 5 miles of Vandy humidity!
- MVrockersPS3 == Considering the normal amount of fog we got pretty lucky. The bit of haze actually really enhanced the orange glow from the flames. This was a pretty amazing launch to see for my first one.



# SpaceX SAOCOM 1A Launch & RTLS! #2

- Stephen McLendon == THERE WAS NO FOG AT ALL THAT NIGHT. That was local haze at the beach, if any. ABSOLUTELY CLEAR DAY AND NIGHT!!! I was there. I saw it all from N of VAFB looking up the tail-end. The engines shut down at 'Maximum Dynamic Pressure'. The blue light bursts are cold nitrogen adjustment bursts on the booster. The final burn is called the back-burn, just before landing. You should learn the correct terminology from previous SpaceX launches and 1st stage (booster) re-entry and landing before becoming a reporter. Hope this helps.
- kimmer6 == Thanks for an awesome video. I drove the 250 miles to Pismo Beach to watch this from the boardwalk by the beach house on stilts. We were not disappointed. That separation plume with 2 bright objects was insane! Then the orientation jets were like nothing we ever saw in the sky. Then to see the rocket backing down like Buck Rogers was fantastic. The sonic boom came about 2 minutes later as we were walking back to the car. The marine layer made a huge hemisphere of orange light after Stage 1 went below the mountain on the North edge of Vandenburg. Your video and commentary is amazing and appreciated.
- Austin Steenman == Das' train of thought talking perfectly captures what me and my friend were going on about while we stood practically UNDERNEATH the rocket on Ocean Ave. What a privilege, what a rush, what an amazing night for space enthusiasts!

# Falcon9 technical discussion

<https://youtu.be/sEaTe38-l4Y>

Chemist4271 == Ambient Morality thankyou, yes I was pretty sure that I have read many a time on Reddit that the helium is used for engine startup on not just Merlins but just about every liquid engine I can think of. Although I hadn't even thought of the gas generator exhaust from the second stage as a culprit for the pre ignition plumage, from watching videos of Merlin 1D firing on the test stand, it seems like the helium purge that flows out of the nozzle precedes the igniting of the gas generator but the Helium spin up probably runs simultaneously, just a guess. That suggests that Helium gas IS capable of creating the Twilight phenomenon even though its physical properties assure us it is staying in a gaseous diatomic form (no freezing or liquifying and no chemical bonding).

# SpaceX Falcon 9 SAOCOM 1A Launch in 8K

<https://youtu.be/xNUHp-Df9t0> [Alex Kiritz](#)

- Destructor1701 == REGARDING COLORS -- You're pretty spot on. You're seeing differing amounts of atmosphere (all the way down to basically no atmosphere) filtering the light illuminating the exhaust trail as it ascends out of the shadow of Earth (aka night). There's also some refraction going on in the big cloud dispersed by the opposing Merlin burns during boostback. The differing colours of the actual flame and the shock front between the rockets during boostback are down to the chemistry and physics of combustion as the rocket ascends through lower and lower atmospheric oxygenation and pressures, and then the artificial pressurisation and recombination of unburnt fuel and oxygen when the rockets fire against one another. ... By all [witness] accounts it looked exactly like this, covering a maybe 15-20° patch of the sky and traversing from North to South.

Sai Ram Ganti  
Published on Oct 7, 2018  
Oct 7th, video shot from  
Nikon D7200 200mm F4  
Location: Inspiration Point,  
Newport Beach. \*\*This  
video is copyrighted\*\*

**JO: REMARKABLY  
EXPERT DISCUSSIONS  
OF 'ROCKET SCIENCE'  
INTERSPERSED WITH  
OFF-THE-WALL TALK**

## SpaceX Falcon 9 launch from Vandenberg | Incredible views



<https://youtu.be/sEaTe38-l4Y>

10/07/2018

JO: NOTE coincidence of a/c passing

SpaceX First California Stage1 RTLS

86



# 1 Plumes at <https://youtu.be/sEaTe38-l4Y>

- Chemist4271 == Many people ask about **those waves that shoot out like rings**. Those are puffs of cold nitrogen gas from the Reaction Control System distributed over the rocket. They are used to maintain the orientation of the rocket and to position the rocket for re-entry. Now, for the people who like the nitty gritty, these are called Draco cold gas thrusters and they produce about 200 pounds of force each, with many thrusters clustered together in groups at the top and bottom of the stage. The thrusters are essentially entirely 3D printed by SpaceX and small enough to pick up and hold. Inside the Liquid Oxygen tank there are high pressure Nitrogen bottles to store the gas and metal tubes to split the gas up and divert some to each thruster. At the thruster is a valve and a nozzle. When a DC electric current is applied to the valve, it's snaps open and shut quickly expelling a consistent jet of dense Nitrogen gas giving the rocket a small push. If you were to sit in a space craft while these where firing it would sound something like smacking a metal trash can with a stick. [comment - Draco burns Nitrogen Tetroxide and Monomethylhydrazine. ] my bad, you are correct. The Draco thrusters are used only on the Dragon 1 and 2 spacecraft . The Falcon 9 booster simply uses cold gas thrusters.
- Ambient morality // **Helium is used to spin turbopumps prior to engine ignition**, otherwise way too much fuel and oxidizer would build up behind the pumps and the engine would probably blow up. You can see this on every second stage engine start where a large white cloud blows out of the nozzle before the green flash of TEA-TEB starting combustion in the gas generator and then main combustion chamber. There's helium tanks close to the engines for supply, it's not from the tank COPVs. We don't know if the first stage engines have separate helium tanks or if the octaweb supplies multiple engines with helium; we know that there's helium tanks nested right up by the thrust structure of MVac for helium supply.

