



[brightness enhanced]

June 15, 2014

Another Russian rocket spotted by chance from the International Space Station

James Oberg // REV C April 6, 2015

[NEWS ITEM: Alexander Gerst](#), a European Space Agency Astronaut currently aboard the International Space Station, Tweeted an impressive set of photos showing the ascending Soyuz. Gerst reported seeing the launcher at 17:25 UTC, roughly eight to nine minutes after launch - right around the time of third stage shutdown and the separation of Fregat.

"Looks like something launched into space yesterday UTC 17:25 over Russia, possibly a GLONASS Sat from Plesetsk," **[Gerst Tweeted](#)**. "Spooky in a way, brilliant in view but without the slightest sound."



Rocket Spotting From Space

- Dozens of rocket launchings have been observed [and often imaged] by astronauts in orbit
- Nighttime launchings usually appear as glaring point of light casting diffuse illumination on earth surface
- Daytime launchings appear as climbing plume trail against bright Earth, rarely silhouetted by black space
- Scheduled visiting launchings occur on parallel path to orbiting vehicle [same orbital plane], along flight path
- RARELY, unique twilight illumination with observer in darkness creates spectacular backlighting of plume
- In 2013-4, TWO such unanticipated non-visiting launches were accidentally observed by crewmembers in cupola
- Soviet-era Mir and Salyut crewmembers MAY have similarly spotted a few such coincidental rocket launches
- Future ISS crews should be alerted to possible sightings

Earlier observed launches of ISS visiting vehicles

- 2013 March 29 and 2014 March 25
- <http://www.space.com/25201-soyuz-launch-photos-expedition-39.html>
<http://www.universetoday.com/101098/space-station-crew-captures-soyuz-launch-as-seen-from-orbit/>
<http://www.spaceref.com/news/viewsr.html?pid=43688>
- DIFFERENCE -- From Baykonur, directly into plane with ISS [hence, head-on viewing angle]
- SECOND BIG DIFFERENCE – These were in the middle of the night local time with no just-over-horizon sun back-lighting, so the only possible illumination is from propellant combustion

<http://www.space.com/25201-soyuz-launch-photos-expedition-39.html>



Astronaut Rick Mastracchio, aboard the International Space Station, tweeted this photo of the Soyuz rocket launching the Expedition 39 crew from Kazakhstan to the station on March 25, 2014 [21:17 gmt].
[sunset 14:05, sunrise 01:41]

Space Station Crew Captures Soyuz Launch, As Seen from Orbit

by Nancy Atkinson on March 29, 2013

<http://www.universetoday.com/101098/space-station-crew-captures-soyuz-launch-as-seen-from-orbit/>



Soyuz Rocket Launch – the moment of ignition, as seen from their target, the Space Station.

Credit: NASA/CSA/Chris Hadfield.

Photo: Soyuz TMA-08M Launch As Seen From Orbit

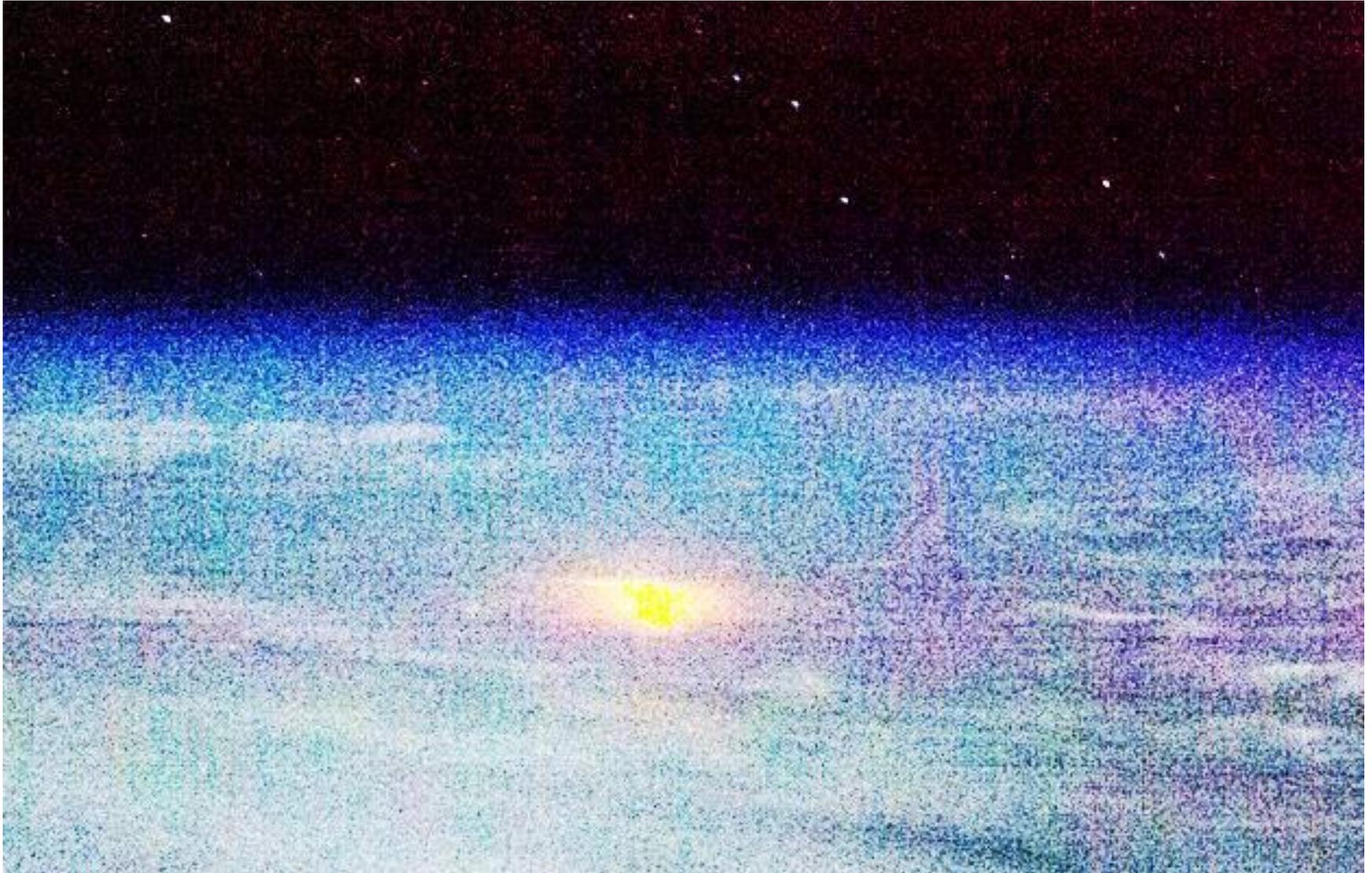
March 28, 2013 20:42 gmt [sunrise 01:35 gmt]

