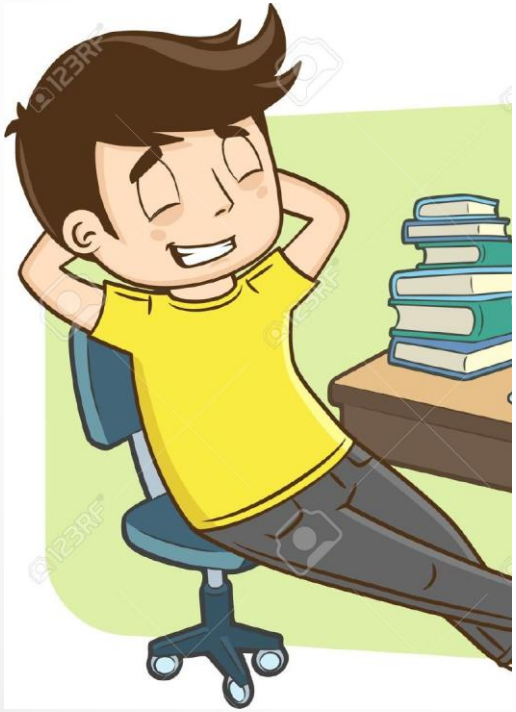
Reminiscences of an adventurous career in human spaceflight

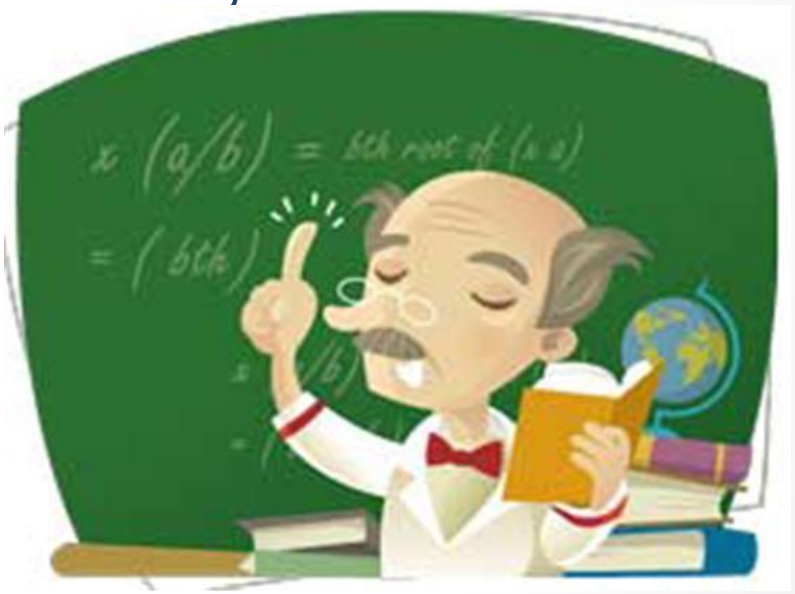
Dr James Kass

James R Kass, Space Consulting

The beginning of it all . . .

- 1962 – Chasing a Dream in Human Spaceflight
  - Shut your eyes and imagine yourself 20 years in the future and describe an exciting 10-minute slice of your work!