## 2 Plumes at <https://youtu.be/sEaTe38-l4Y>

- sweinberger == The helium is **not used to start the engine but to pressurize the fuel and oxidizer tanks**. For lighting the engines they use TEA-TEB (two chemicals which spontaneously ignite on contact with the oxygen; btw. that's one of the reasons why **they prime the engines with oxygen before launch**, so the TEA-TEB has something to react with - apart from gently pre-cooling the LOX piping of course). What you see glowing on the side of the Merlin engine is the exhaust port of the gas generator that burns part of the fuel/oxidizer to drive the engine's turbo pump. On the sea level Merlin engines this is the secondary flame which can be seen next to the main engine nozzle, but in the vacuum it doesn't burn in a flame but rather a glow - just like the engine itself. **After the final SECO the stage will vent all remaining oxidizer - this produces a very different looking flow of liquid oxygen**, which - just like the nitrogen from the RCS thrusters - immediately freezes when it expands into the vacuum (you can see lots of chunks of ice at that time).

# Plumes 3

- Hopi Ng == We Have footage of the multiple UFOs sighted around those launches. And a better explanation for what the weird light show is all about.
- SimpleQuestion CanUAnswer == I honestly sit here and can't figure out what is sadder. That Nasa and Space X and the government lie to the people on such a large scale or that you guys just blindly follow and believe anything you are told by your "authority " and officials" . Do you guys ever question anything or is every official version true to you guys? Have a good day humans and humanity and hopefully some of you wake up .
- ace toxic == Thank God for one sane comment. Whatever this thing is, it is not a simple tube 8n the shape of a rocket launching into space. The part that falls off of the main ballistic missile is doing something that has no purpose if it is a rocket as explained. This is a purposeful light show under the guise of a SpaceX launch. **If rockets could put on these shows we would have been seeing them for decades.** The bs about them **catching sunlight over the horizon** I'm not buying at all.
- Lisa Thomas == SpaceX uses IRIDIUM--- not nitrogen or oxygen.. besides you can check out other nitrogen launched objects and it looks NOTHING like this... no spirals... anyone else notice all the light orbs in the trail? i'm pretty sure no plane is going to go play in it's contrail... so what are the moving lights eh? check them out @ [1:11](#)--- they're not stars... **why would we be able to see them in the contrail when the rest of the sky is black?** question everything folks... this is not what you are being told it is.. looks more like they're figuring out **how to open portals**, which would be the only logical way to travel through space- look up spiral over norway 2009....

# Rational descriptions

<https://www.youtube.com/watch?v=83LWpjFfnKQ&t=100s>

Laurie Flood == Where were you when you video taped this? In what direction was the spacecraft? I was in Alpine County, CA in Hope Valley. Like your video, I could see that **the plume came from 5 locations on the craft and was entirely symmetrical**. It was to the west of me, **but more overhead**, especially at first, than your location. This did not look like anything out of Vandenberg. It landed to the west. It was clear that the plume was helping the craft land softly and slowly. There was no explosion, nor lights when it landed. Like in your video, it was clear that the lights all dimmed shortly before landing.

- =====
- <https://www.youtube.com/watch?v=JOHhUYmGWDw>
- Pooja Thorat == Don't know what was this but some unusual sight we watched in the sky while driving back from napa valley just now. Date Oct 7th time 7.30pm It was a bright red light in the Beginning then it got split into two white bright lights then it lasted in the sky for almost 15 minutes then moved in one direction fast and totally disappeared. Then I got to know that it was SpaceX Falcon Launch.



SpaceX SAOCCOM 1A Falcon 9 Rocket Launch Seen  
From San Diego 5000 views

<https://www.youtube.com/watch?v=rN8gceUElqo>

# SpaceX's Spectacular Twilight Launch of SAOCOM

<https://youtu.be/4G6GLhleZ9w>

- Scott Manley

# SpaceX's Spectacular Twilight Launch of SAOCOM

<https://www.youtube.com/watch?v=4G6GLhleZ9w>

# What were those crazy lights in SoCal?!?!?

<https://youtu.be/aPznHcZEuQ4>

Everyday Astronaut 44,000 views

There were some CRAZY lights and giant smoke cloud west of LA on October 7th, 2018... what were they?!? Did you see them? Well, luckily, us rocket nerds were patiently waiting for this launch and even knew it'd have this amazing phenomena!

