
SPACE
and
UKRAINE
Jonathan McDowell

Dnipropetrovsʹk

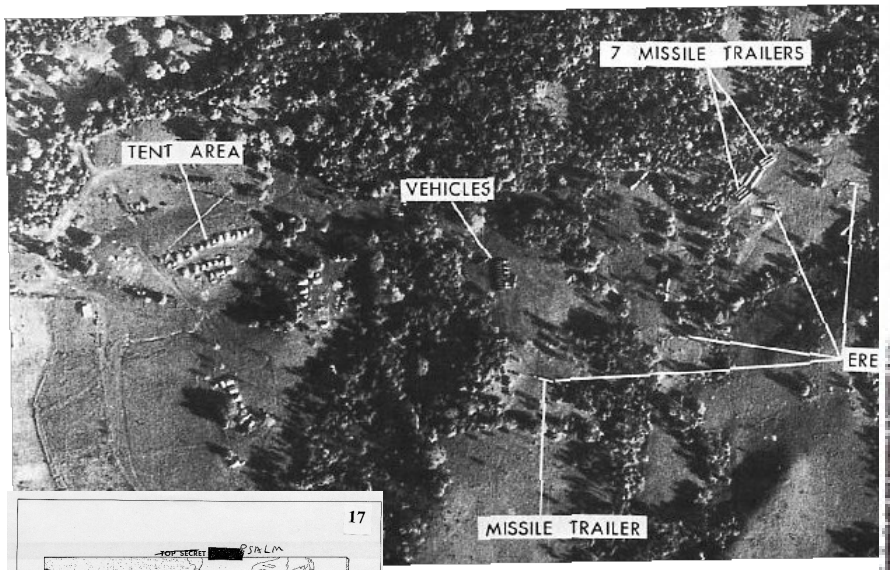
ЮЖМАШ
YUZHMASH

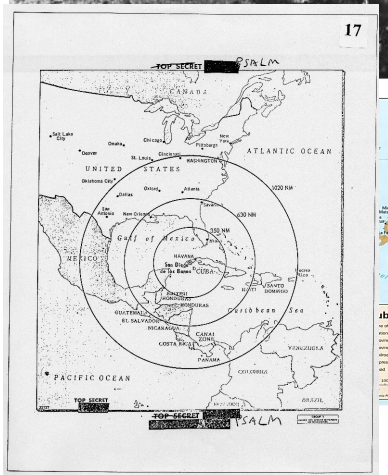
YUZHNOYE
design office

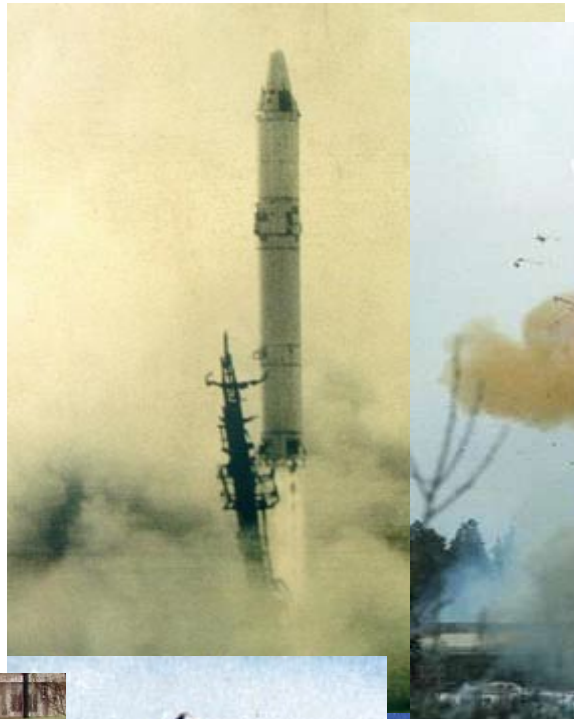
The R-12 missile

Built in Ukraine

Sent to Cuba 1962







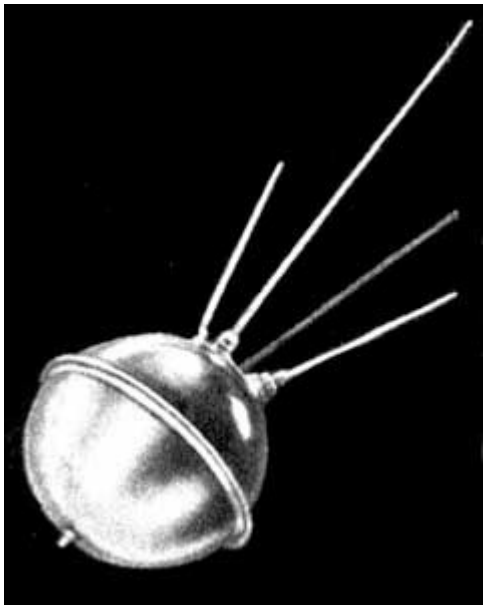
Many of the most important Soviet missiles:
R-12
R-14
R-36 (SS-9)
R-36M (SS-18)
MR-UR-100

RT-20
RT-23

Space Launch Vehicles:

Dnepr
Tsiklon-2 (ASAT launch vehicle, retired)
Tsiklon-3 (last launch 2009, retired?)
Zenit-2, Zenit-3