<http://www.spaceref.com/news/viewsr.html?pid=43688>



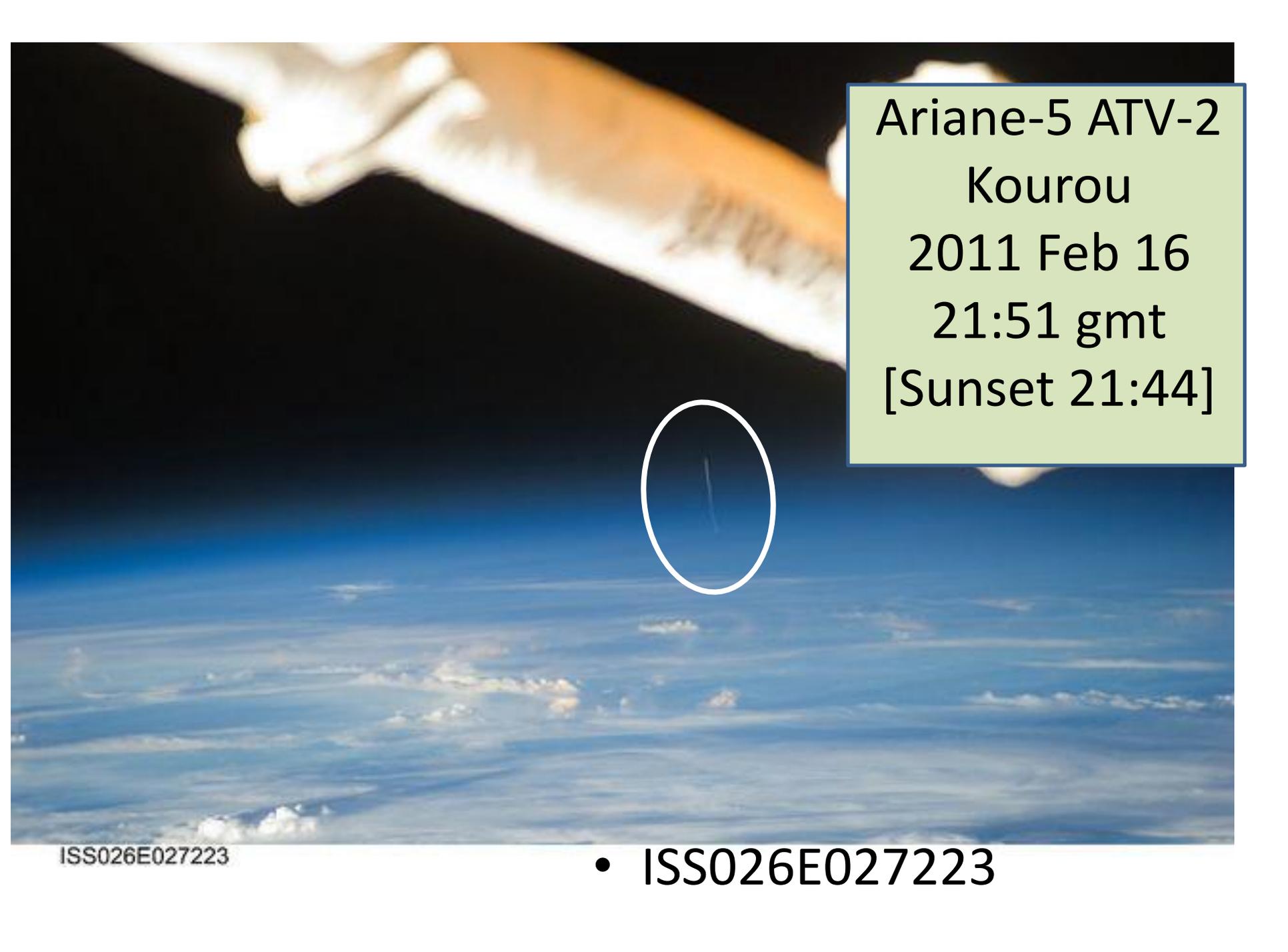
One of the Expedition 35 crew members aboard the Earth-orbiting International Space Station took this photo which was part of a series documenting the launch of the "other half" of the Expedition 35 crew. The Soyuz TMA-08M rocket launched from the Baikonur Cosmodrome in Kazakhstan on March 29, 2013 (Kazakh time) carrying Expedition 35 Soyuz Commander Pavel Vinogradov, NASA Flight Engineer Chris Cassidy and Russian Flight Engineer Alexander Misurkin to the International Space Station. Their Soyuz rocket launched at 2:43 a.m., March 29, local time, while it was still March 28 in GMT and USA time zones. ISS035-E-010313 (28 March 2013)

Brightness enhancement shows identifiable starfield



Progress M-22 launch,
2014 Feb 5 16:23 gmt
[sunset 12:58 gmt]

- Observed by Rick Mastracchio

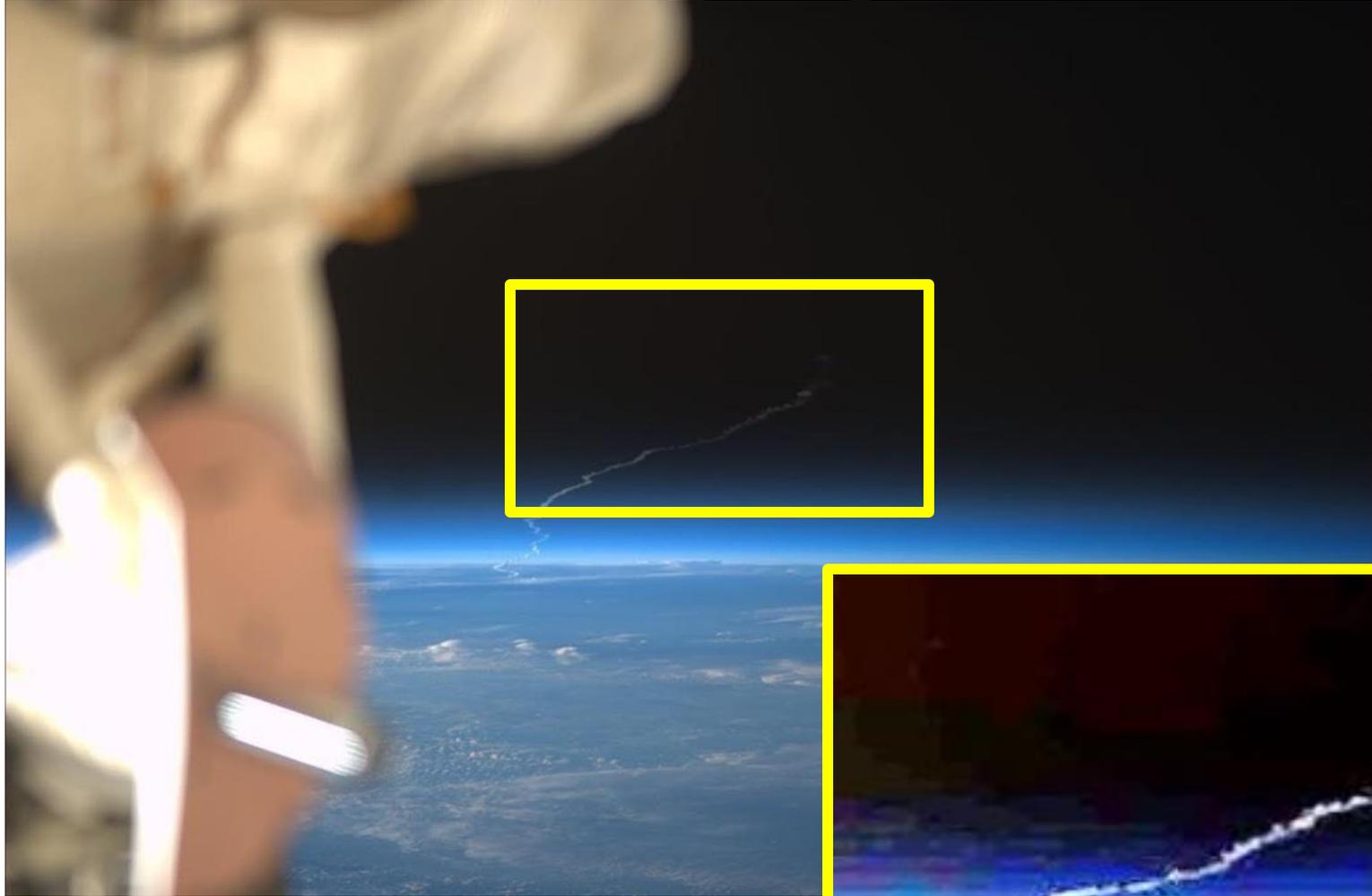


Ariane-5 ATV-2
Kourou
2011 Feb 16
21:51 gmt
[Sunset 21:44]

ISS026E027223

• ISS026E027223

Ariane 5 VA217 Launch, Kourou, 2014 Feb 6 21:30 gmt [sunset 21:42]



By Rick Mastracchio

Soyuz Launch, Baykonur
2012 Oct 23 10:51 gmt
[sunset 13:49 gmt]



Follo-on plume views possible
– seeking them now

Ascent plume, enhanced



Previous example of twilight illumination --

Luca Parmitano, October 10, 2013

Fortuitous ISS observation of 'Topol' ICBM test flight from Kapustin Yar.

