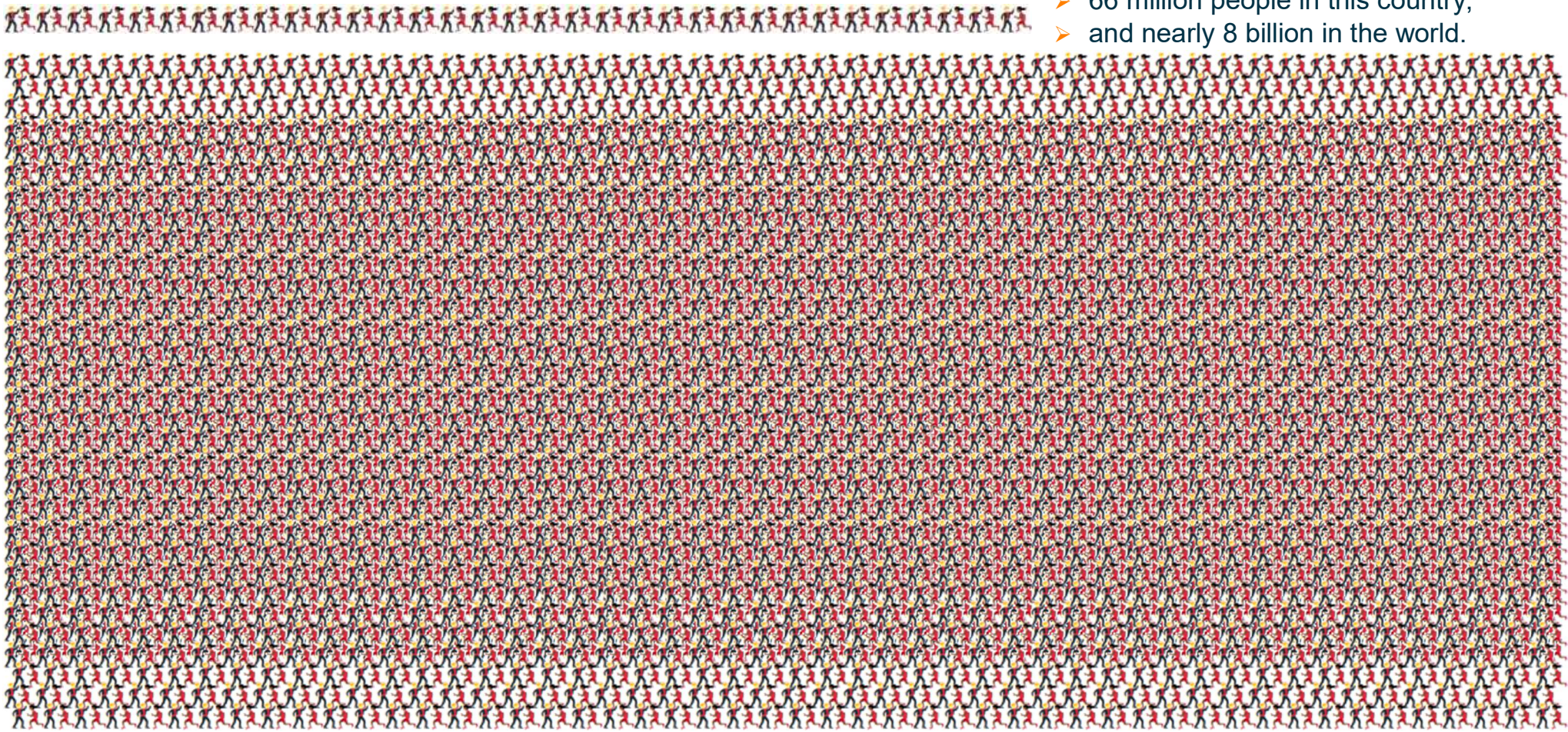
From a Dream to the International Space Station

Jessica Meir
Marine Biologist
NASA Astronaut

So What's So Special about an Astronaut?

- 66 million people in this country,
- and nearly 8 billion in the world.



- But only 6 of all these people are outside Earth, in space.

Who is Jessica?

- Why am I interested in her?
  - She is my youngest cousin.
  - Her father was my childhood hero, my uncle Josef.

- Her childhood dreams –
  - For school assignment,
    she drew pictures of herself as an astronaut.
  - Did she like spiders?

What did she do about her dream?

- She studied marine biology at university in the United states.
- Then went to do research for NASA on astronaut physiology, in France.
  - This was the International Space University in Strasbourg, France.
  - And they have zero gravity training aeroplanes.

OK, What Next?

- Jessica applied several times to NASA to become an astronaut.
- So …
  - She decided to do something even more extreme –
  - Research on emperor penguin physiology,
  - in …