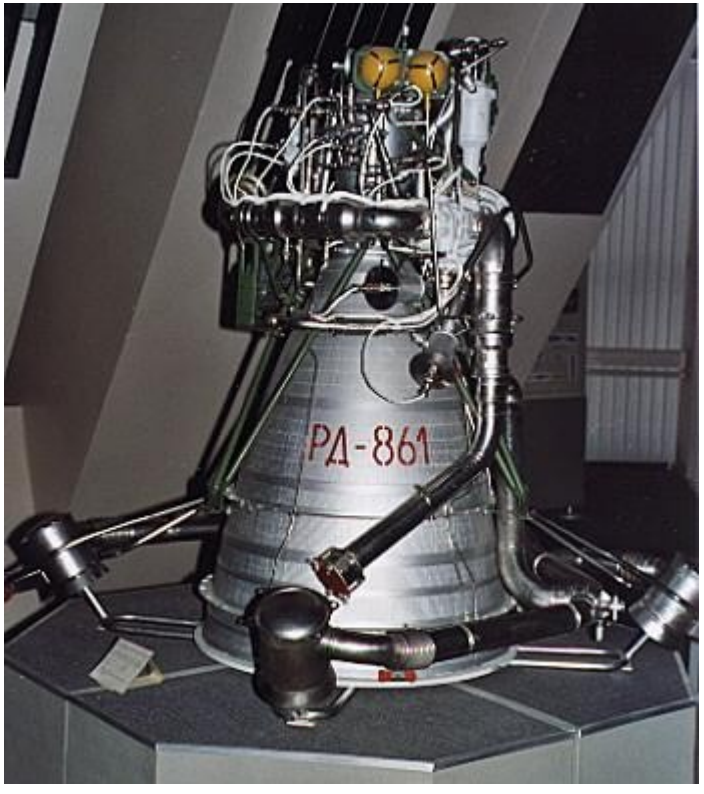
450 satellites built in Ukraine



Kosmos-1 satellite, 1962

Sich-2 satellite for national Ukrainian space program, 2011

Liquid and solid propellant rocket engines

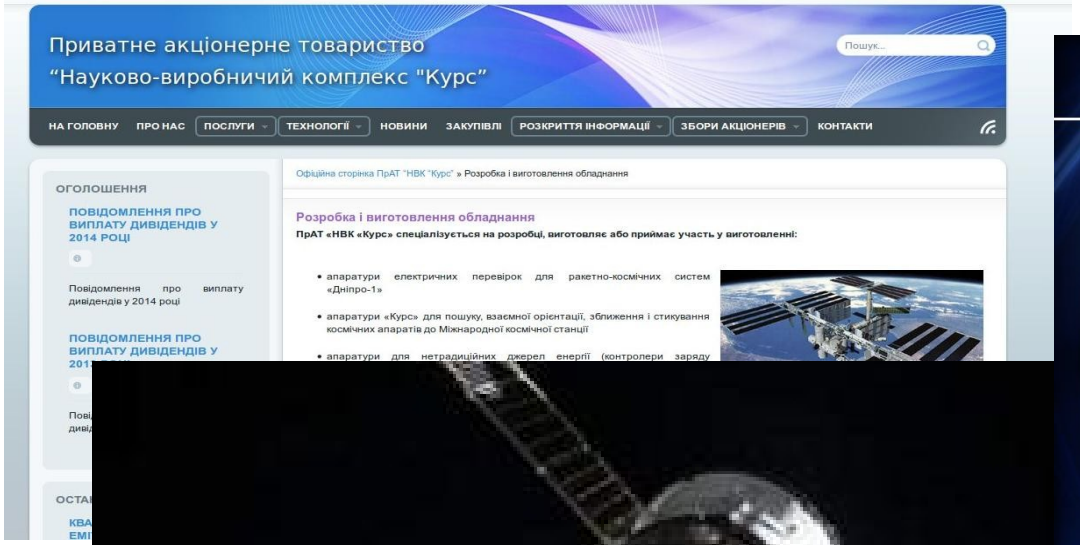


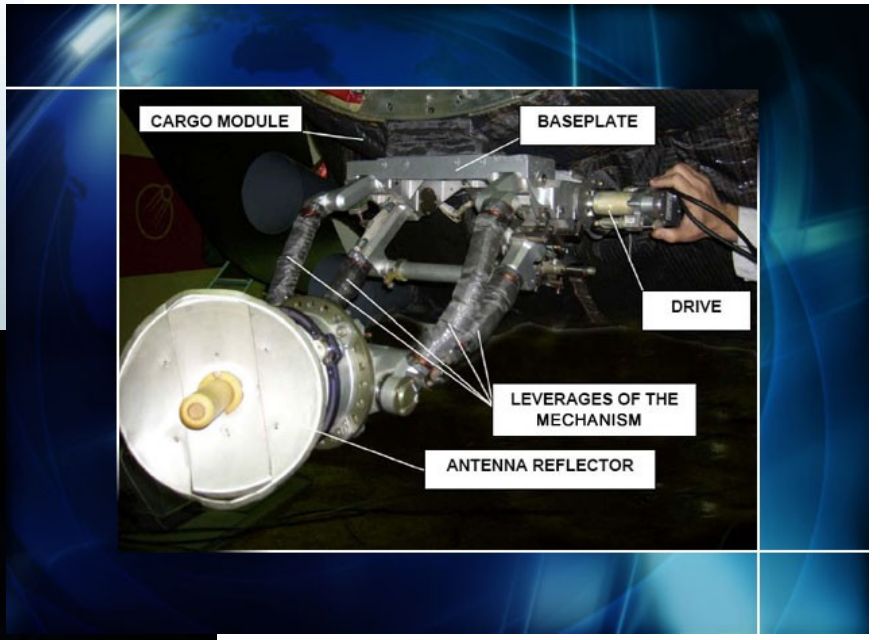
RD-861 engine for Tsiklon-3
third stage

15D305 solid motor
for RT-23 ICBM

Subsystems:

Kurs rendezvous system
(NVK Kurs, Kyiv)
used for docking of Soyuz and Progress to ISS