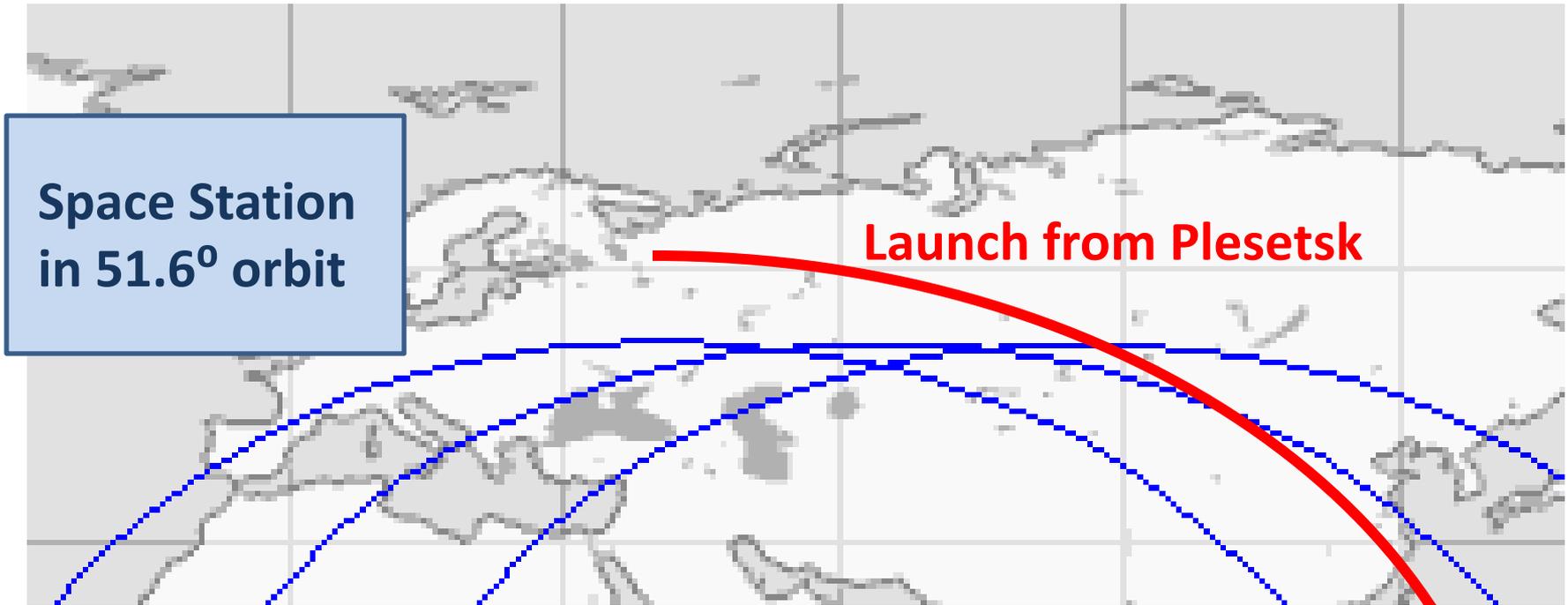
Two separate phases observed – first, initial ascent right on horizon, then brief gap [~ one minute] to summon crewmates to the cupola, then second phase showing post-third-stage shutdown and exhaust plume dispersal.



Second back-lit rocket plume accidentally observed from ISS

- June 15, 2014 observation of Russian ‘Glonass’ launch from Plesetsk space center, by ISS crewman Alexander Gerst [ESA].
- Ten images taken over 70 second interval, from cupola
- Same illumination conditions as October 10, 2013, observation of Topol ICBM launch from Kapustin Yar – plume sunlit, ISS dark
- No indications any Russian crewman observed either event
- Interpretation: Gerst caught final moments of third stage powered flight followed by flare of separation motors
- Ground videos and stills are consistent and overlapping, with specific odd visual phenomena [e.g. “headlights”] as well
- Analysis verified investigative techniques developed for October 2013 event, especially brightness/contrast manipulation
- By luck, author had briefed Gerst on October observation
- Both observations more awesome than earlier day/night views

Matching trajectories

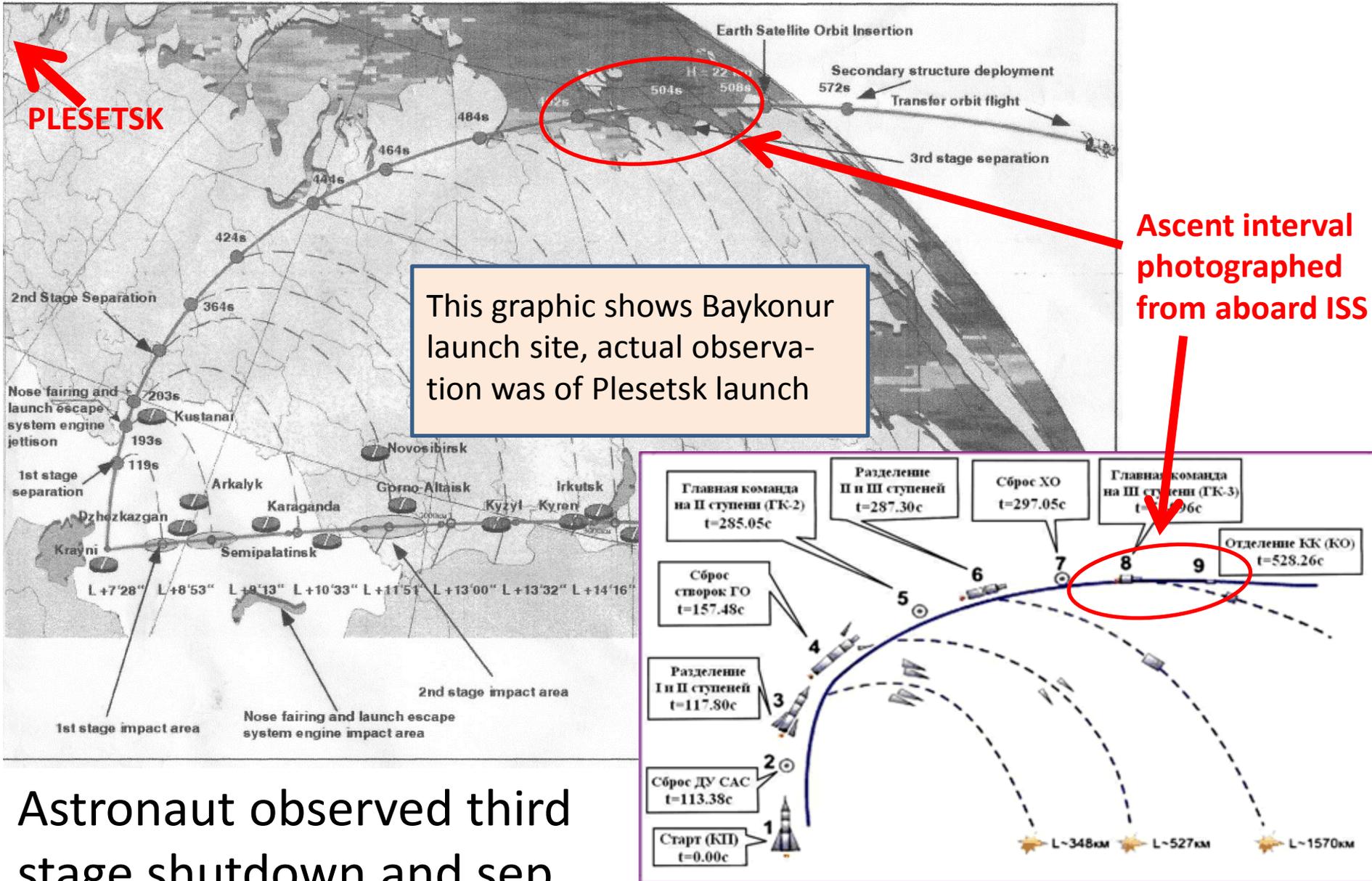


Precise launch time 2014-06-15 17:25:00

NOTE: Spectacular view due to special condition of back-sunlit plume and earth-shadowed ISS

<http://www.isstracker.com/historical>

Soyuz booster ascent staging sequence



Astronaut observed third stage shutdown and sep.