- Swordblaster == I was watching it on the live stream. First thought, wow, those puffs are genuinely pretty illuminated like that. Second thought, **some people will freak out. I kinda understand it, not everyone follows launches like us nerds. :)**
- Dang Itshere == Florida: oh look what a beautiful rocket that is California: OMGASH THATS THE BLUBELL PROJECKT ITS GOVERNMENT CONSPIRACY!!! NASA IS LYING ITS AN ALIEN EARTH IS FLAAAT!!!!
- Mark Orcutt == Thank you for focusing on the 1st stage re-entry, my family witnessed the launch in SoCal. **The flame is so much different from the other rockets I've witnessed throughout my 50+ years in SoCal.**
- lextacy2008 == this should be common knowledge by now. im sick of crappy dumbhead brains
- Hanniffy Dinn == **All the UFO YouTubers are going crazy.** Pisses me off they don't even look at launch schedules. Idiots.
- Lensflare Deviant == Of course, it's their bread and butter. All the loonies will be watching it's a great scheme for making money. You don't have to be credible or honest and your audience is already hardwired to believe.



# CONCLUSIONS

- EXTRAORDINARY SKY SPECTACLE BROUGHT OUT WELL-INFORMED ENTHUSIASTS AND STARTLED NEWBIES....
  - VIDEO AND IMAGERY MOST SENSATIONAL EVER
  - GROUND IMAGERY PROMISES TO PROVIDE COMPLEMENTARY PERFORMANCE INSIGHTS TO TELEMETRY AND ONBOARD VIDEO
  - ALLOWED REFINEMENT OF BASIC IMAGE-ANALYSIS TOOLS
  - ALLOWED ENHANCEMENT OF OBSERVER-SEARCH TECHNIQUES
  - INTERNET BUZZ ENABLED LOCATION OF IMPORTANT WITNESSES AND VIDEOS INCLUDING UNEXPECTED OBSERVERS OF DEORBIT BURN
  - BROADENED APPRECIATION OF SOCIAL/CULTURAL IMPACT OF THESE APPARITIONS, NOT ALL OF THEM BENEFICIAL
- 
- FUTURE TASKS

# APPENDIX 1 – ADDITIONAL OBSERVER COMMENTS


- NOTE: AN ENTIRELY SEPARATE REPORT IS DEVOTED TO WIDER SAMPLING AND DEEPER ANALYSIS

<https://youtu.be/YLgOSd-HA6k>



# Missile? Space shuttle launch?

<https://youtu.be/cZb-6zZXZg0>

- kuro == I have a video of it, but me and my aunt **were like freaking out** lol. It was hella weird.
- shark bait tuber == I saw that when me and my friends were playing outside am I swear I told my friend “ **do u remember the rocket launch last year** and he said yay and when I went inside my house to get water my friend said look I the middle happen and we started crying
- Nukebones13 Nukebones13 == Yes I was playing in front of my and my neighbors house with my friend/neighbor sitting there talking when I said look it was like a rocket  going up with a trail of blazing fire and **exploded into colors** I got a video and picture on it. it was crazy and interesting I'm glad I experience it
- yes sir == All of a sudden it **disappeared like it shut off** or something



## Part 2 WEIRD, STRANGE, & BRIGHT OBJECT

[https://www.youtube.com/watch?v=QQBiDSKv\\_YI](https://www.youtube.com/watch?v=QQBiDSKv_YI)

- skiwealdo == I seen this over by Merced CA at about 7:25 pm off of HW140 heading toward Gustine. I **pulled over off the side of the road** to observe it and thinking **what the heck** is this, going to slow to be meteor! It seem to **vaporize in the air leaving a cloud of dust expanding with a rainbow effect**, leaving a **hot white cluster** to fall back down and disappear, but **started a red hot ball of flame**, was very interesting to see!!!
- HotChocolateYT == My sister saw this and showed me, so we went outside and we saw it and as it was fading away **we saw that it had stopped making that trail or whatever that glow was behind it** and it started to move faster than it was before (yes it was moving you just had to look) but that's my story about it

<https://www.youtube.com/watch?v=1Qhl2UhFjEE>

- Jane do == There was like **a color of the fire and then the lights opening and closing**
- Im Bored47605 == It looked way better from where i sww it. It seperated into 2 pieces and then created a bright spot in the sky with something that looked like **a fire rainbow**
- YoAhGirlRektYou ! == yes I saw the same thing where it looked like a **fire ball falling down**
- Hey LorenCristy == We are currently traveling too and it looked like a rip in the galaxy! It **got bigger and it had like this rainbow color!** But like **a flashlight on the middle** lol