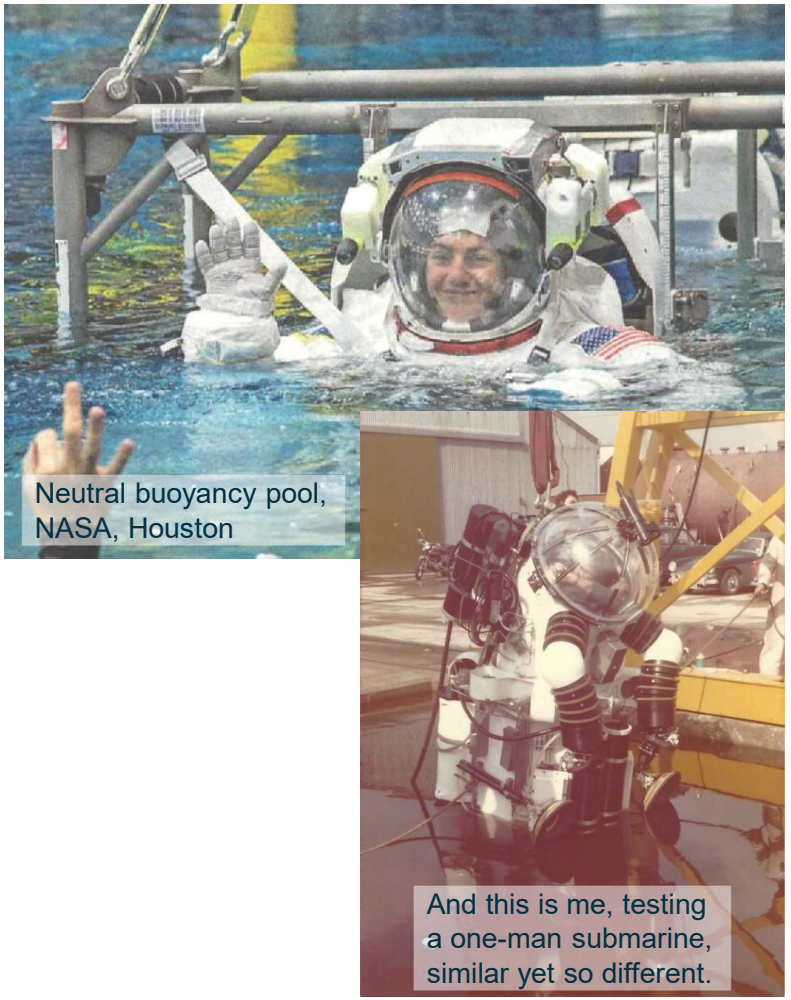
Antarctica

Still not enough!

- Jessica gets deeper into science –
- With penguins,
  - It was research into physiology under great pressure.
- Now she turned to,
  - Research into physiology under very low pressure.
  - She became mother to,
    bar-headed geese, the highest flying birds on Earth.
  - They have even been seen flying over Mount Everest!

Becoming an Astronaut

- Then she took flying lessons
  - and received licence to pilot light planes.
- Then she went to teach anaesthesia
  - at the medical school of Harvard University.
- And finally she was accepted.
  - Why did it take so long?
    Because NASA expects proven excellence to be an astronaut!
  - Here you see her training for space walks in NASA's neutral buoyancy pool.
- Subsea engineering is just as exciting as space engineering.
  - And here is a picture of me, testing a one man submarine.
  - Look how similar it looks to a space suit.



Neutral buoyancy pool, NASA, Houston

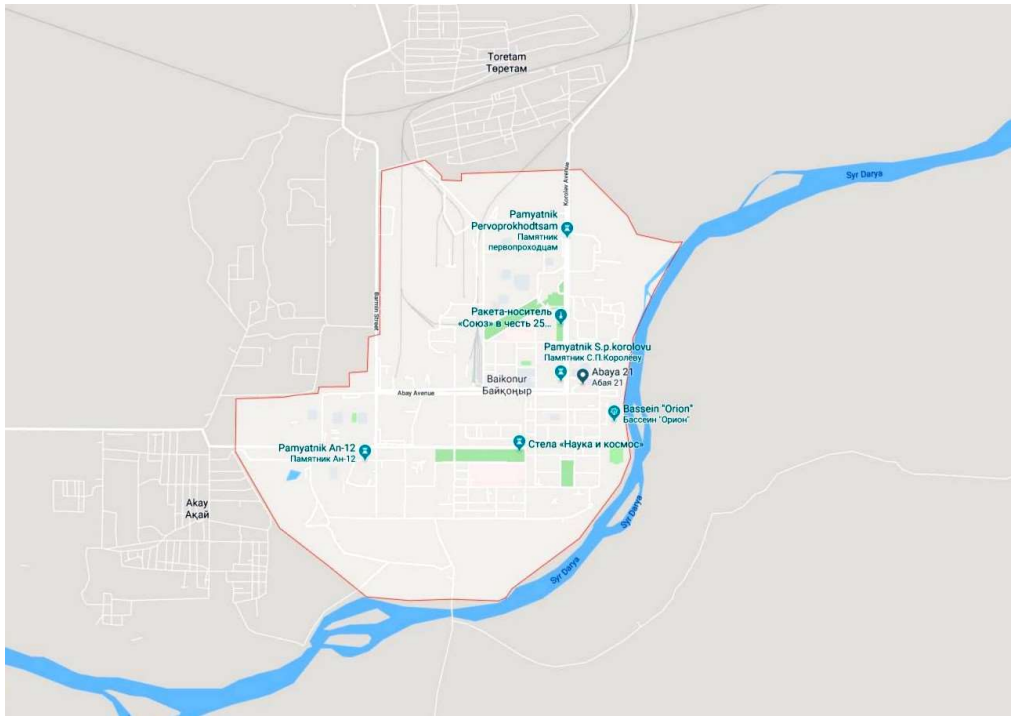
And this is me, testing a one-man submarine, similar yet so different.