Ascent events

	flight time	GMT time
• Launch	0	17:16:48
• Separation of strap-ons	1'58"	17:18:46
• Faring jettison	2'45"	17:19:33
• Second stage shut down	4'46"	17:21:34
• Second Stage Separation	4'47"	
• Firing of Third Stage	4'52"	17:21:40
• Shutdown of Third Stage	9'19"	17:26:07
• Separation of upper segment	9'23"	17:26:11
• Firing of SOZ motors	9'28"	17:26:16
• First ignition of S5.92 stage	10'23"	17:27:11
• Shutdown of S5.92	10'42"	17:27:30

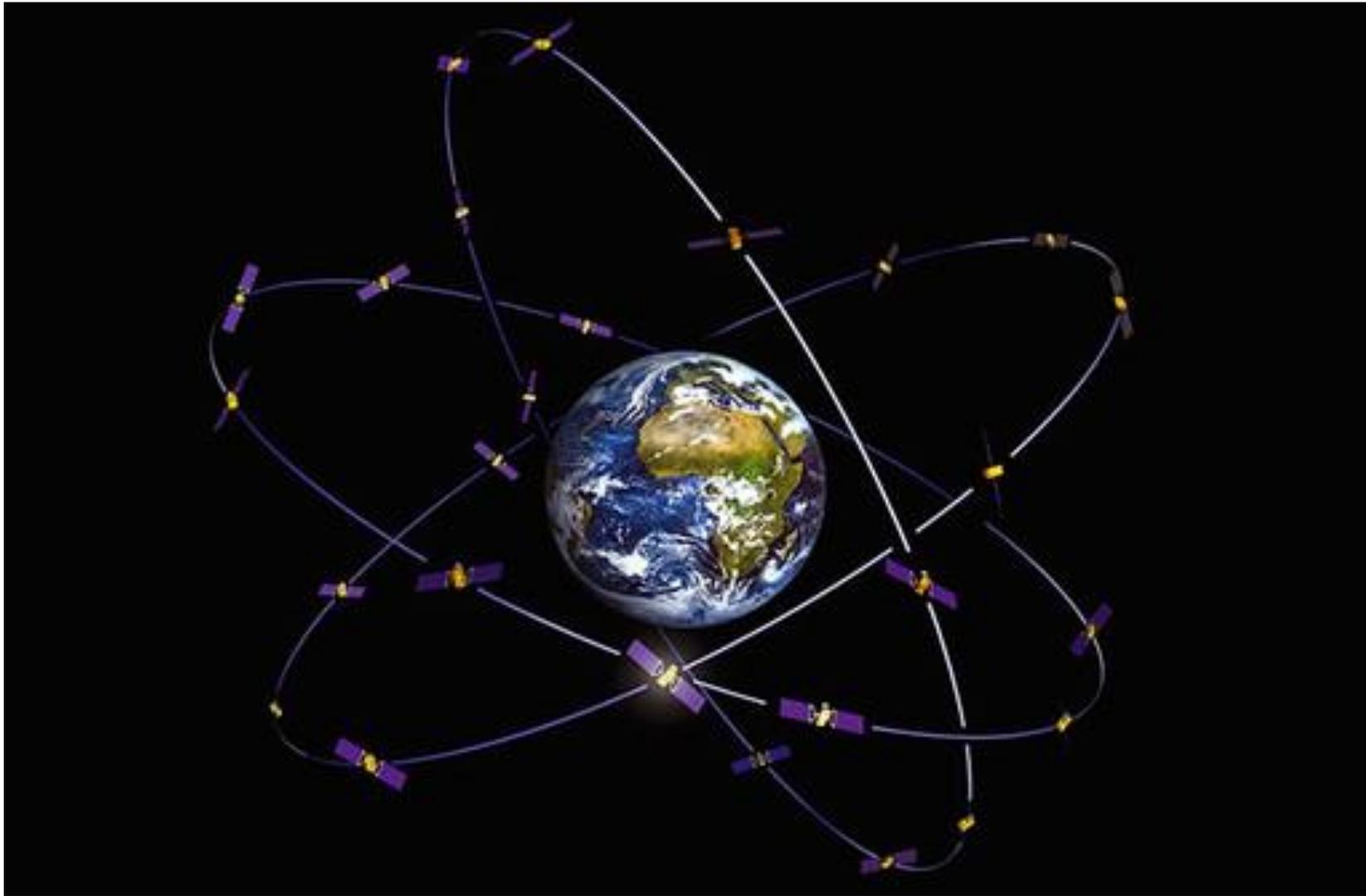
<http://www.sdcm.ru/smglo/news?month=6&year=2014&site=extern&repdate=8&version=rus>

14.06.2014 в 20:16:48 ДМВ с космодрома Плесецк
осуществлен запуск КА Глонасс-М №755 (Космос-2500).

Kosmos-2500 “Glonass-K”

- Only fourth launch of this type.
- Ascent trajectory, final orbit
- Describe TBS
- Describe TBS
- Describe TBS

GLONASS constellation



- description

Russian launch was announced in advance

- NOTAM for 1st stage and fairing debris = **V5033/14** - ATS RTE SEGMENTS CLOSED: A491 SOTER - UKHTA VORDME (UHT) A575 SORIG - ABLAR A834 AKADA - OGROM B152 SONIB - GAPRA B154 SONIB - BAMON B486 AKADA - MEDER R822 DIBIN - TITKO. SFC - UNL, DAILY 1710-1825, 14 JUN 17:10 2014 UNTIL 15 JUN 18:25 2014. CREATED: 10 JUN 06:41 2014
- NOTAM for 2nd stage debris = **P3875/14** - FLW ATS RTE SEGMENTS CLSD: A843 PIRED - TOBOLSK NDB (NH), G356 TOBOLSK NDB (NH) - VOREG, R200 TOBOLSK NDB (NH) - RISIR, R211 TOBOLSK NDB (NH) - NIKUL, P865 LERPI - INKOR. SFC - UNL, DAILY 1710-1825, 14 JUN 17:10 2014 UNTIL 15 JUN 18:25 2014. CREATED: 10 JUN 06:44 2014
- NOTAM for 3rd stage debris = **B2383/14** - TEMPO DANGER AREA NZD026 (SOUTH AUCKLAND OCEANIC FIR) IS PRESCRIBED AS FLW: ALL THAT AIRSPACE BOUNDED BY A LINE JOINING S 57 38 00, W 131 00 00, S 60 39 00, W 131 00 00, S 62 33 00, E 163 00 00, S 62 09 00, E 163 00 00, S 59 43 00, E 165 49 00, S 57 38 00, W 131 00 00. ACTIVITY: SPACE DEBRIS RETURN. USER AGENCY: FOREIGN SPACE AGENCY. PRESCRIBED PURSUANT TO CIVIL AVIATION RULE PART 71 UNDER A DELEGATED AUTHORITY ISSUED BY THE DIRECTOR OF CIVIL AVIATION. SFC - FL999, 14 JUN 17:10 2014 UNTIL 14 JUN 18:25 2014. CREATED: 08 JUN 22:07 2014

Gerst had been briefed on rocket spotting

March 18, 2014, NASA Johnson Space Center, Houston, news media interviews with future station crewmembers.

Oberg showed Gerst images from October and summarized issues about the observation..

Advised him the best opportunities would occur post sunset [or pre sunrise] with object above the horizon and backlit by sun.