Now being phased out, replaced by new Russian version





The US, Russia and Ukraine:

Increasingly Intertwined in the Cosmos

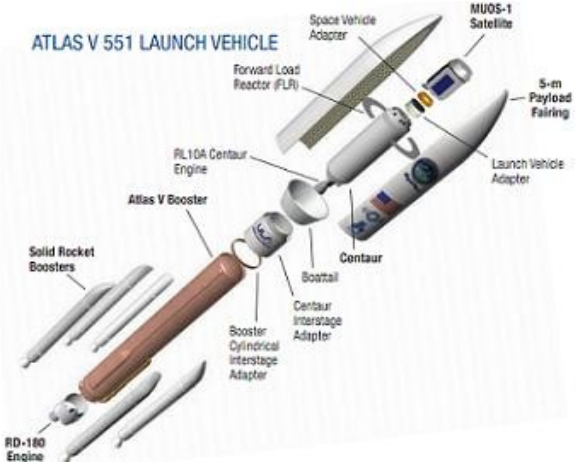
Launch vehicles:

Sea Launch: Russian owned company with US subsidiary operating company.
Rocket has Ukrainian stage 1 and 2 (Zenit) and Russian stage 3 (Blok-DM-SL).
Payload/Rocket integration in Long Beach, California, float on oil rig out to equatorial Pacific for launch. Zenit built in Dnepropetrovsk but has Russian rocket engines.