Some More on Engineering

- Here is Jossefa, one of Jessica's older sisters.
- Standing by one of her creations,
  - a beautiful modern bridge.
- She is a bridge engineer,
  - and in her free time she is a mountain climber.
- Science leads to Engineering.
  - Engineers shape the world.
  - They create everything that is around us.
- If you are good at sciences, you could do all these:
  - Design bridges and buildings,
  - Become a famous software engineer, creating Apps,
  - Or be the first astronaut on a mission to Mars…

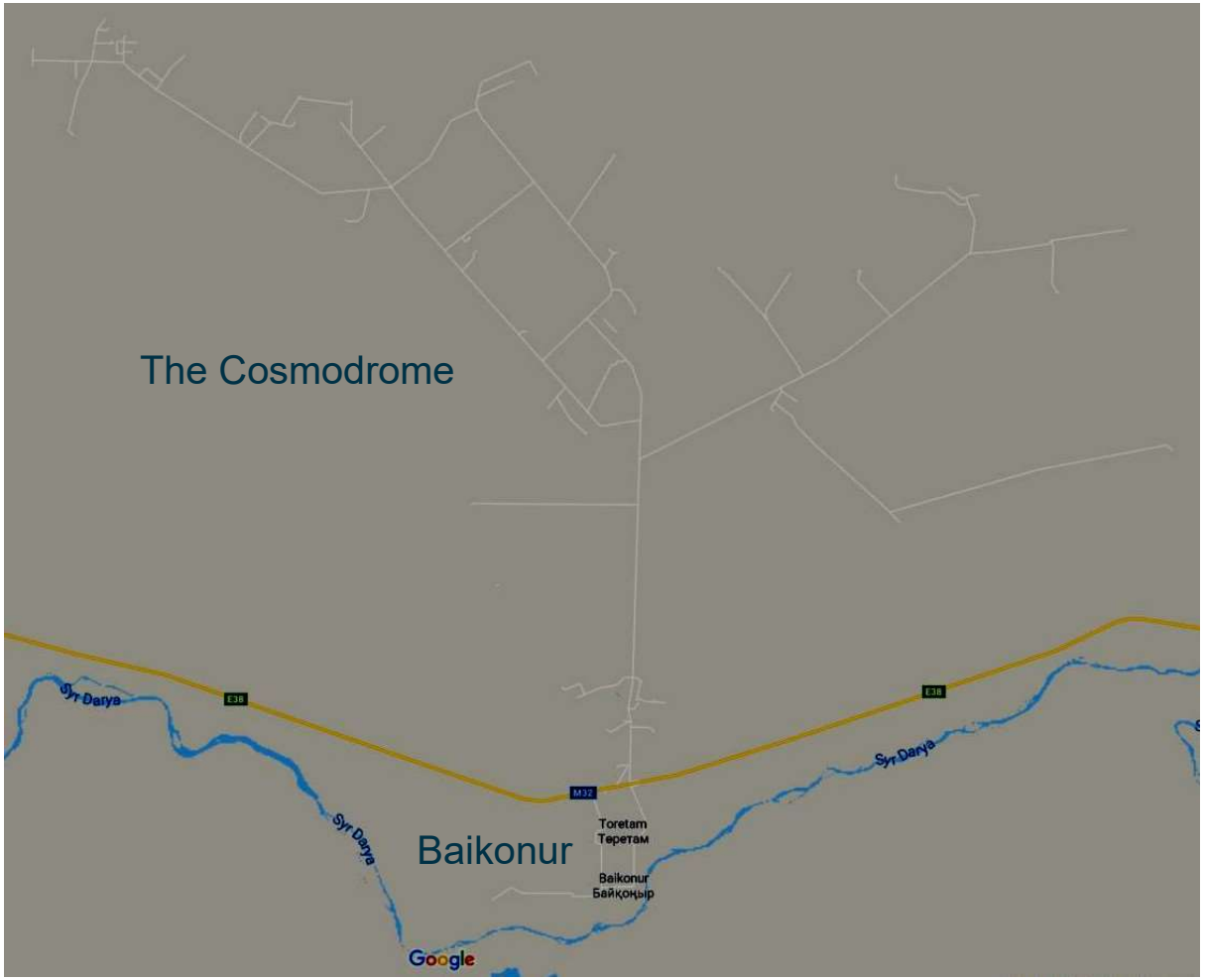
Jessica was Launched from Baikonur in Kazakhstan

- Baikonur is a small city.
  - It has
    housing, schools, shops, markets.
  - Quite normal.
- So what's special about it?
  - It is the home for the people working in the Cosmodrome.
  - And…
  - It is a centrally heated city.
  - Yes, the entire city!



The Launch Site – the Cosmodrome

- The Cosmodrome
  - It is huge, as big as Yorkshire.
  - It is criss-crossed with railway lines for rocket transportation.
  - The launch towers can be seen on the horizon from the main highway.



Rollout

- 23/09/2019
  - Monday

- The Hangar
  - They don’t maintain the buildings

Rollout

- 23/09/2019
  - Monday

- 7 am sharp
  - Doors open

Rollout

- 23/09/2019
  - Monday

- First stage connection

Soyuz Rocket – Facts and Figures

Total launch mass	305,000 kg mostly kerosene and liquified oxygen
Mass to Low Earth Orbit	7,100 kg
Stages	3
Total height	50 m
Max diameter	10.3 m

The Chase

- 23/09/2019
  - Monday
- 2km trek
  - Many walked it.
- We went for breakfast
  - Joined half way
  - Then drove to the launch site.

Verticalisation

- 23/09/2019
  - Monday

- At the launch pad
- Slow rise
  - While first stage rocket and boosters descend into the combustion pit.

Verticalisation

- 23/09/2019
  - Monday

- Met with the family
  - Mixed with personalities.