Nov 7 2015 comments added oct 7 2018

<https://www.youtube.com/watch?v=FyWccT3E904>

- CRAZEmations Yt == Just happened today :))
- TheEnd == I just saw this tonight 10/7/18 in San Diego. I looked up thought I was seeing **the moon shining its light like a Spot Light**. I never seen anything like it. I took pictures. I went online to find anything scheduled tonight for astronomical events. I'm convinced it was a military rocket. It appears in the sky like **the moon that is directly shining its light in a specific area like a flashlight**
- Brianna Banana == I saw this right now! It's 2018 in LA I'm confused it's beautiful tho but **it disappeared so it can't be a rocket**
- Lin lin == Im here cause i saw one today and its very bright and u could see **waves**
- ICEY Carloz == I saw this exact same thing and **disappeared on the clouds**

# Strange Lights over Oxnard, California

<https://youtu.be/ImpTjCtu100?list=PL2AfeT-PQ5siKBcwjJ5Nt4tphUM00SPKc>

- Whatthenabe = Oct 7, 2018 = My family and I were eating dinner when my dad walked in the house telling us there's **strange lights** in the sky. 🙄
- imjee9 == I saw the same thing in vista, ca . **lights looked closer and stationary**, i did see the 1 pulsating. I was at a gas station, went inside to pay and came back out and they where gone
- Couch gaming news == I saw it till the end **It was falling then the lights went off** .... It looked light **a star shooting light** To me i think it was a projection shooting light that formed a huge cloud that was **rainbow colorish**. After a while the light started to dim and fade then it looked like it was falling. Probably governments doing



# UFO over Los Angeles California? No, just Space X

<https://youtu.be/VUxkj3NhEK0> 1200 views

- Pepin Health == Published on Oct 7, 2018 == At 7:26 pm on October 7, 2018 I saw this above Long Beach, California. **This is the weirdest thing I ever saw in the sky.** I was thinking aliens for about an hour until I found out it was the Space X Falcon 9 rocket launch from Vandenberg Air Force Base. Still, it was very cool to witness.
- Sagiri Izumi == I saw this. **The 2 lights faced each other and there were pulse beams.** Then one part blew up, the craft turned a 180 and flew over the ocean. It wasn't a rocket landing at Vandenberg in Santa Barbara in Lompoc. This is a cover story. After this happened **2 helicopters started circling and 3 lights appeared in the sky and vanished.** ... My guess is **the US shot down a Chinese built fighter with a Russian pilot that has been running espionage flights.** That's why they closed those observatories down for awhile. They knew when this fighter has been in our air space and **used the Falcon 9 launch as a cover story.** Magically, since this event, China's stocks and tech stocks tanked. Why? Their fighter got shot down.

# Pepin health 2

- Terry Silverstein == Space x? Really out of LB or SoCal? Think! There's no launch site in SoCal. Nearest one is at Vandenberg AFB northern California by San Luis Obispo, where I've watched rockets launch when? Day time... **those are shot straight up - none if this side-to-side, east west stuff like tonight**... I saw it to.
- Mc Poopypants == Agreed this was huge, not that it wasn't a rocket, I wholly believe it was, just never in that direction and that intense. Space X doesn't have its own site in CA.
- Duke The VHS Wizard == It was a ufo, not a rocket.
- Mc Poopypants == Why the hell is it so bright? I have seen rockets launch but **never anything even close to this**. .... Sun set at 6:28 this was around 7:30. Also this was seen from Mexico to Idaho. Why the hell is it **that damn bright**.
- Sagiri Izumi == Look at this other video. **Was this a Falcon 9 rocket too?** And these sightings have been reported more and more since the announcement of Space Force. <https://www.youtube.com/watch?v=XWTqqletdps> [JO: 2004 police helicopter video of a flare balloon dropping sparks]

Last time [dec 22, 2017]

<https://www.youtube.com/watch?v=ctGuS2MylAo>

- Moriah&Mady == That was right over our house
- Mas21Savage == Bruh now you F\*\*\*ED THAT NOT A MISSILE THATS A UFO **BECAUSE THE PLANES UP THERE HAVE VIDS OF IT**
- Kodi Bancs == First it was said it was a missile launch test "officially" then it is changed to Space X "officially" my question **is where is the footage from the helicopter that looked like it was following it?**
- Kobe Egypt == it's not a missile but if that makes y'all feel better y'all believe anything the government tells **y'all slow ass people**
- CV10K == DirtyBrownwt I'm saying maybe the livestream was a cover up. To make people believe it was a rocket instead of a UFO.
- Just Another Minority == You guys know better than to believe the bs on the news
- ulf fy == This light thing **is right on top of my house** but it's a big cloud with light shining through it
- <https://www.youtube.com/watch?v=ctGuS2MylAo>