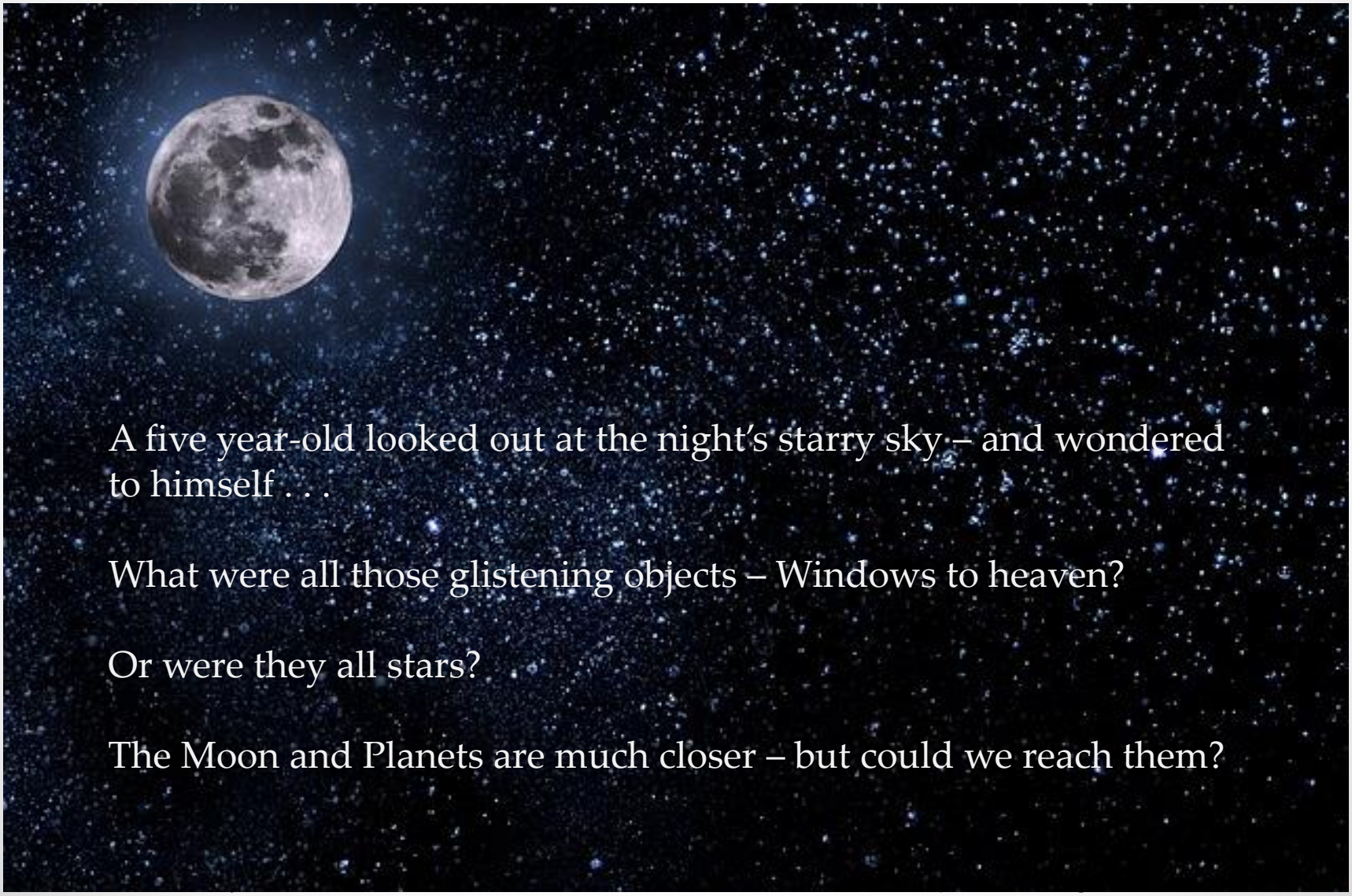




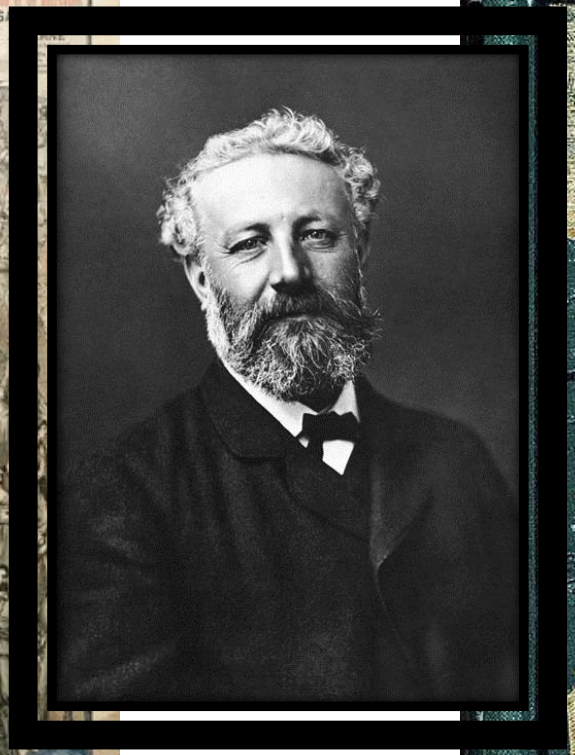
The beginning of it all . . .

- He then told the professor his dream . . .