This is exactly the situation Gerst found himself in, on June 15.



Gerst tweets from space



Alexander Gerst @Astro_Alex · Jun 15

Looks like something launched into space yesterday UTC 17:25 over Russia, possibly a #GLONASS Sat from Plesetsk.



Alexander Gerst @Astro_Alex · Jun 15

Spooky in a way, brilliant in view but without the slightest sound. Glad it didn't come much closer ;)

#GLONASS

<http://www.spaceflight101.com/soyuz-2-1b-glonass-755-launch-updates.html>

Gerst posts several photos

- These following images were posted on his twitter account
- Using heavens-above.com I verified that the round object below the rocket is NOT the moon, but must be something associated with the jettisoned second stage
- **Each image is here followed by a brightness/contrast enhanced version of the same scene, that I created**
- Such enhancements of in-vacuum or VERY dark sky images of dim diffuse targets can produce amazingly detailed views of plumes [less effective from ground with airglow background]
- Complex plumes following sep burn consistent with ground video of bizarre motions and pluming [and “headlights”?]











Вчера над Омском видели НЛО



Очевидцы засняли на камеру полёт неопознанного объекта над Чкаловским посёлком.

http://omskpress.ru/news/51891/vchera_nad_omskom_videli_nlo/

Над Омском на высокой скорости пронёсся НЛО - видео

 This is interesting

11

15.06.1

Как сообщили очевидцы в сообщении в первом часу ночи над Чкаловски выше облаков, неопознанный объект прямой траектории с северо-запад



<http://gorod55.ru/news/article/nad-omskom-na-vysokoj-skorosti-pronessya-nlo-video/324209bf-014d-4b6b-81ac-51b38056e20f>

Неопознанный объект сняли на видео очевидцы.

Rocket also
seen from
the ground

Russian press reports
called it a "UFO"

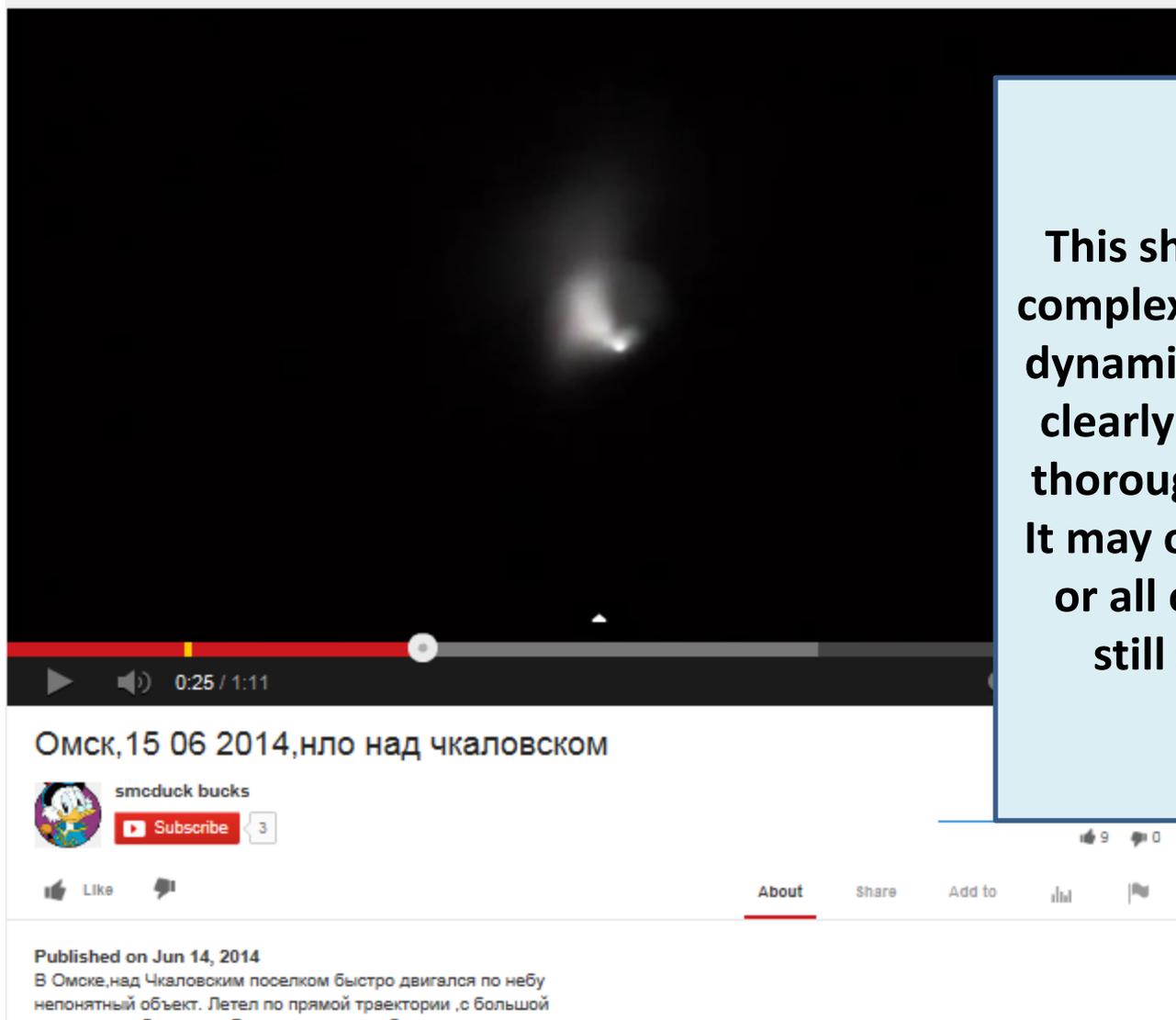
Comments on newspaper websites

- [Igor Uklein](#) – я над Новосибирском тоже наблюдал..
- I also watched over Novosibirsk ..
-
- [Viktor Nakeev](#) -- Ракета, сразу стало понятно по видео.
- A rocket. , it became clear at once from the video.
-
- [Sergey Chernov](#) - вряд ли, т.к хвоста то не было, а было много света и в каком то тумане
- unlikely wrong kind of tail. and there was plenty of light and some kind of mist
-
- Автор видео - дебил. Все пытался наехать на объект, а здесь важна была привязка к местности. Приблизить объект можно и на компе. Не умеешь снимать - не мучай жопу, откуда у тебя руки растут.
- Author of video is a moron. All tried to get to an object, but here was important was the connection to the locality. You can zoom in on your computer. You do not know how to shoot - do not torture your ass where your hands are swelling.

Comments - 2

- Как заявил директор омского планетария Владимир Крупко, что это был не НЛО, а бумажный китайский шарик со свечкой внутри.
- As the director of the Omsk planetarium Vladimir Krupko said that it was not a UFO, but a Chinese paper lantern with a candle inside.
-
- Скажите пожалуйста, какая ракета во время полета освещает себе дорогу?
- Tell me please, what kind of missile during flight illuminates their way?
-
- 14 пролетело 4 объекта наблюдал на левом берегу, сначала 3 группой а потом 1 в догонку, без следа от сгорания топлива
- 14 flew 4 object I observed on the left bank, a group of first 3 and then 1 in chase, without a trace of combustion
-
- Блин, это отработанная ступень ракеты запущенной с Байконура. Каждые полгода такое зарево происходит и все новость, НЛО. Тупое быдло...
- Damn, it's a spent rocket stage launched from Baikonur. Every six months, such a glow going all news UFO. Stupid rednecks ...

Videos popped up on Internet



This shows a **VERY** complex sequence of dynamic events that clearly needs to be thoroughly studied. It may overlap some or all of the Gerst still sequence

<https://www.youtube.com/watch?v=wfPXJliQCU0>

Comments translated from Russian video

юрий чирков – видел такое же только в центре было красное пятно, и двигалось с быстрой скоростью

Yuriy Chirkov -- I SAW THE SAME. ONLY IN THE CENTER WAS A RED SPOT, AND IT MOVED AT A FAST RATE

Макс Заславский -- Видел тоже самое над Матвеевкой, Новосибирск. Примерно в 00:30 двигалось параллельно земле и без шума.