Last time [dec 22, 2017] 2

<https://www.youtube.com/watch?v=ctGuS2MylAo>

- Marinna Freund I honestly wouldn't doubt if it wasn't something else(UFO)... **I don't think a rocket is that bright** and for there to be more than one in the air because it would be a risk of crashing and Why do you think there are top secret military bases that citizens can't even be near and the fact that people always try and come up with lame reasons why stuff can't be true and alot of people have had exspiriences and people just write it off as nothing bc there afraid.... Thos are possible key points why and What it could be.. I mean nothings impossible. ["rocket"] well maybe I just Don't know ..I mean this time I kinda believe it was A rocket....but usually when they are going to launch something...**they inform people** before it happens BEFORE PEOPLE FREAK OUT, for example, any Launches and meteor showers ETC!!! so maybe...maybe not



# SpaceX: “SAOCOM 1A Mission” 1,200,000 views [https://youtu.be/vr\\_C6LQ7mHc](https://youtu.be/vr_C6LQ7mHc)

- Uematscrates == Saw this while at work at a concert. I thought it was a fuc4ing supernova that happened 500 million years ago a zillion miles away in whos image barely reached us on that day...hahaha I should watch the news more
- Jonah Billings == Saw this driving home out of the corner of my eye, **nearly crashed the car**. Then I realized what it was and pulled the car over. One of the coolest things I have ever seen.
- SD Bomeddy CLASH OF CLANS == I thought it was aliens haha. Seen it in the dark mojave desert on hwy58 west. So **it was very bright and looked like a nebula**. This vid is great but doesnt compare to what i seen. I posted on my channel. Warning i was freaking out. I captured right after the seperation. All the way to the landing cutoff at low altitude.
- Margaret Kluz == We saw the glorious Falcon light up the sky from Mount Soledad in San Diego! People were watching the live broadcast on their phones simultaneously. **Crowd went WILD upon confirmation of F9's successful landing** at 24:56.

# “SAOCOM 1A Mission” 2

- Jonathan Collins == Holy \$hit. I had no idea this was going on tonight. Went outside to get something out of my truck and saw this **light in the sky**. I thought for sure I was seeing a ufo. It slowly **moved up in the sky** with an obvious direction then **it turned around the other way towards the earth..**
- Kurtis Rader == **This will be the cause of a lot of "UFO" reports**. I was walking my dogs in Santa Clara, CA (a few hundred miles north of the launch site) when this launch occurred. When I noticed it other people I encountered at the same time talked about UFOs and planets like Mars being an explanation for what they were observing. I was perplexed for a few seconds until I recognized the boosters descending, and the continued ascent of the main element, made me realize I was observing a rocket launch.
- A Table == I actually saw this **fly over my house** and **eject some huge flames**, SpaceX gave a warning saying it could possibly do that. It was really beautiful. It looked like aurora borealis.

# UFO 2 October 7, 2018

<https://www.youtube.com/watch?v=Je8gJLTXEUc>

Flip Jupiter == UFO 2 October 7, 2018. Tarzana, California. Unfortunately I couldn't zoom much to see the right side. It looked like a shooting star on the right side. As if the lights on the left shot it down. Strange and cool! I don't think it's a UFO, but I don't know what it is. It lasted about 4 minutes.

H GM == **Diamond Shape. HUGE. Slowly DESCENDED 20-30km into mexican territory just south of Santa Teresa NM.** Air Force went crazy **patrolling air space** border land. ["space X rocket launch"] Nah. And if so, let them know their junk fallen down about 20-30 km south the border of Santa Teresa, NM. So. Total fail

Janice Zimmerman == I saw saw the same thing tonight at about 8:15 p.m. or so in Wildomar CA (about 15 miles or so south of Temecula). I don't have the capacity to download the photos to Youtube but it was identical viewpoint and distance and light shape as your video. **It was stationary for about five minutes then slowly faded then disappeared just like your video.** Very strange. It was not similar to a plane or helicopter, at all..... I didn't think to take video because I was so surprised. Several others in the Albertson's parking lot saw it, too and were incredulous.

# Strange lights above Inglewood/Lennox

<https://www.youtube.com/watch?v=bAysbEp3eC8>

- Liz G == Oct 7, 2018, Was walking home and saw this **weird lights and ripples** in the sky around 7:20 PM in the Inglewood/Lennox area in Los Angeles.
- Kevin Alderson == Saw it in Pomona, CA skies. **Four long tails** of (like WHAT E-V-E-R!) flowing out the backside of the brilliant light. At one moment, it was almost stilled, then, just-like-a-super-energized-rocket, **it turned South Westerely** and dis-appeared within moments. And I swear, I only had one glass of Chardonnay for dinner.
- Travis Peterson == i saw it in red bluff CA it looked like a comet as it had what appeared like **multiple tails facing multiple directions** then it broke up... weird
- Kathi Edwards == CLEAR SKIES...**DIDNT MOVE...just the glow rotated**...WOW!
- LIVE&LOVE&LAUGH == I saw it in Woodland Hills CA. ...What ever it was the whole process was amazing. One piece of the light disappeared and other piece, which was very bright traveled the sky very very fast.
- cody quattlebaum == I saw it in Penn valley Ca. There was also a orange ball falling from the sky **that looked like a control decend**.
- Chris Parkhurst == ...There were **parts that came off and glowed for a bit**, like the stages of a rocket. And there was a **haze trailing behind it in a 'V' shape**, like rocket exhaust. It's strange though that we could see it 300 miles apart from each other...