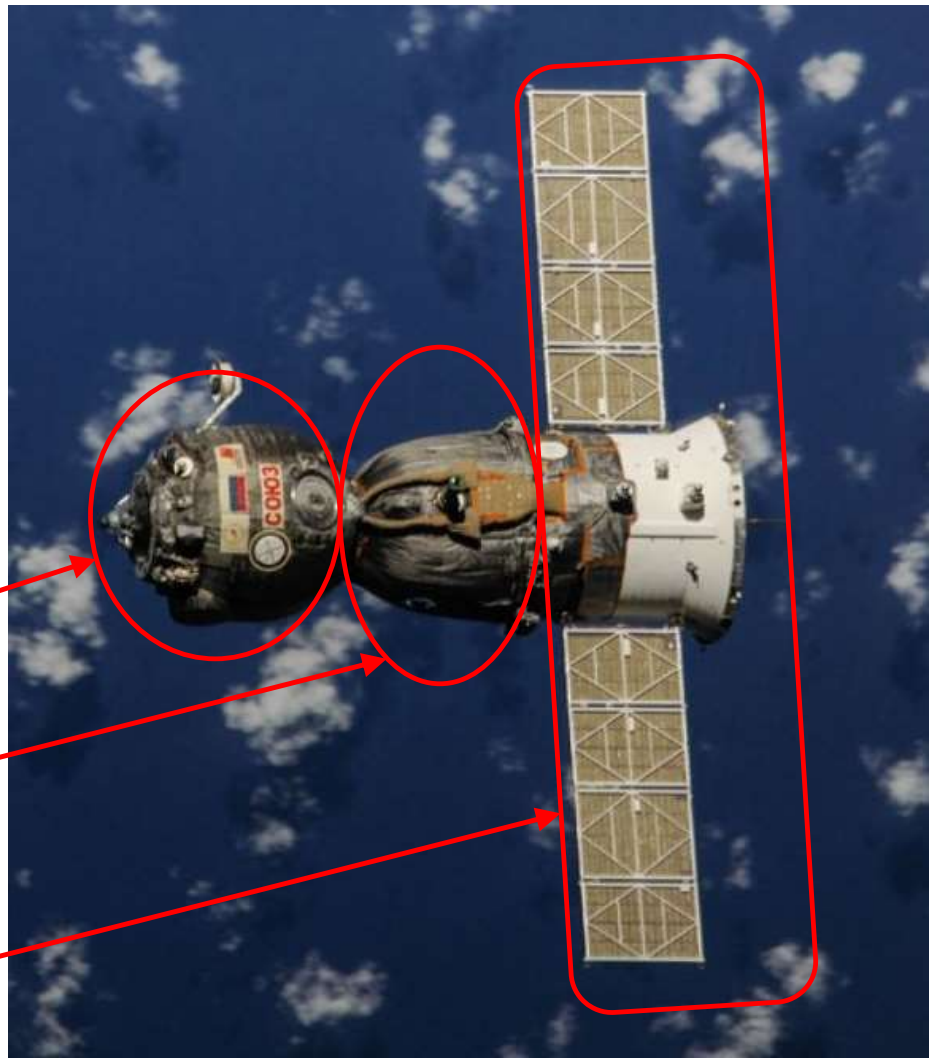
- Jeff Williams (middle)
  - A seasoned astronaut
  - Holds the longest EVA (spacewalk) record.

Verticalisation

- 23/09/2019
  - Monday

- The lifting rig is lowered
- Then –
  - The booster quick release supports arms are raised
  - access and maintenance towers are pinned to the rocket on two sides.