Max Zaslavskiy -- I SAW THE SAME THING OVER MATVEYEVKA, NOVOSIBIRSK. AROUND 00:30 IT MOVED PARALLEL TO THE GROUND AND WITHOUT NOISE.

Artem Borovik -- Видел такой над Чистоозёрным. 15.06.14г примерно в 00.25 двигалась вдоль ЖД, со стороны г. Татарска в сторону г. Купино.

I SAW THIS AT CHISTO'OZERNOYE. 15.06.2014 APPROXIMATELY 00.25 MOVING ALONG THE RAILWAY, FROM THE DIRECTION OF TATARSK TOWARDS KUPINO.

more

smcduck bucks -- В живую эта штука смотрелась очень впечатляюще, очень быстро пронеслась через всю видимую часть неба, жаль что было немного облачно.

THIS THING LOOKED VERY IMPRESSIVE, VERY QUICKLY IT SWEEP ACROSS THE ENTIRE VISIBLE PART OF THE SKY, A PITY IT WAS A BIT CLOUDY.

Da ka -- видел его в Казахстане, Павлодарской области, это примерно в 500 - 600 км от Омска по времени примерно 00:30. крутился в облаках, будто фарами светил))) два дня из-за этого не спал думал прилетят за мной))))

I saw it in Kazakhstan, Pavlodar region, about 500 - 600 km from Omsk at about 00:30. spinning in clouds, shining like headlights. For two days I did not sleep because of this. thinking it was coming for me!!

Николай Фокин -- Где ты видел, чтоб хоть одна ракета излучала впереди себя свет, сильно крутилась вокруг своей оси, а, ОСТОЛОП !!!

Nikolay Fokin -- Where have you seen even one missile radiate light in front of it, and revolve around its axis, well, you IDIOT!!

Analysis of Russian comments

- UFO interpretations common, but edited out here
- Many correctly identified it as space launch but new-type mission was unfamiliar to them
- Wide spread of witness locations confirmed it was high and rapidly moving apparition
- Three references to a “headlight” suggest fan-like projection forward, possibly a separation motor
- More TBS
- More TBS

Similar twilight ground views of Soyuz plumes on **previous** launches



Seen from downrange cities, most visible at twilight, Soyuz launches have distinct forms that reflect engine arrangement.

A screenshot of a YouTube video player. The video shows a bright, elongated object, likely a satellite, streaking across a dark sky. The video player interface includes a progress bar at 2:30 / 6:20, a play button, volume control, and various settings icons. Below the video, the title is "Launch of Glonass-K1 on 2011-02-26 (amateur video)" by Alexander Krasnyansky. The video has 70,885 views, 200 likes, and 1 comment. The upload date is Feb 26, 2011. The description reads: "Russia launched a new Glonass-K1 navigation satellite from Plesetsk space center atop Soyuz-2.1b with Fregat upper stage on February 26, 2011."

UNREGI STORED

Launch of Glonass-K1 on 2011-02-26 (amateur video)

Alexander Krasnyansky

Subscribe 15

70,885

200 1

Like About Share Add to

Uploaded on Feb 26, 2011

Russia launched a new Glonass-K1 navigation satellite from Plesetsk space center atop Soyuz-2.1b with Fregat upper stage on February 26, 2011.

EARLIER
IDENTICAL
PLESETSK
MISSION
LAUNCH
Feb 26, 2011

Video filmed by Alexey Trapeznikov,
[unspecified location]
originally found at
http://vk.com/video4108145_159972415

<https://www.youtube.com/watch?v=EQzja1WpZPc>

End of Second Stage Firing

Viewed from below and behind, to left of departing track



Third stage ignition as second stage plumes drop behind

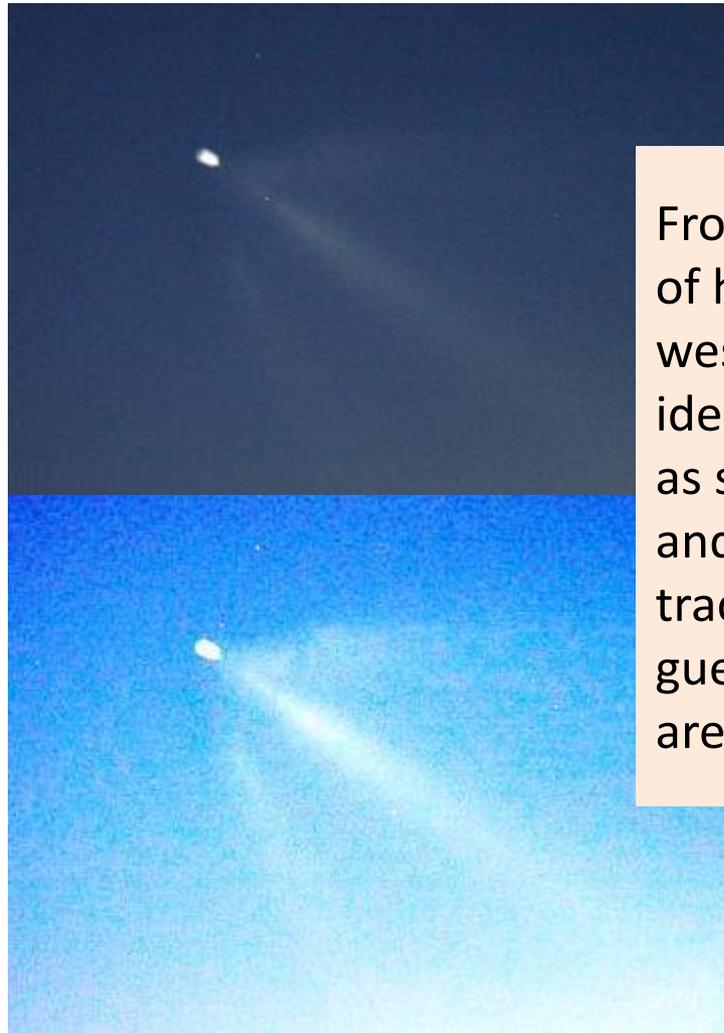


<https://www.youtube.com/watch?v=ZwMoXv3vKpY> at 17:50

“Yanus” website photos [June 15] [unspecified time, location]



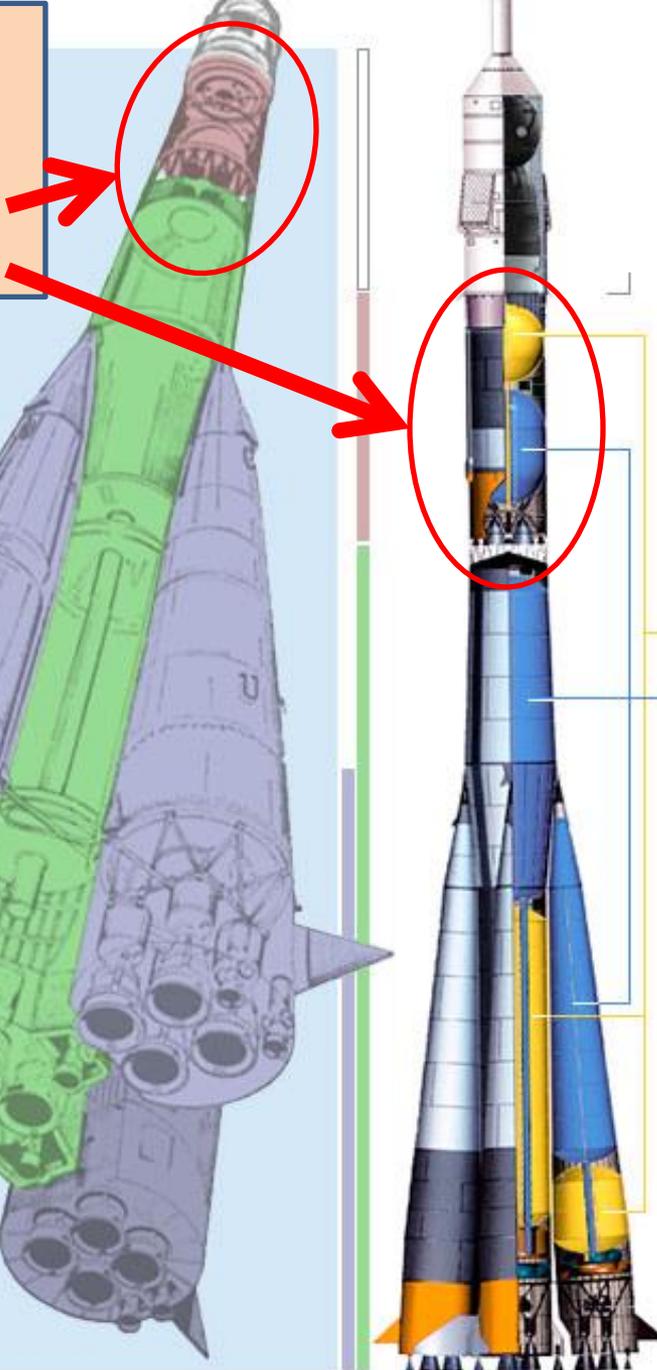
Upper originals, Lower enhanced.
Note that enhancing typical in-atmosphere views is MUCH less productive than in-vacuum views due to background sky brightness.