# LIGHTS AND BOOM NOISES IN THE CALIFORNIA SKY TODAY!!!

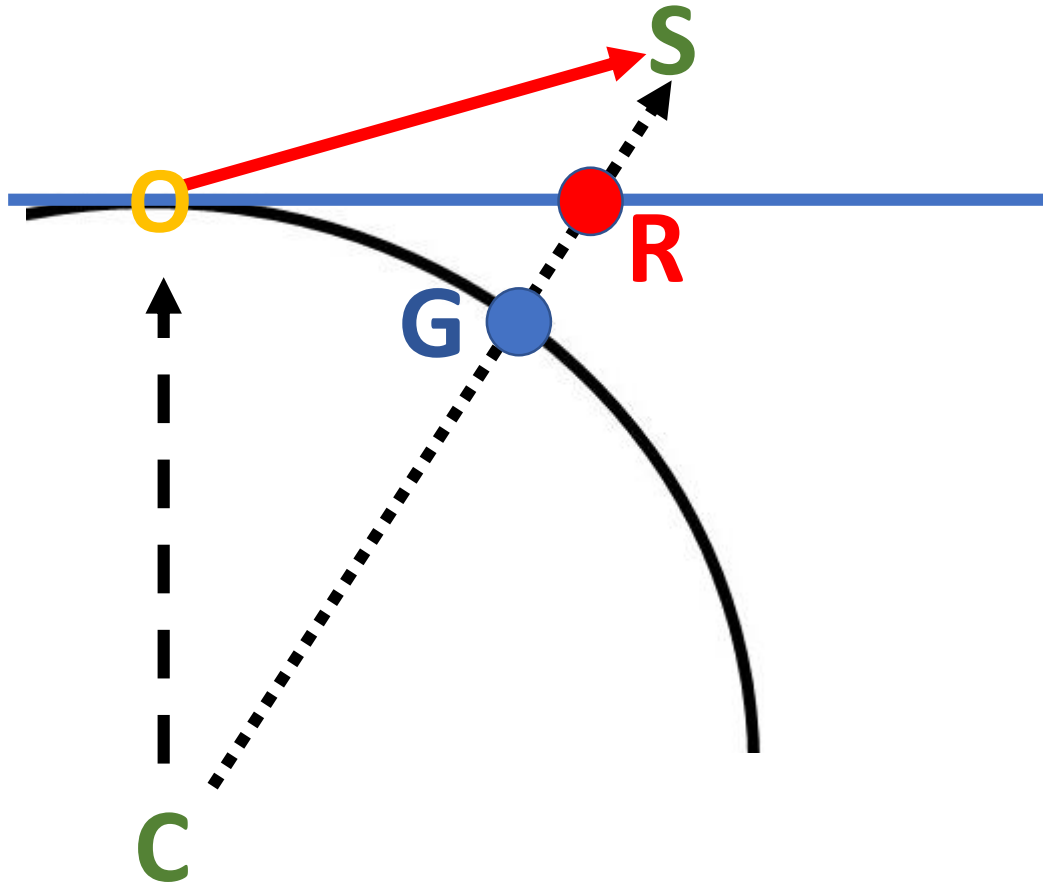
RapTheNews // 9000 views

- U S. == I saw the whole thing it was **two lights that came together then it was like an explosion**, I saw a triangler space image volcano looking with **red at the bottom of it and smoke around it** looked kinda a sign.. because then there was a light moving as **it was flashing at it** then it was fading as it left
- Denise Stark == NASholes are going to deceive the main public, but for **those who's eyes and ears are open**, they are not fooling anyone.
- Greg DeBacker == If its a rocket **why can people see it in different states?**
- Imma Ware == I saw it , **looked like a colorful firework/projectile that disappeared, then spread into white light, then colorful again** ... very weird!