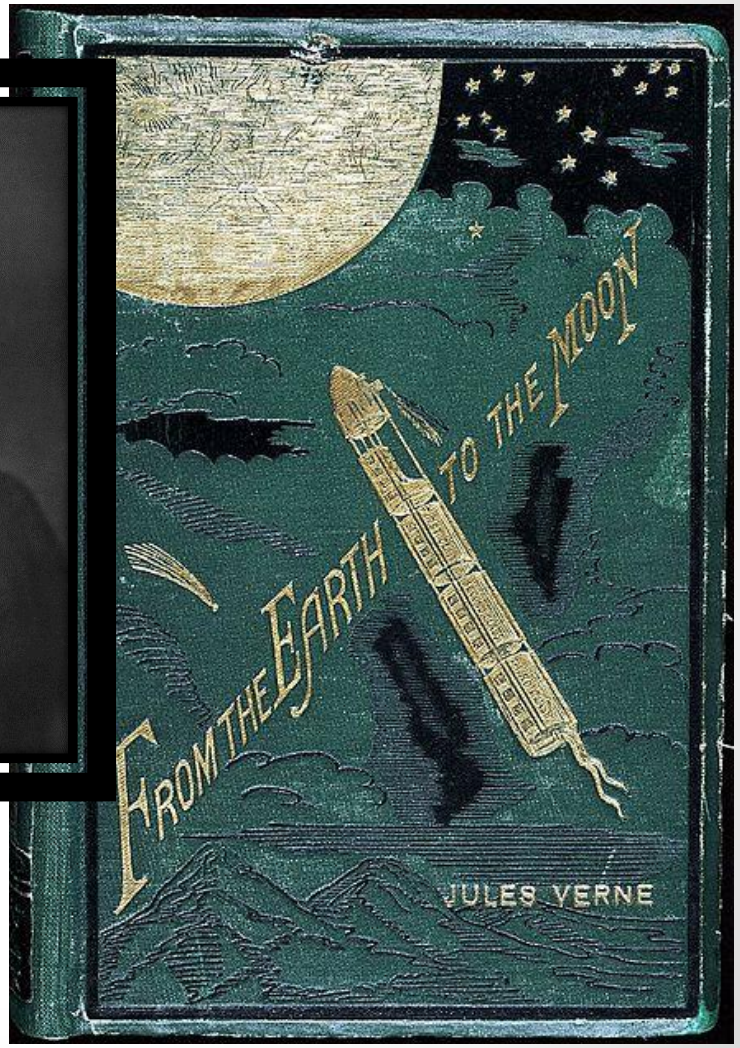
The beginning of the Dream . . .



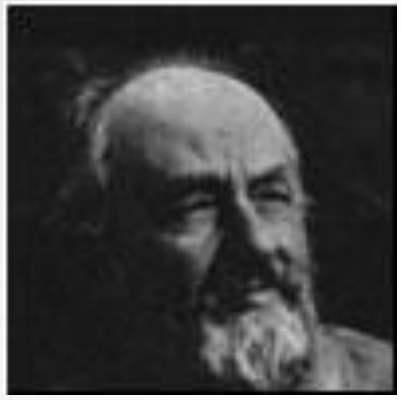
He later did some reading . . .



Jules Verne
1828-1905
(1865)



I was not alone to be inspired by Jules Verne . . .



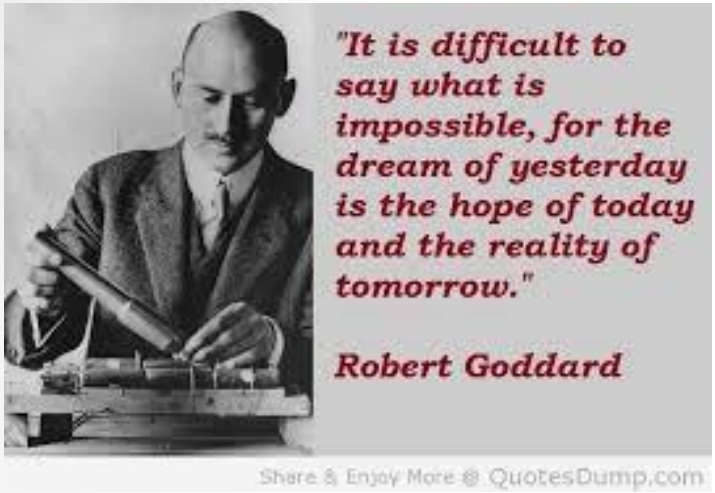
- **Konstantin Tsiolkovskiy**: 1857-1935 (Russia)
  - He was inspired by Jules Verne
  - first rockets ideas 1903-1914 with liquid-fueled propulsion
  - 1914: Tsiolkovsky's revolutionary work "Exploration of the World Space with Reaction Machines."