The Soyuz MS Spacecraft

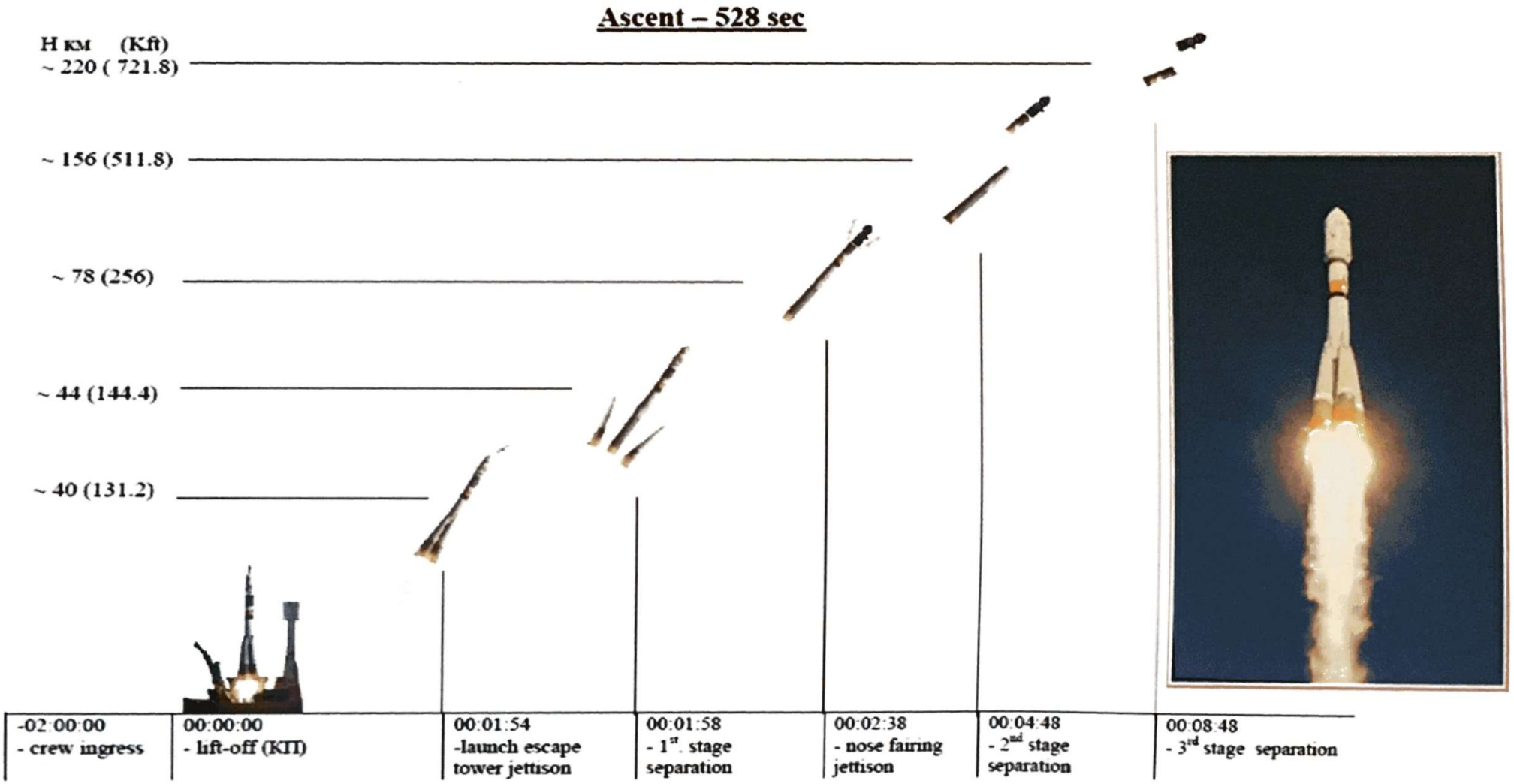


Habitation Module

Descent Module

Instrumentation and Propulsion Module

Soyuz Flight Launch Sequence

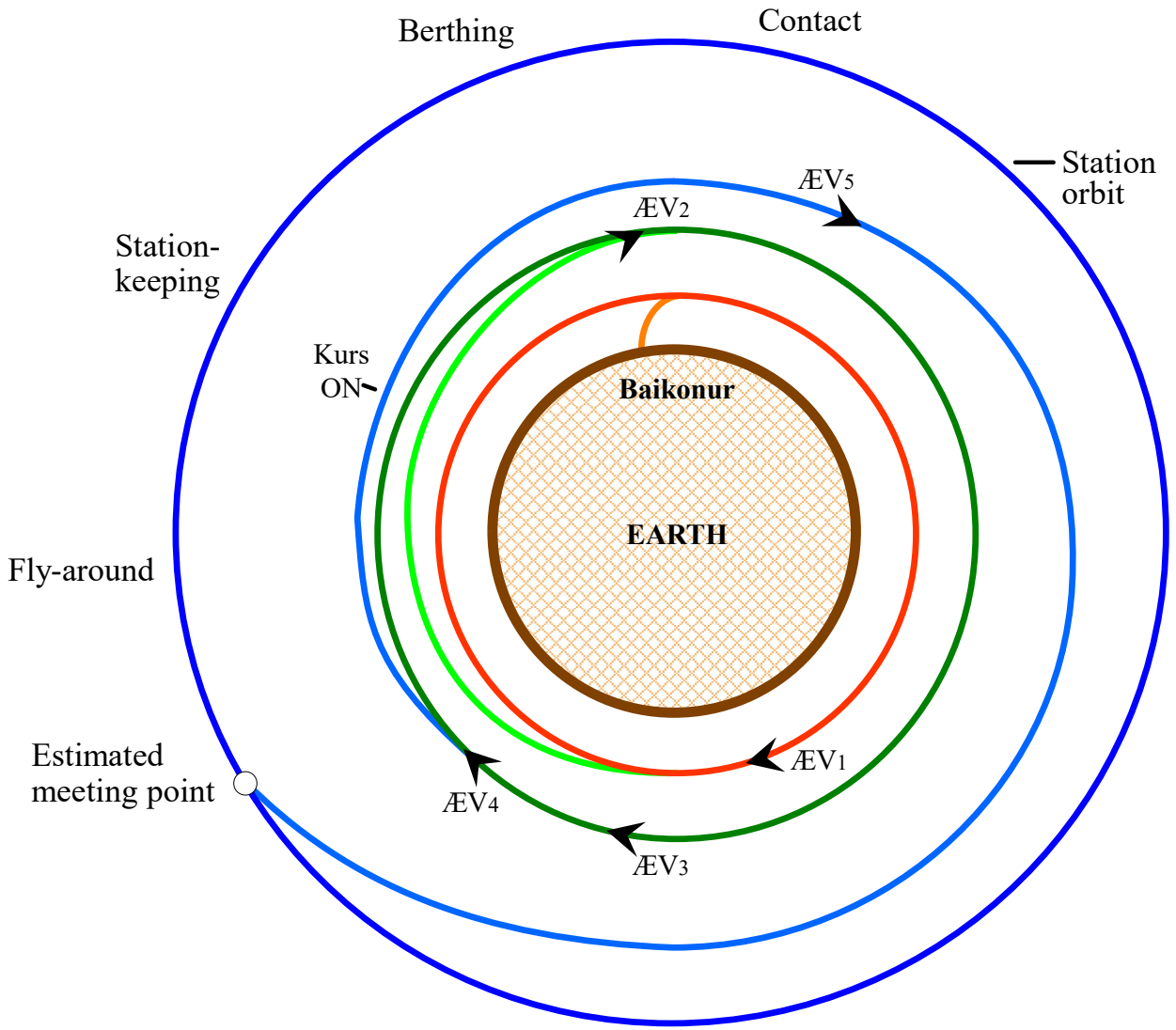


Rendezvous and Docking Scheme

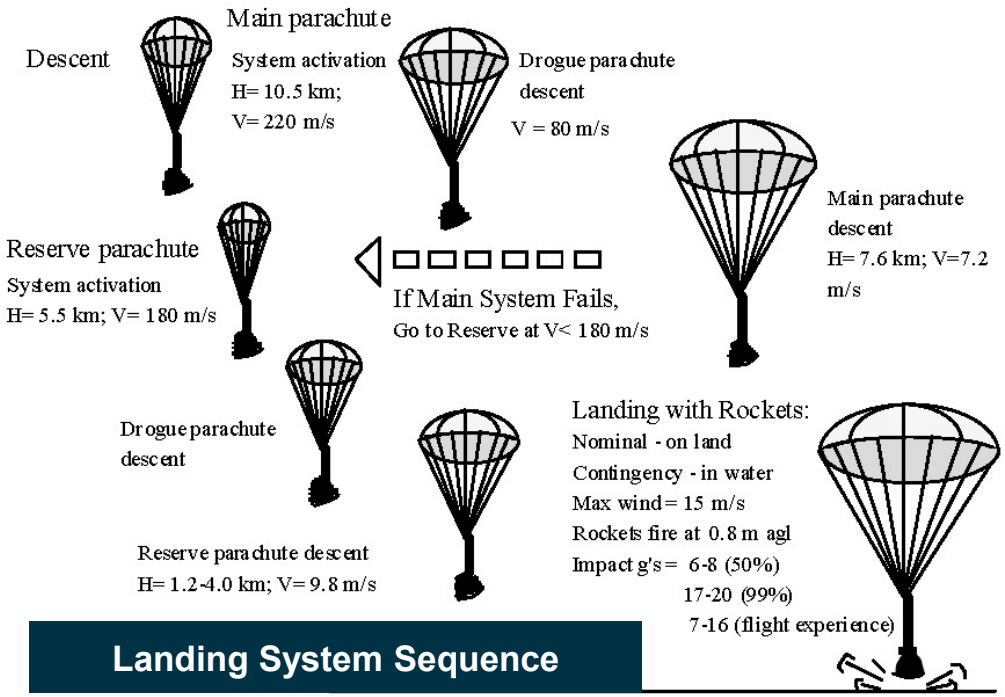
- ISS orbit ~400km above Earth
  - Launch ~9 minutes
  - Lower orbit ~220km above Earth
  - First set of impulses
  - Middle orbit ~300km above Earth
  - Second set of impulses
  - Dock with ISS

- Standard rendezvous
  = 2 days, 34 orbits
- Accelerated rendezvous
  = 6 hours, 4 orbits