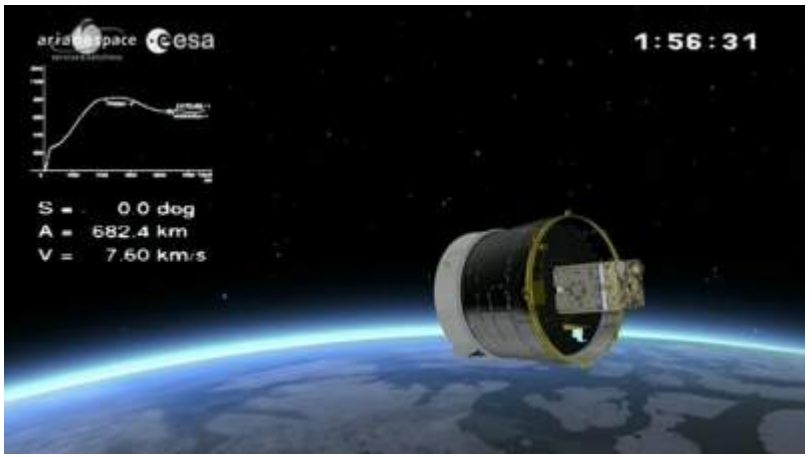
Antares: Orbital Sciences launch vehicle for Cygnus robot cargo launches to ISS, takeoff from Wallops Island, Virginia. First stage is based on Zenit - again, Ukrainian stage with Russian rocket engines.

Atlas 5: United Launch Alliance / Lockheed Martin launch vehicle with Russian RD-180 first stage main engine. Used for launches of US NRO spy satellites etc.
* Congress considering funding for a US engine to replace RD-180 - eventually

(Other US LVs such as Minotaur, Falcon 9, Delta 4 have no significant Russian or Ukrainian involvement)



Europe's Vega small launch vehicle has a Ukrainian engine on the orbit insertion stage
Ariane is all-European, however



Launch Services

Why build your own rocket? Just buy a ride on a Russian one!

Dnepr, Rokot (small LEO satellites)
Soyuz-2 (medium satellites, all orbits)
Proton (large GEO satellites)
Zenit-2 Land Launch (GEO satellites)
Angara – coming soon, all-Russian (no dependence on Ukraine parts?)

Small Canadian satellite pulled off the June Dnepr launch as Ukraine-related protest

Can US and Euro rockets make up for lost launch capacity if Russian launch services became unavailable?

2011	Proton:	Telstar, QuetzSat, ViaSat (US-ish), SES-3 (Eur-ish), Asiasat-7 (Hong Kong), Amos-5 (Israel)
	Zenit:	Atlantic Bird 7, Intelsat 18
	Soyuz:	Globalstar (2 x 6 sats), Galileo (Europe), Pleiades (France)
2012	Proton:	SES-4, 5; Intelsat 22,23; Echostar 16 Nimiq 6 (Canada); Telkom (Indonesia); Yahsat (UAE)
	Zenit:	Intelsat 19, 21; Eutelsat 70B
	Soyuz:	Metop (ESA), Galileo (Europe), Pleiades (France)
2013	Proton:	Satmex 8 (Mexico), Anik G1(Canada), Eutelsat 3D; SES-6, Astra 2E, Sirius Radio 6, Inmarsat 5
	Zenit:	Intelsat 27, Amos 4 (Israel)
	Soyuz:	Globalstar x 6, O3b x 4, Gaia (ESA)
	Rokot:	Swarm

Russian satellite technology used by US organizations:

- not so much

Small startup Canopus Systems (San Francisco) is a subsidiary of a small Russian company, Dauria Aerospace.
Launched 2 small AIS (ship tracking) satellites.