<https://www.youtube.com/watch?v=bwllt9M7kM8>

# Appendix 2    observational math

# Altitude versus elevation angle



KNOWN QUANTITIES:

ELEVATION ANGLE 'SOR'

GROUND RANGE ARC 'OG'

EARTH RADIUS 'CO' AND 'CG'

UNKNOWN - OBJECT ALT 'GS'

COMPUTE ANGLE OCS =  $360 \times OG / [2\pi \times CO]$

COMPUTE ANGLE COS =  $90 + SOR$

COMPUTE ANGLE CSO =  $180 - [COS + OCS]$

Sine [COS]/CS = Sine [CSO]/CO [LAW OF SINES]

SOLVE FOR CS

GS = CS - CG

SIMILARLY, given known distance and alt, solve for elevation  
Or given known elevation and altitude, solve for distance

# HOW HIGH WOULD AN OBJECT HAVE TO BE TO STILL BE SUNLIT?

For 'theta' [the depression angle of the sun from the observer's location] the shadow height is provided by this equation:

$$\text{Radius} \times (1/\cos \theta - 1)$$

**THE TRIGONOMETRY PROBLEM IS GIVEN DEPRESSION ANGLE 'PXT' & DESIRED LOCATION [POINT BELOW OBJECT], 'X', HOW HIGH ABOVE 'X' DOES EARTH'S SHADOW EXTEND? SOLVE FOR 'XS' USING SIMILAR TRIANGLES & LAW OF SINES.**

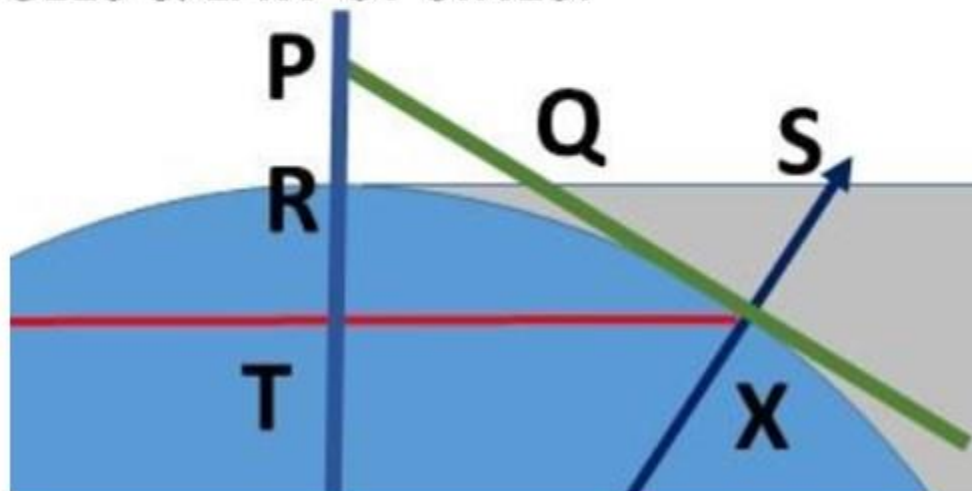
ATMOSPHERIC REFRACTION  
WILL CREATE SOME SPILLOVER  
SPREAD OF SUNLIGHT [ $<1$  deg],  
LOWERING THE ILLUMINATED  
ZONE SOMEWHAT.

Radius = 6371 km

## TYPICAL 'SHADOW HEIGHT'

SUN DEPRESSION ANGLE	CALCULATED ALTITUDE
5.0°	15 km
10.0°	79 km
15.0°	195 km
20.0°	367 km
25.0°	603 km
30.0°	913 km
35.0°	1314 km
40.0°	1827 km

**"RULE OF THUMB"  
"GRAHN'S LAW"  
SHADOW HEIGHT  
[IN KILOMETERS] IS  
APPROXIMATELY  
SUN DEPRESSION  
ANGLE [degrees]  
SQUARED IN RANGE  
OF INTEREST**