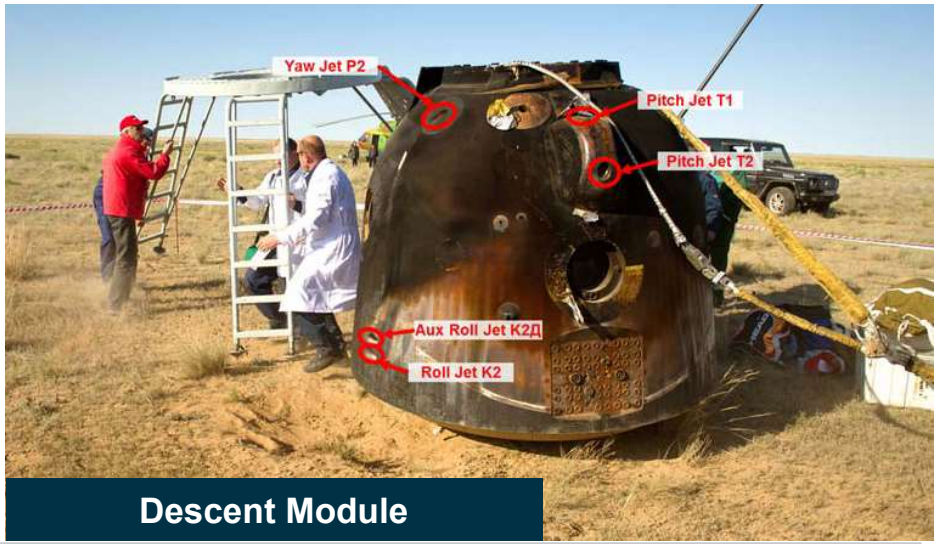
(not drawn to scale)



Coming Back Down to Earth



Landing System Sequence



Descent Module

Touring day

- 24/09/2019
  - Tuesday

- At Soyuz launch pad 2

Touring day

- 24/09/2019
  - Tuesday

- At Soyuz launch pad 2
  - The combustion pit

Touring day

- 24/09/2019
  - Tuesday

- At Soyuz launch pad 2
  - The exhaust trench.

Launch day

- 25/09/2019
  - Wednesday

	Time to launch
Crew wake up	9:00
Depart hotel	6:00
Arrive bldg. 254	5:15
Entry suit	4:30
Meeting family	3:30
Bus to launch	3:00
Report to State Commission	2:35
Elevator to Soyuz	2:25
Launch	0:00