He also had dreams – Book: "Dreams of Earth and Sky"

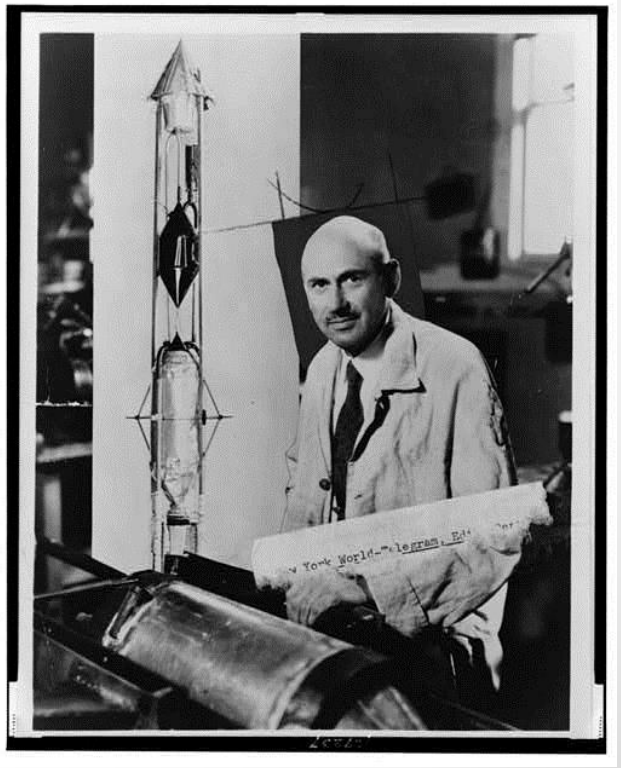
And wrote science fiction: "Na Lune" (On the Moon)

Human Spaceflight

I was not alone to be inspired by Jules Verne . . .



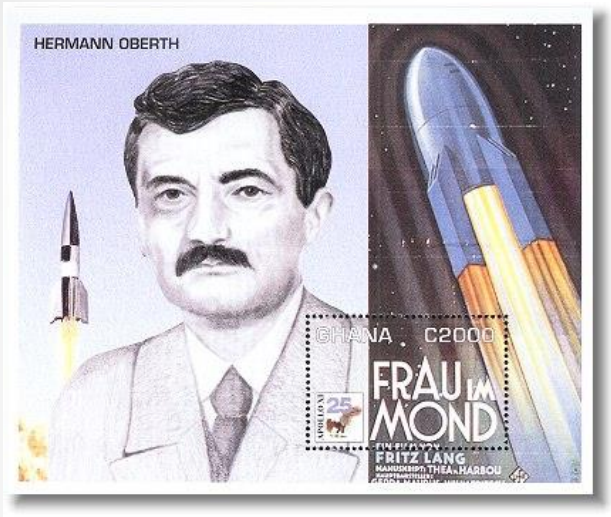
- **Robert Goddard**
  - 1882-1945 (USA)



- He built rockets from 1914;
- The first liquid-fuel rocket in 1926.
- His first proposition of getting to the Moon was ridiculed by the NY Times in 1920;
- When Apollo-11 successfully landed its first human payload on the Moon in 1969, NYT published an apology.