From interpretation of horizon lighting as western post-sunset, identification of flare as sep motor firing, and swagged ground track geometry, I'd guess northern Urals area

Source: <http://novosti-kosmonavtiki.ru/forum/messages/forum12/topic14158/message1268517/#message1268517>

THIRD
STAGE



What are
they seeing?
4 engines of stage-3



Third stage in flight



Artist concept shows separation OK but has the trajectory too steep and has the in-vacuum plume too narrow and short; computer simulation is somewhat better.



<https://www.youtube.com/watch?v=7cYuTxvPLyc>

Full set of Gerst photos with metadata

- 17:16:48 LAUNCH
- 17:25:29 First image taken, thrusting
- 17:26:10 Thrusting appears to stop
- 17:26:17 Flare begins [? 9:28 MET?]
- 17:26:36 Flare continues. Last image

Astronaut captured very end of third stage burn and the separation motor firing, but not Fregat ignition

FULL SEQUENCE DETAILED ANALYSIS FOLLOWS



#14 2014:06:14 17:25:29



#15 2014:06:14 17:25:36



#17 2014:06:14 17:25:41

First three images show 4-plume thrusting
and circular cloud behind rocket

Thrusting continues as aft cloud fades



#18 1/200
2014:06:14 17:25:58



#19 1/200
2014:06:14 17:26:02



#20 1/200
2014:06:14 17:26:05

The trailing cloud – what was it?



- Not the moon [wouldn't rise for hours; two days past full]
- Expanding fuel dump, but why not seen from ground
- Looks roughly spherical but could be head-on view of elongated plume [requires cooperative coincidence of ISS viewing angle]

What's that cloud below the third stage? One idea...



<https://www.youtube.com/watch?v=k3cBCW6lmpQ>

Last moment of second stage flight, above sensible atmosphere, plume trail broadens considerably, is left behind by third stage.