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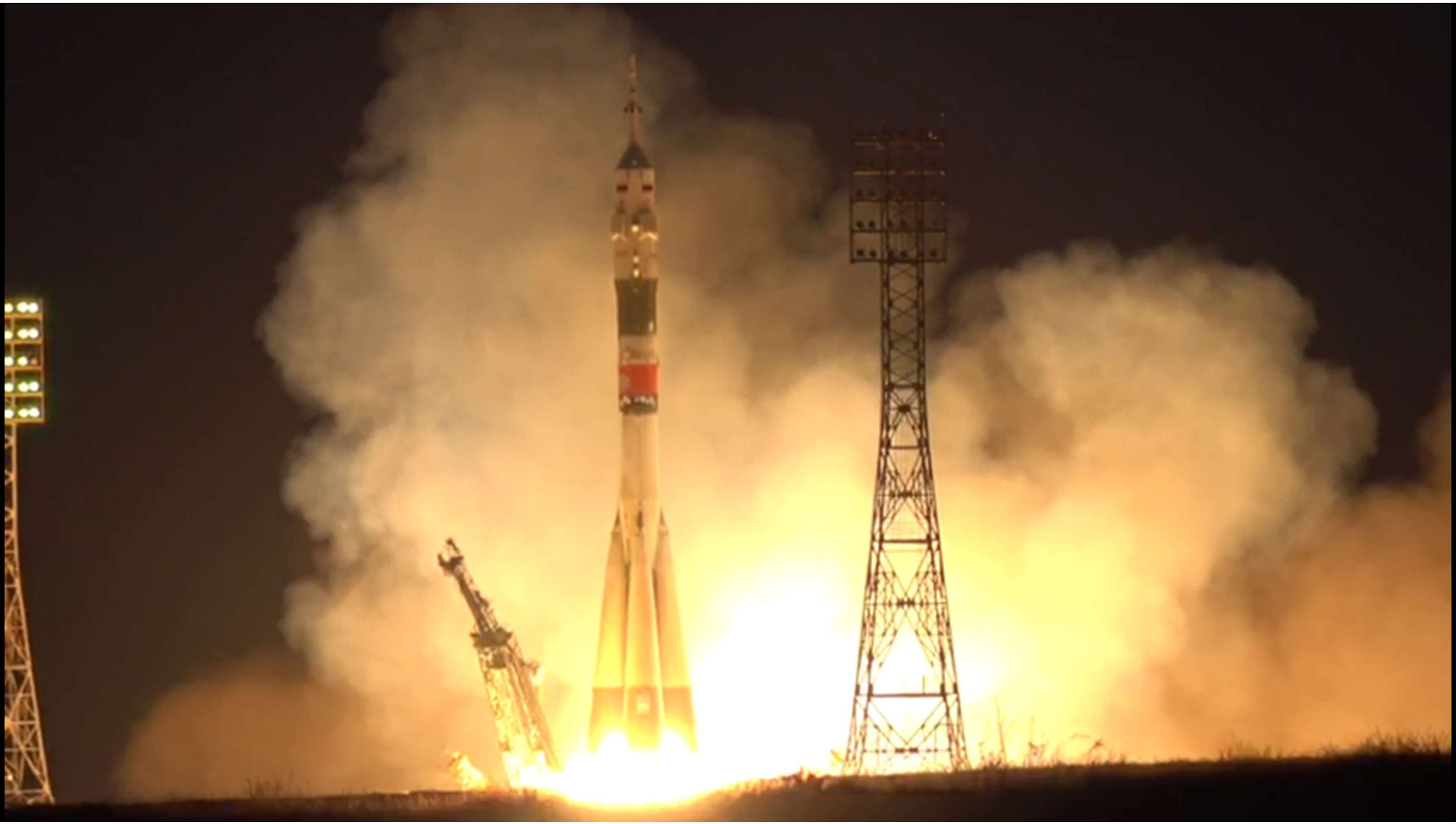

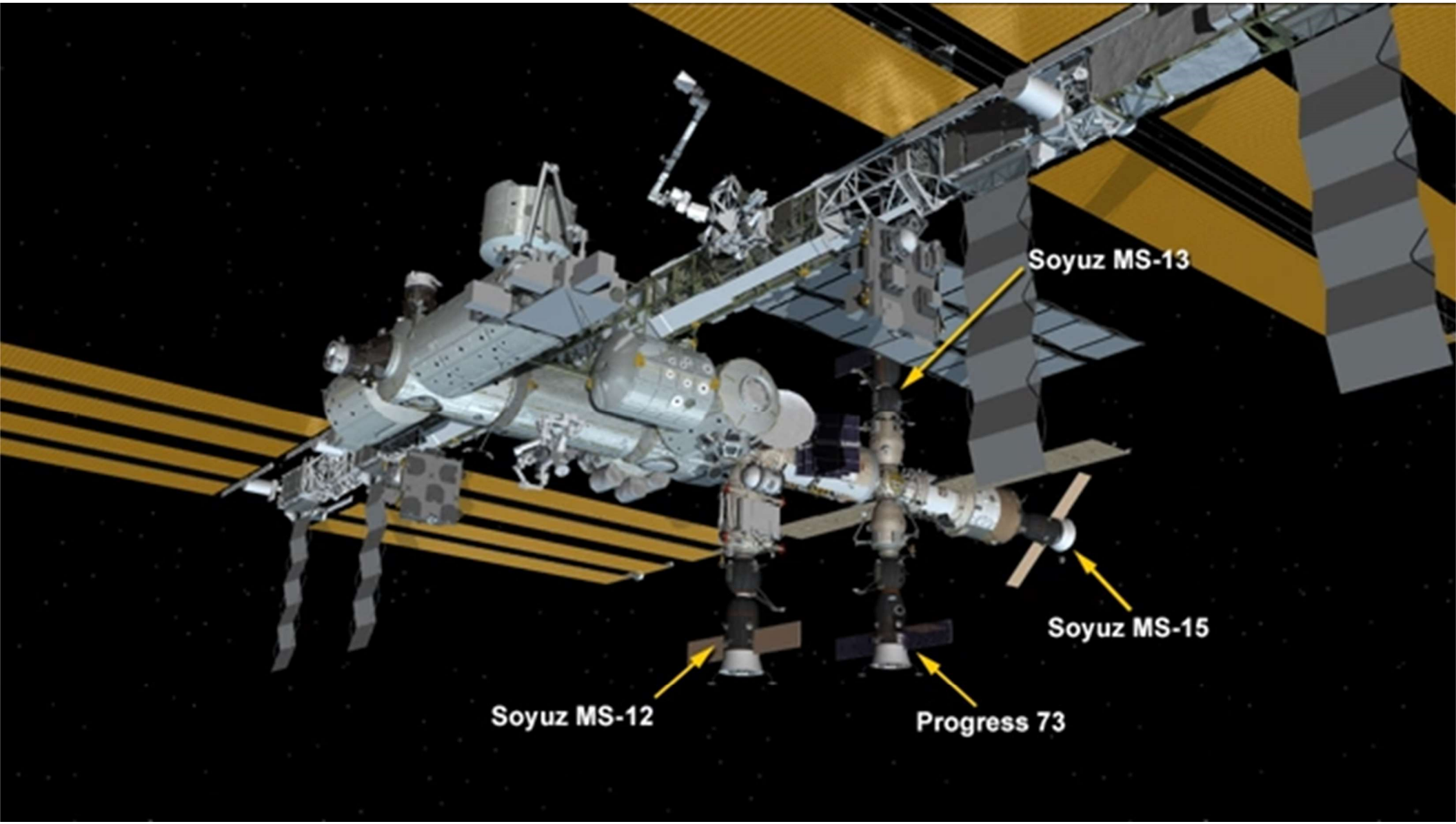
Soyuz MS-13
Soyuz MS-15
Soyuz MS-12
Progress 73