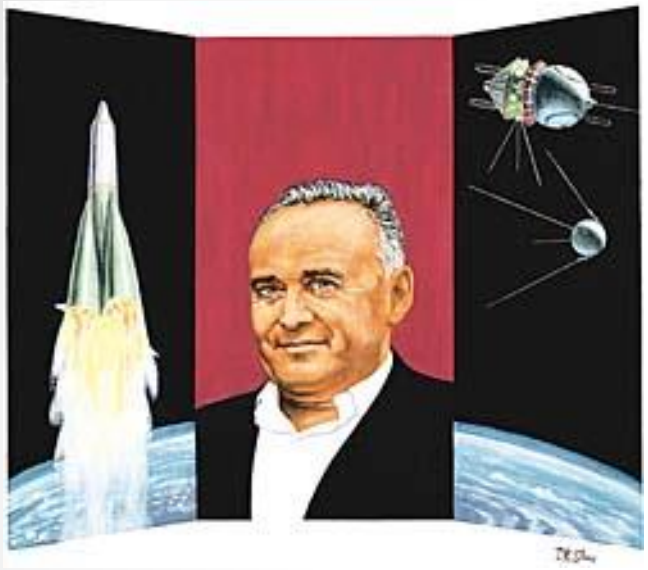
Human Spaceflight

I was not alone to be inspired by Jules Verne . . .

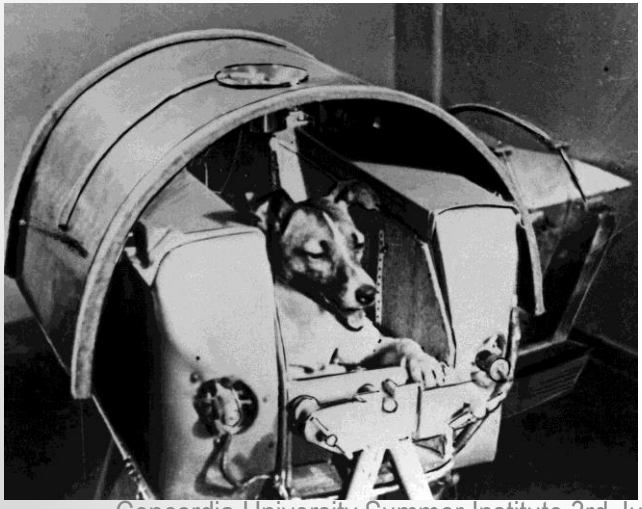


- **Hermann Oberth**
  - 1894-1989 (Transylvania, Germany)
  - Professor Hermann Oberth "the father of space flight,"
  - Wrote sci-fi; worked in Fritz Lang film "Frau im Mond" (lost an eye in the attempt to organize a rocket launch on same day as film premiere);
  - Wrote inspiring books, such as "The Rocket into Planetary Space"
  - WWII: German V2 developer with Wernher von Braun;
  - Postwar: Worked with his subordinate, Wernher von Braun for US gov on spaceflight;