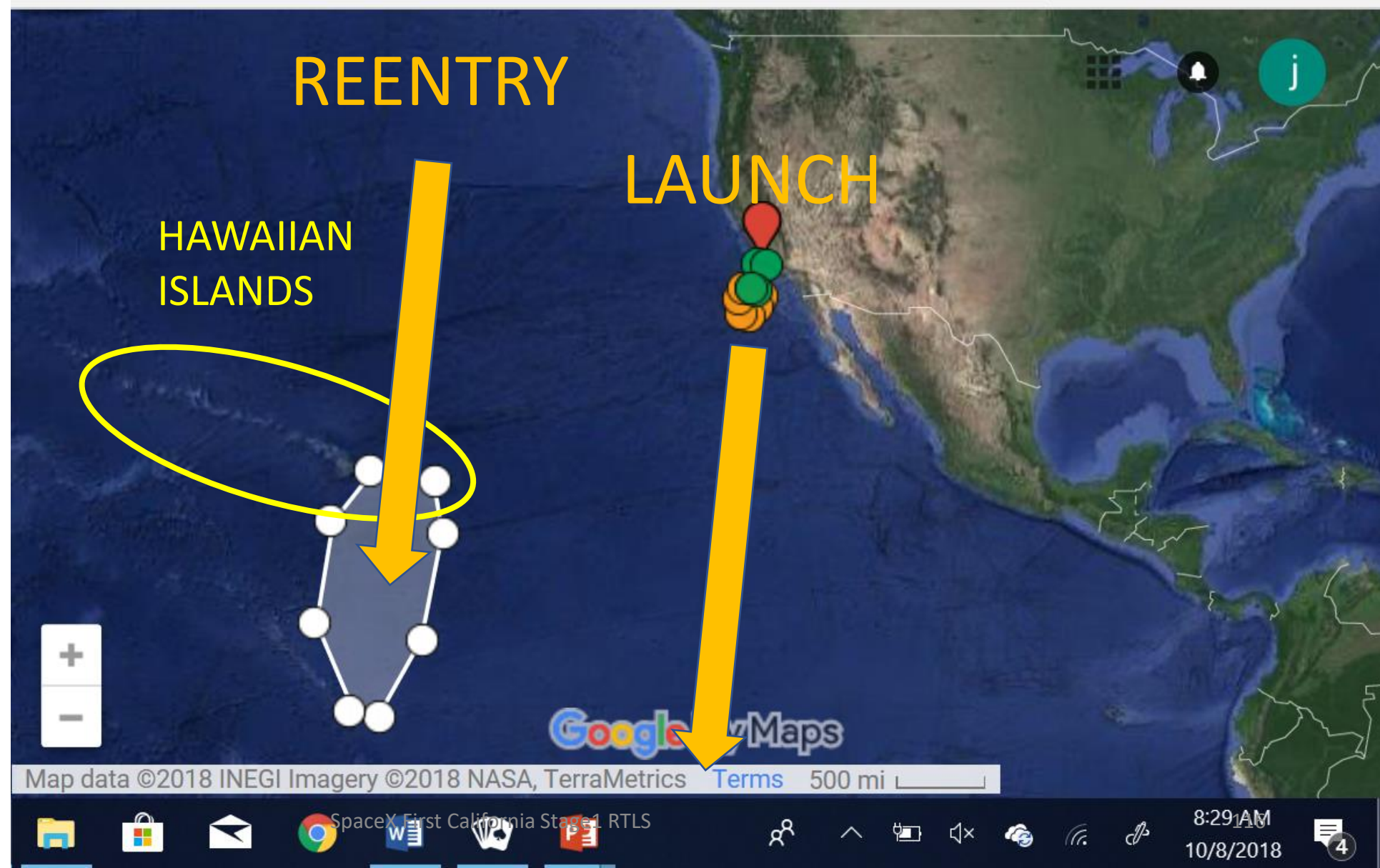
# Appendix 3 -- Deorbit burn observations

- Entirely different report

Stage-2 launches west of south, enters retrograde polar orbit, deploys satellite, then performs deorbit burn on opposite side of Earth, reenters SE of Hawaii

[SAOCOM-1A Launch](#)

[Hazard Area](#) based on issued NOTMAR, valid for Oct 07 to Oct 10 UTC. Stage2 Reentry Debris Area south of Hawaii active on the second orbit between 04:07 to 04:22 UTC. [late-afternoon local time]



# Appendix 4 Analogous Previous Launch Videos

- text

# COMPARITIVE PREVIOUS LAUNCHES

- Nov 7, 2015 trident plus comments
- <https://www.youtube.com/watch?v=CiOKaOJDnj4>
- This is a Minotaur Rocket Launched from Vandenberg AFB on 2005-09-23 after sunset.  
<https://www.youtube.com/watch?v=7tNFWkdCvFs>
- Minuteman III Rocket Launch 10/14/2002
- <https://www.youtube.com/watch?v=gFKcMd8AME0>



# Further reading

- X
- X
- X
- X

# Appendix 5    ADDITIONAL VIDEOS

- X
- X
- check out [Reddit.Com/r/SpaceX](https://www.reddit.com/r/SpaceX)

# LIVE VOICE COMMENTS

- SPACE X LAUNCHING ROCKET “and my dumb brother being stupid\_”
- <https://www.youtube.com/watch?v=I0i0WLWsl> 8
- Jesse Watson, Imperial Sand Dunes, CA
- <https://www.youtube.com/watch?v=tXv0KehKJ-w&t=51s>
- Time lapse above clouds, amazing depth
- <https://www.youtube.com/watch?v=1Tx6jrvCCd4>
- Tampa dawn time lapse  
<https://www.youtube.com/watch?v=gOpQVlp5pOQ>

# SpaceX launch from airplane

- Remarkable view from westbound Iberia airliner in mid-Atlantic of SpaceX vehicle heading for orbit while first stage has turned around and heading for sea platform! I've seen LOTS of videos of spectacular backlit launch plumes but never seen TWO.  
Published on Mar 11, 2016
- "SpaceX SES9 Launch, video by Iberia crew flying from Madrid to Habana. 3/5/2016 3:35Z. You can see the first stage returning to earth as a white point in the middle of the trail."
- 
- 
- 
- <https://www.youtube.com/watch?v=rDZKFo4X5il>
- Published on Mar 11, 2016
- SpaceX SES9 Launch, video by Iberia crew flying from Madrid to Habana. 3/5/2016 [3:35Z](#). You can see the first stage returning to earth as a white point in the middle of the trail.