Ф44 СБЛИЖ
ОБЛЕТ
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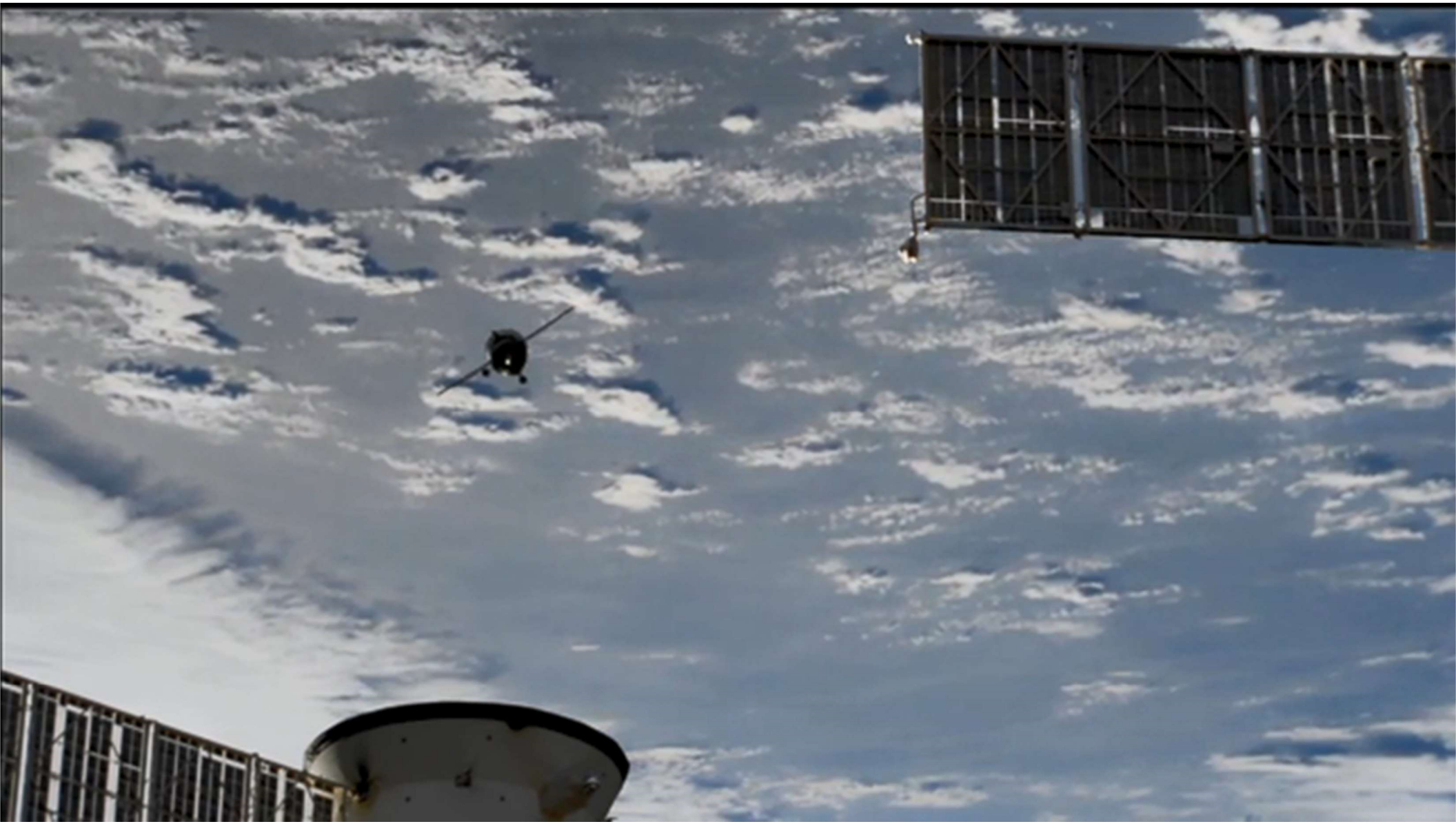
ГСО
1234
ДУС123
АСН1
К1 Б12
ЭАХВАТ
КУРС



The Morning after in the ISS

- 26/09/2019
  - Early morning
- Happy gathering
  - Live interview
- Are you at home?
  - sister asked.
- I am home,
  - she answered.

The All Female Space Walk

Questions to Jessica

- What's your favourite space food?
- Did you make any sacrifices to reach where you are today?
- What has been your favourite moment so far?
- What is your daily routine?
- How do you sleep in Space?
- What do you miss about Earth?
- How much fuel is used to get you to the ISS and back?
- Could you describe a space walk?
- What experiments are you doing and why?
- What does take-off feel like?

- Jessica answered –
  - Big hugs from space.
  - Avigayil – Teachers are the ones doing all the difficult work and inspiring the next generation of scientists and explorers, so thank you so much for all that you do! It is so important.
  - Hope I get to London once I get back down to Earth and can see all of you soon!
  - Meir – the kids usually ask better (and often harder!) questions than the adults.
- Then she answered most of your questions.