Pioneers of modern spaceflight

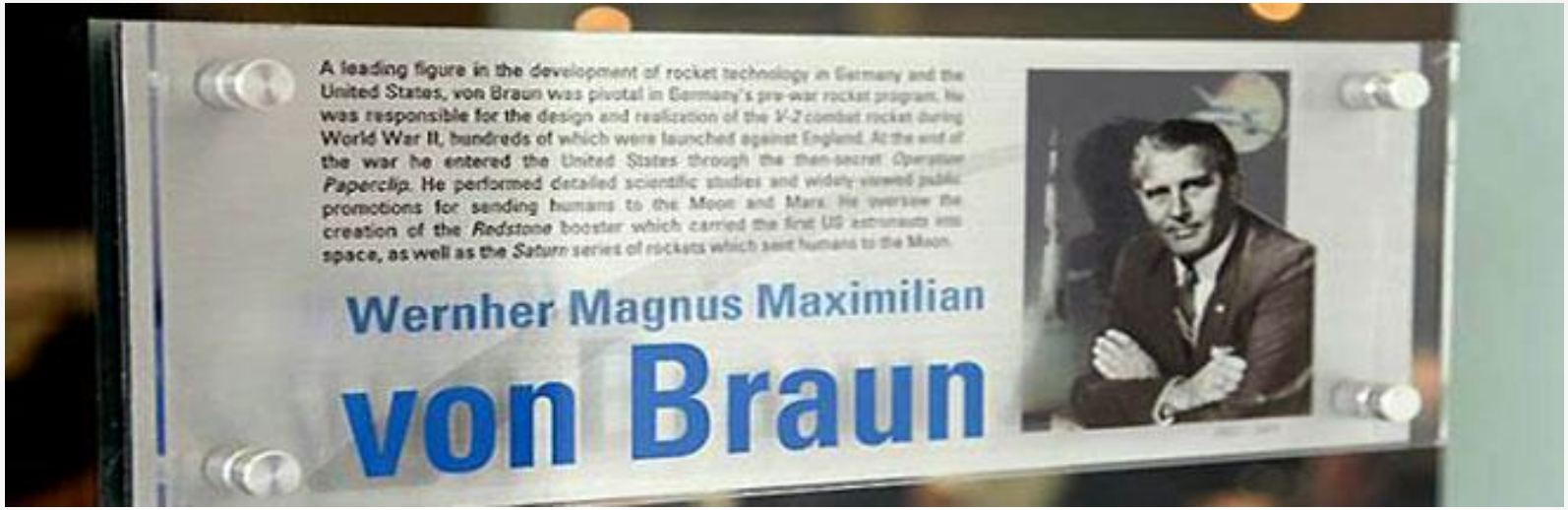


- **Sergei Koroliev**
  - 1907-1966 (Ukraine, Russia)
  - Chief designer for Soviet rocketry. Started in the 1930's.
  - After WWII V2 talent from Germany for a short time.
  - First ICBM world-wide developed in 1957.
  - First satellite launched Sputnik-1 1957.10.04



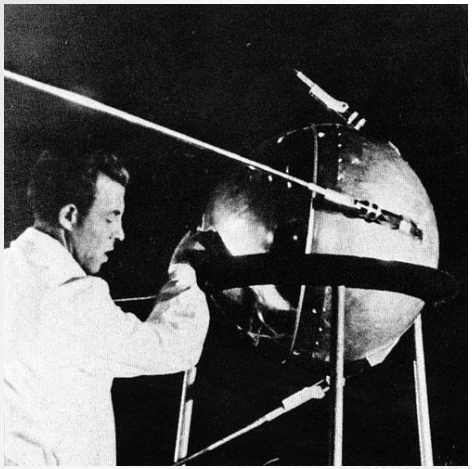
  - First animals in space: Dogs (not from the canine elite, but one of many stray dogs).
  - Leika (sub-orbital 1951), Belka & Strelka (Orbital, 1960).
  - First human in orbital space, Gagarin 1961.04.12;

Pioneers of modern spaceflight



- **Wernher von Braun**
  - 1912-1977 (Germany, USA)
  - He headed US space efforts to build the Saturn rocket at Redstone Arsenal
  - He was director of Marshall Space Flight Centre
  - He was named by Life magazine as one of the "100 Most Important Americans of the 20th Century," touting him as the man who "launched the greatest adventure of all, a journey to the Moon"

What kicked off the Dream?



Sputnik-1

(4-Oct-1957)

Oh little Sputnik flying high
With made-in-Moscow beep,
You tell the world it's a Commie sky
and Uncle Sam's asleep.

You say on fairway and on rough
The Kremlin knows it all,
We hope our golfer knows enough
To get us on the ball.

Mennen-Williams (Mich. USA)

"All the News That's Fit to Print"

The New York Times.

LATE CITY EDITION

SOVIET FIRES EARTH SATELLITE INTO SPACE; IT IS CIRCLING THE GLOBE AT 18,000 M. P. H.; SPHERE TRACKED IN 4 CROSSINGS OVER U. S.

HOFFA IS ELECTED TEAMSTERS HEAD; WARNS OF BATTLE

COURSE RECORDED

Navy Picks Up Radio Signals—4 Report Sighting Device

500 MILES HIGH

Visible With Simple Binoculars, Moscow Statement Says

Device Is 8 Times Heavier Than One Planned by U.S.