In contrast to launch vehicles and rocket engines,
Russian satellite tech not seen as appealing

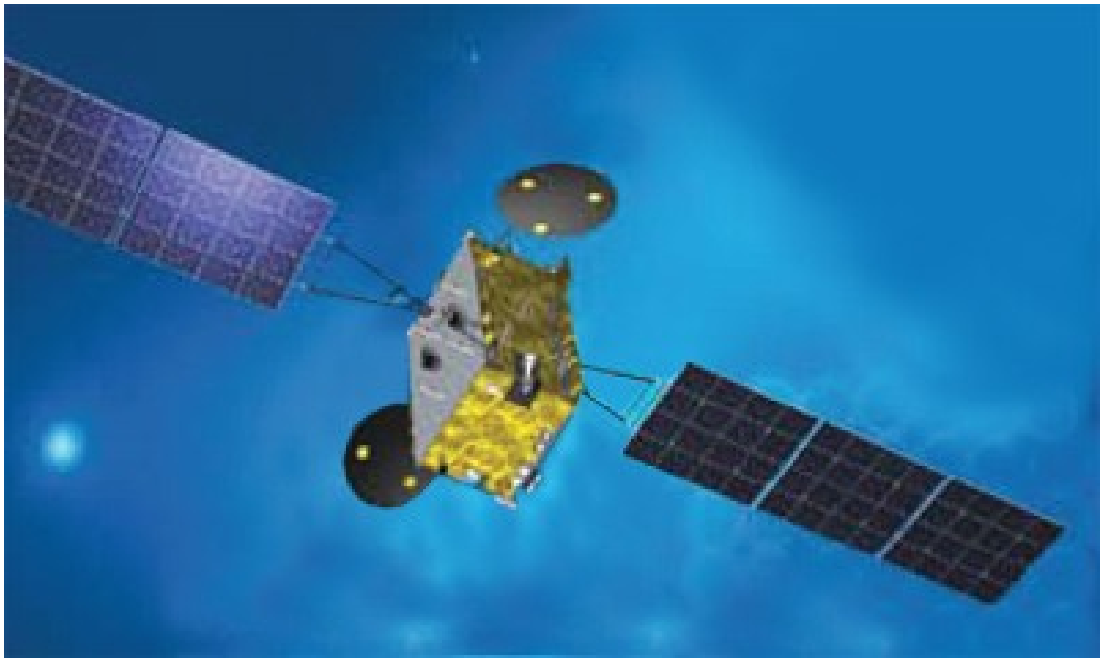
Some collaborative work with instruments on Russian science sats
(e.g. Spektr-RG X-ray astronomy satellite)

US and European satellite technology used by Russia

Russian Satellite Communications Company has
- European-built satellites (Astrium Eurostar)
2 so far, both failed to reach
planned orbit due to Proton rocket failures;
More scheduled for this year and next

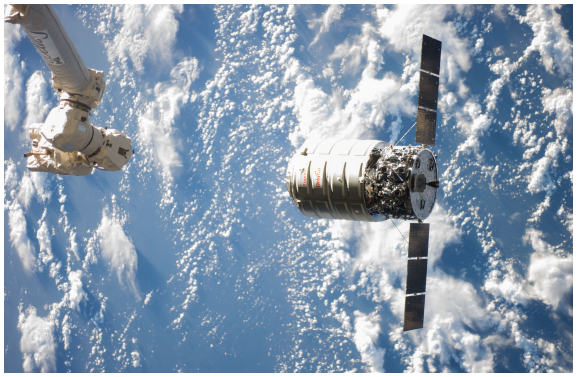
- Russian satellite buses with Euro and Canadian comm payloads
(since 2003)

Ekspress-AM2,3, 11, 22	Thales Alenia payloads
Ekspress-AT-1,2	Thales Alenia payloads
Ekspress-AM5	MDA (Canada) payload
Ekspress-MD1,2	Thales Alenia payloads



…. and then there's the ISS

Russia vs. Ukraine: New Russian Kurs-NA rendezvous system flight-tested in April aboard Progress M-21M, to replace Ukrainian Kurs