Thrusting stops, followed by bright flare

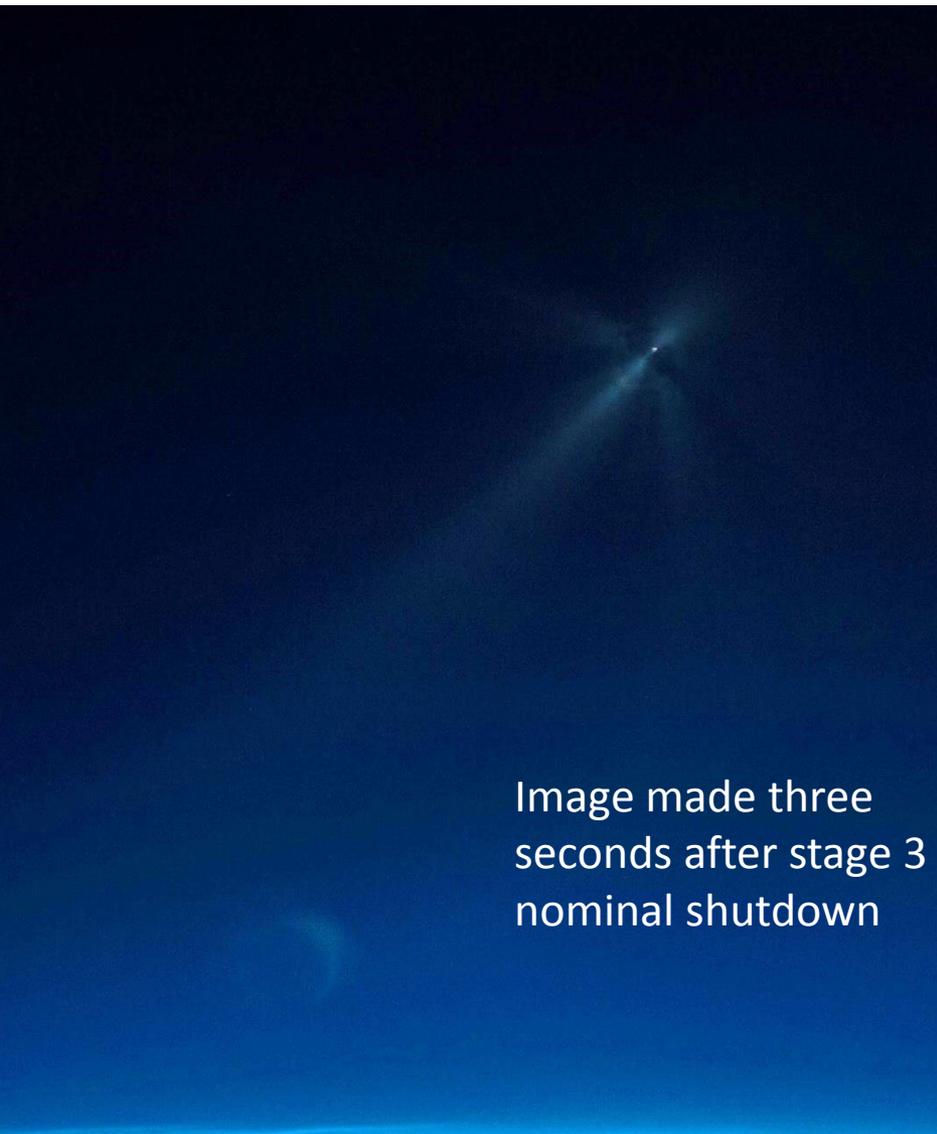


Image made three
seconds after stage 3
nominal shutdown

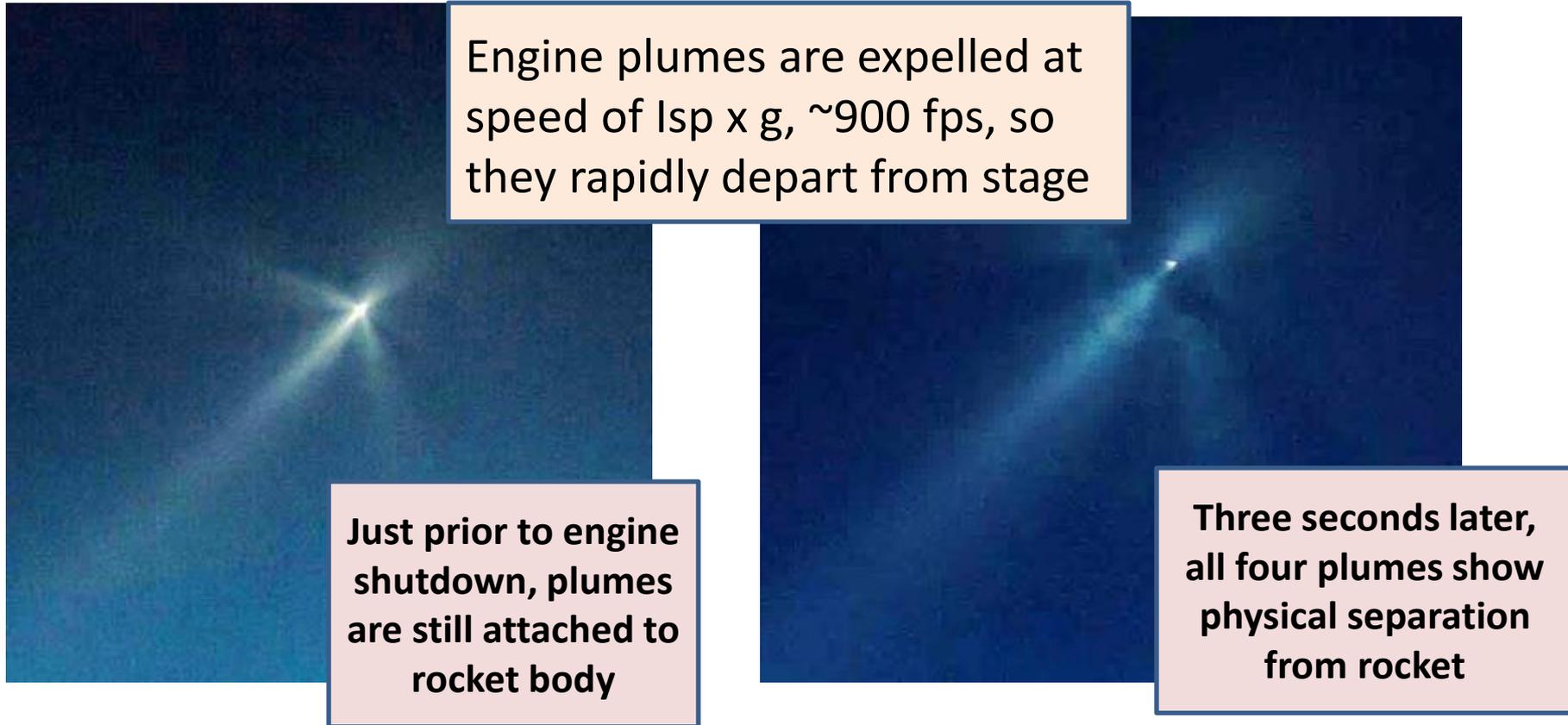


Image made within
one second of
separation motor
firing

#21 1/200 2014:06:14 17:26:10

#22 1/160 2014:06:14 17:26:17

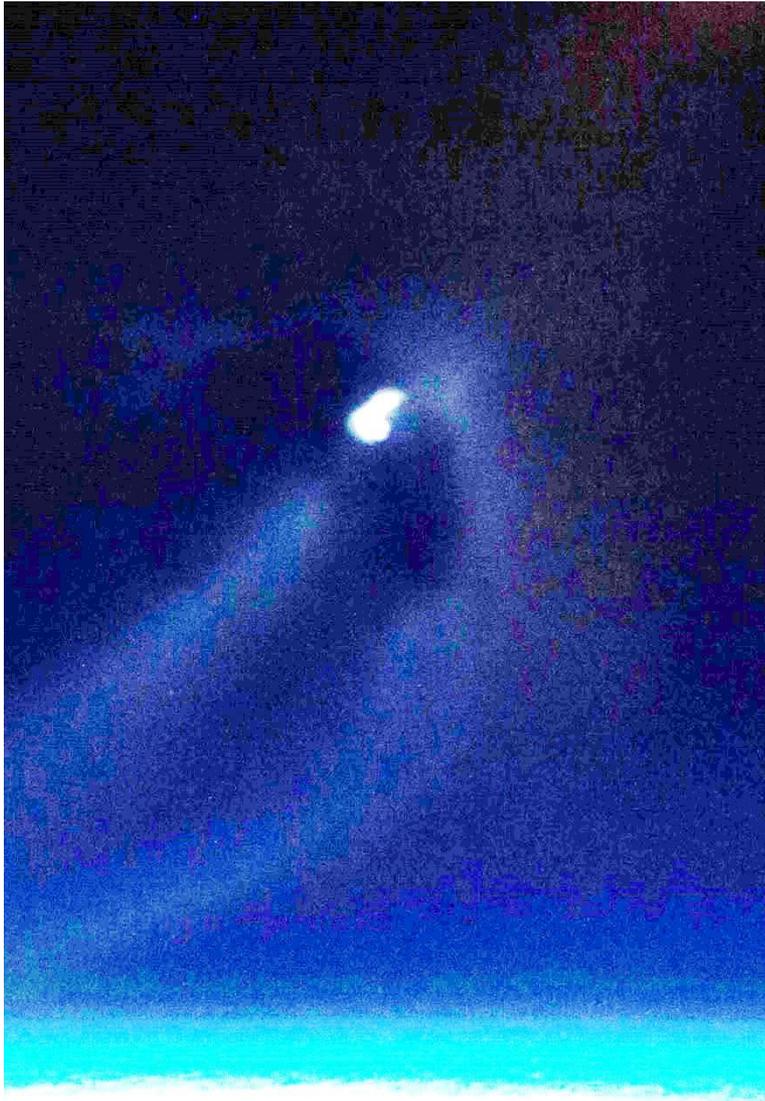
Engine shutdown indicated by “disconnection” of exhaust plumes



Interpretation originally made purely from image analysis subsequently fully confirmed by documented ascent sequence timeline.

NOTE: Orientation of rocket can be grossly estimated by comparing plume apparent lengths to perspective views, to determine aspect angle.

Final flare



Over-brightening shows traces of former plume dispersal



#24 1/160 2014:06:14 17:26:36



What are we actually seeing?

- Under ideal illumination conditions, the entire engine plume from ignition to cutoff can be seen
- Physical size can be immense – a one minute firing will create a persistent plume 200 kilometers long
- After thrust completion, departing plume exhibits sharp edge at the narrow head, as plume cloud recedes, expands, fades, and encounters air
- In vacuum, plume tail, sides, and post-cutoff head exhibit sharp boundaries and shapes
- Separation motors plume FORWARD [“headlight” effect], and spin-up thrust throws off spiral plumes

Plume origin

Conventional wisdom is that streamers indicate engine plumes. Recently released Soyuz ascent rocketcam videos suggest visible streamers may form at interface of two invisible engine plumes [alternately this shows plumes of core stage brighter than strap-ons]. Video shows stage-1.



Out-of-plane twilight launches VERY RARE

- Without extreme azimuth range of cupola module windows [installed February 2010], accidentally spotting the recent spectacular launches was VERY unlikely.
- One earlier deliberate crew effort to observe scheduled on-orbit rocket burn [Fobos-Grunt in 2011, over South America] aborted when rocket burn failed to occur, probe crashed.
- Salyut and Mir cosmonauts observed at least two launches [one Soviet, one South African] in 1980s

Prospects for further observations

- Despite extreme unlikelihood of accidental plume observation, crew should always be aware & ready
- In the event of detection, photography should begin immediately, and continue for a minute or more after eyeball visibility is lost [for photo enhancement]
- Processing of international launch alerts [NOTAMS] should include messaging ISS of potential visibility
- ESPECIALLY important if thrusting is expected to occur in sunlight or twilight while ISS is in darkness
- As able, information on major on-orbit thrusting by other spacecraft within line-of-sight should also be sought, and relayed to crew for any observational opportunities to characterize pluming, especially with sunlit plume and shadowed ISS

Cosmonaut Anton Shkaplerov [launched to ISS in November]



During interview with author, Shkaplerov was astonished by the ISS Topol missile plume images, he clearly had never seen them or anything similar, but would keep eyes open. I'm awaiting chance to ask him.