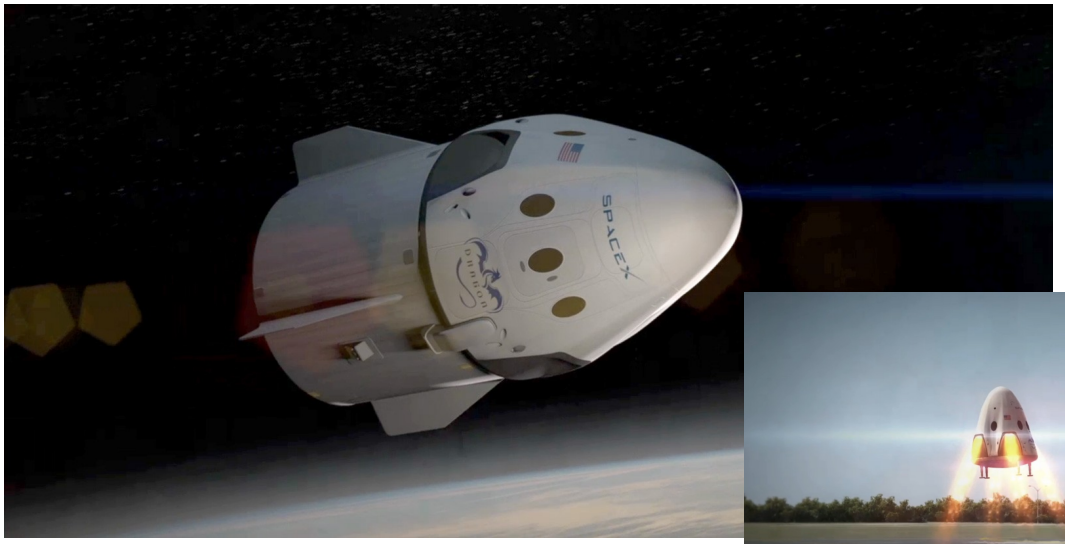


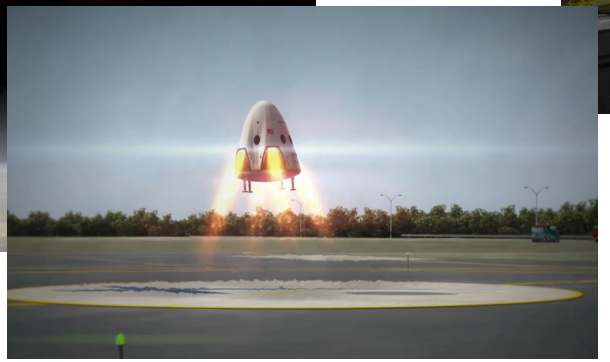
US vs. Russia:
- US now has independent cargo delivery via Dragon, Cygnus
- Japanese HTV also available; ESA ATV being retired

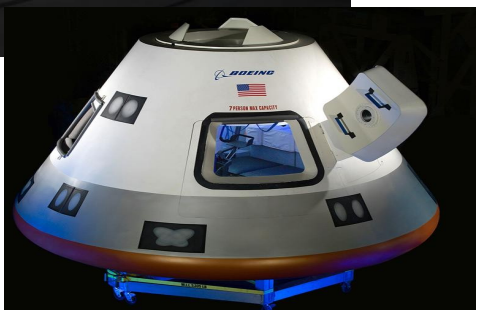
- US reliant on Soyuz for astronaut access to ISS
 - DragonRider abort test later this year
 - Astronauts could fly Dragon to ISS by 2016 (2017 more likely)

Can Elon deliver?

- Boeing CST-100 capsule also being designed
  (but flies on Russian-engined Atlas V)
- Sierra Nevada lifting body as dark horse option (also Atlas V)







Enter **Dmitriy Olegovich Rogozin....**

Deputy Chairman for Defense and Space
(one of 8 Russian deputy prime ministers)

NBC NEWS HOME LATEST SEARCH

Trampoline to Space? Russian Official Tells NASA to Take a Flying Leap

BY ALAN BOYLE

Russian Deputy Prime Minister Dmitry Rogozin, a target of U.S. sanctions sparked by the Ukraine crisis, said Tuesday that those sanctions would boomerang against America's space effort and essentially told NASA to take a flying leap ... on a trampoline.

"After analyzing the sanctions against our space industry, I suggest to the USA to bring their astronauts to the International Space Station using a trampoline," Rogozin said via his Russian-language Twitter account.

Mar: US applies sanctions to Russian officials, freezes their US assets

V. Surkov, S. Glazyev, L. Slutsky, A. Klishas, V. Matvienko, D. Rogozin, Ye. Mizulina

Apr 29: Rogozin responds on Twitter!

Dmitry Rogozin
@Rogozin

Follow

Проанализировав санкции против нашего космопрома, предлагаю США доставлять своих астронавтов на МКС с помощью батута
russian.rt.com/article/29891

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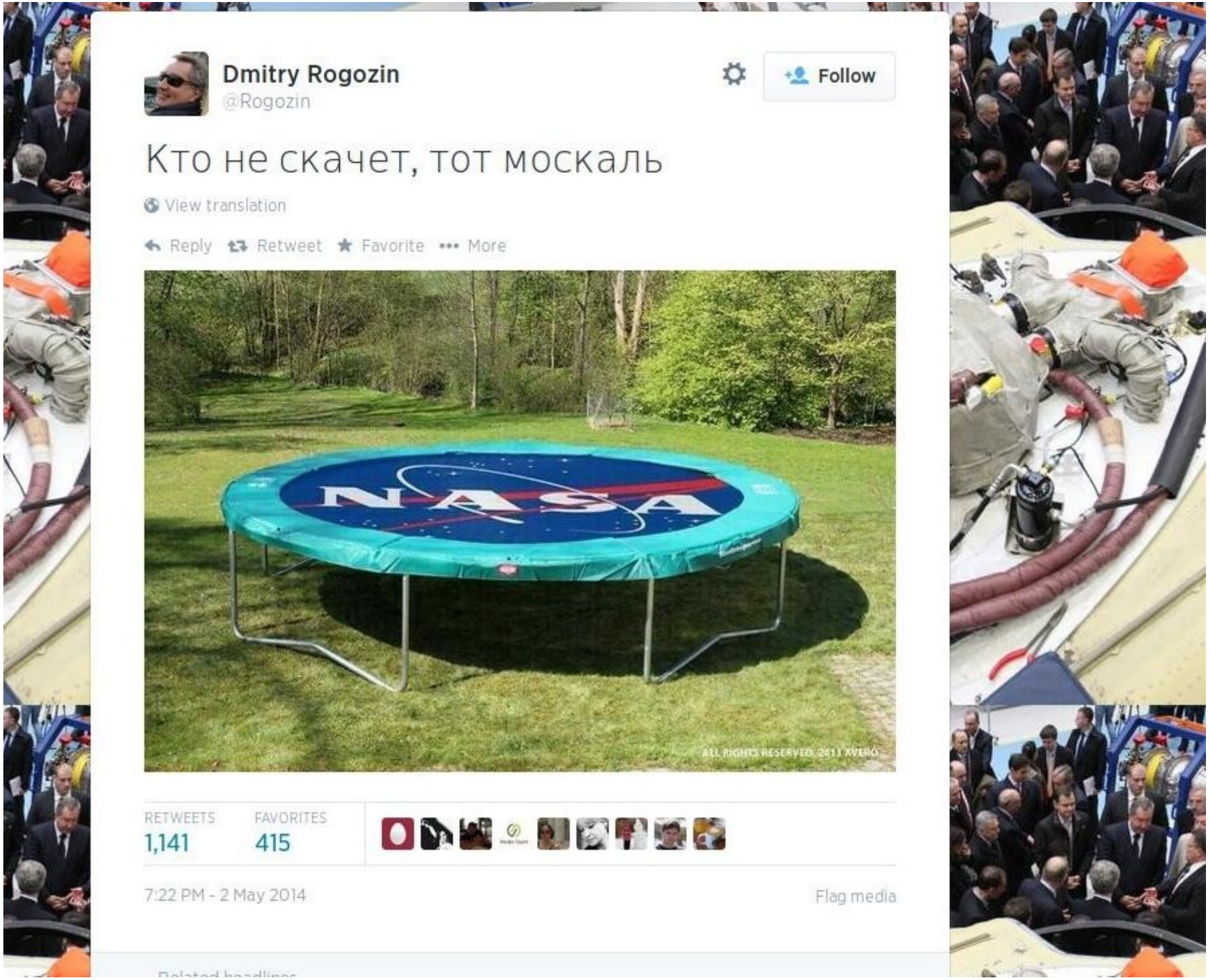
Dmitry Rogozin
@Rogozin
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RETWEETS
1,141
FAVORITES
415
7:22 PM - 2 May 2014
Flag media

May 13:

Rogozin gives a speech in which he says:

Russia will pull out of the ISS in 2020 as planned,
refusing the US request to extend its lifetime

Russia will ban the US from using Russian rocket engines to launch 'military satellites'.

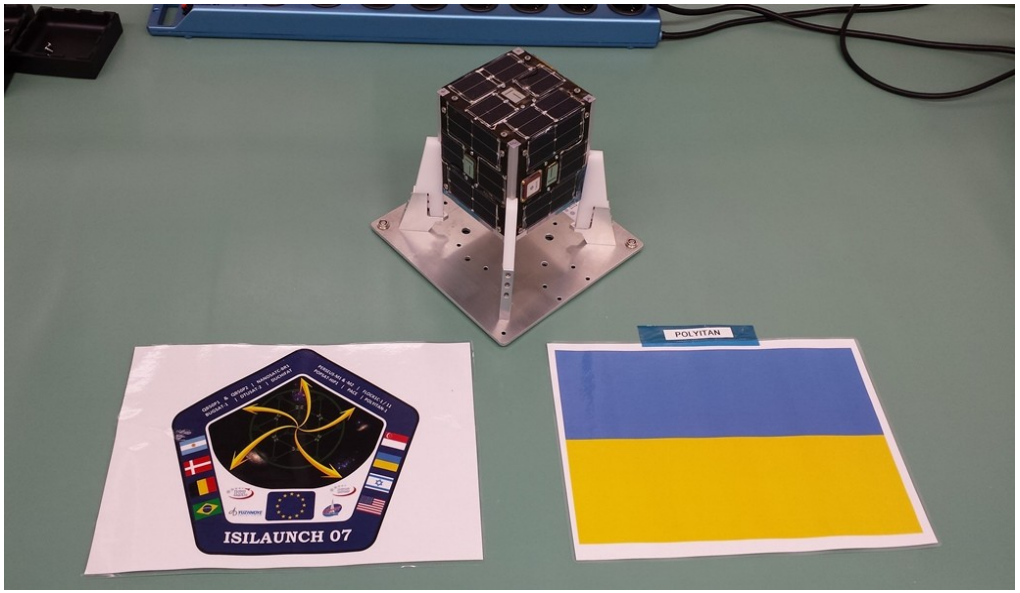
This is reported as: “Russia announced that...”

Question: Is Rogozin announcing official Russian Govt policy, or is he just trolling us?
No official diplomatic or formal govt. agency actions taken so far...

Nevertheless, calls into question future US-Russian space cooperation.
What if we have to disentangle the US, European, Ukrainian and Russian space industries?

June 19:
A Kyiv Poly cubesat launched on a Ukrainian-built, Russian-owned Dnepr rocket from a Russian ICBM base.

Ukraine-Russia space cooperation is by no means on hold – so far



Объект	Время отделения, с	Большая полуось, км	Период обращения,с	Наклонение орбиты, град
КА BugSat-1	950	6977	5800	97,990
КА ТаблетСат-Аврора	952	6984	5809	97,988
КА DEIMOS-2	954	6992	5818	97,986
Платформа А и контейнеры QuadPack 1/5	956	6998	5826	97,984
КА KazEOSat	958	7008	5838	97,982
КА Hodoyoshi-4	960	7015	5847	97,981
КА Hodoyoshi-3	961	7023	5857	97,979
КА SaudiSat-4	962,5	7031	5867	97,978
КА UniSat-6	964	7040	5878	97,976
КА AprizeSat-9	965,5	7048	5889	97,974
КА AprizeSat-10	967	7057	5899	97,972
КА BRITE-Toronto	970	7071	5918	97,970
КА BRITE-Montreal	972	7088	5939	97,966