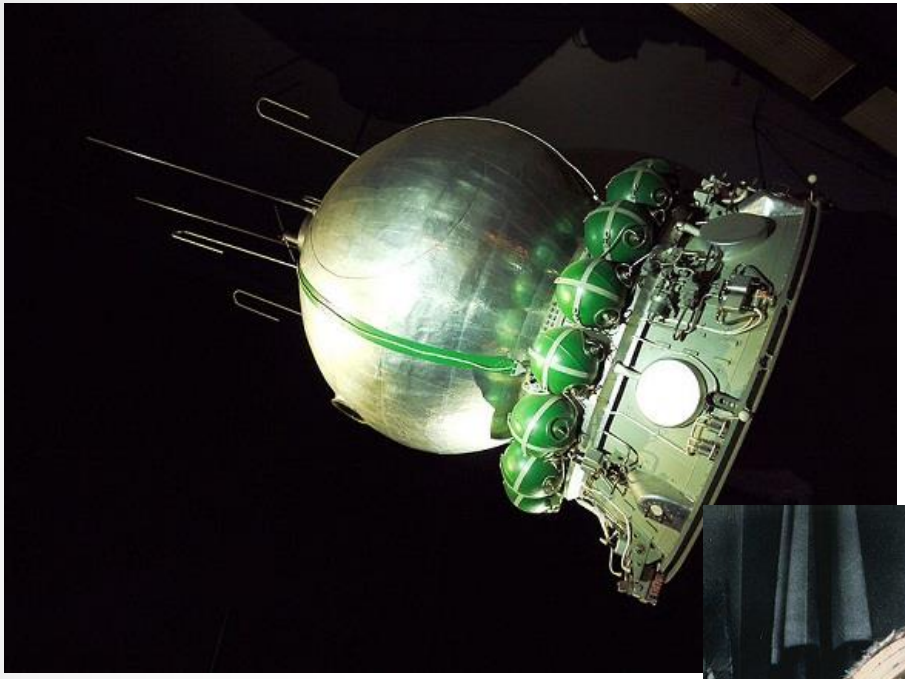
ALIBIS COMPARES HIS STAND TO LEE'S

ARGENTINA TAKES EMERGENCY STEPS

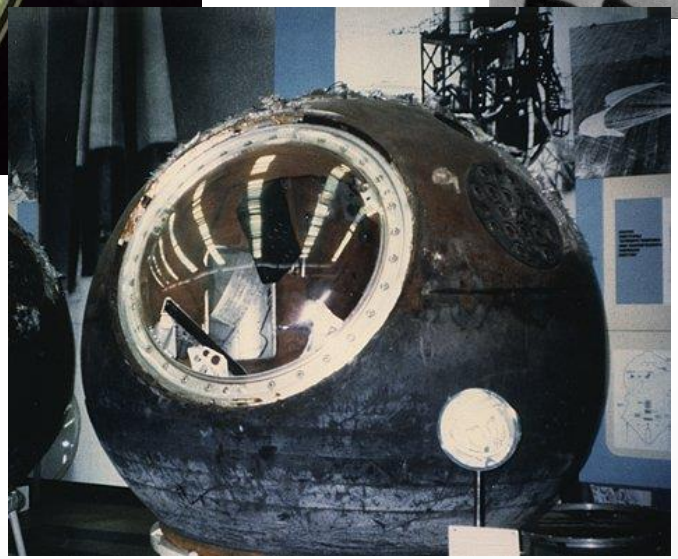
SATELLITE SIGNAL

What kicked off the Dream?

Yuri Gagarin – first man in space



12 April 1961



Meanwhile the Americans were not sleeping . . .

- One of the greatest endeavours of humankind was undertaken.
- A string of successes followed:
  - First US satellite “Explorer-1” Jan-1958.
  - First US man in space (sub-orbital), 1961.07.21 (Alan Shepard, Mercury)
  - First US man in orbital space, John Glenn, 1962.02.20 + and oldest 1998 (77)

Meanwhile the Americans were not sleeping . . .

- More successes followed
  - First manned orbit of the Moon, 1968 (Saturn 5)
  - First manned landing on the Moon, 1969.07 (Apollo) (Neil Armstrong, Buz Aldrin; later John Young – SL-1
  - 8 years after Kennedy's promise to land a man on the Moon before the decade was out – the promise was fulfilled in good time!
- And a little later:
  - Skylab (Owen Gariott, Ed Gibson, Jack Lousma, 1973-1979
  - Space Shuttle (1981-2011)
- But we are getting ahead of ourselves
  - now back to Earth to SGWU I 1962 . . .

And back to the Interview in Montreal in 1962
Career Stage-I: Physics

- I explain my dream
- I receive wise advice
- The die is cast
- I start the long and arduous study of the mother of all science – **natural philosophy** . . .
- Otherwise known as **Physics**
  - And Mathematics – a so-called double-major

And back to the Interview in Montreal in 1962
Career Stage-I: Physics

- SGWU: Physics & Math - BSc
- University of Michigan – Ann Arbor: Physics - MS
  - Opportunities, challenges, and obstacles
- University of Leeds: PhD Physics:
  - A search for the building blocks of matter using the largest cloud chamber in the world.
  - Trying to find quarks in Cosmic rays
  - Combining WWII equipment and new technology to do the job

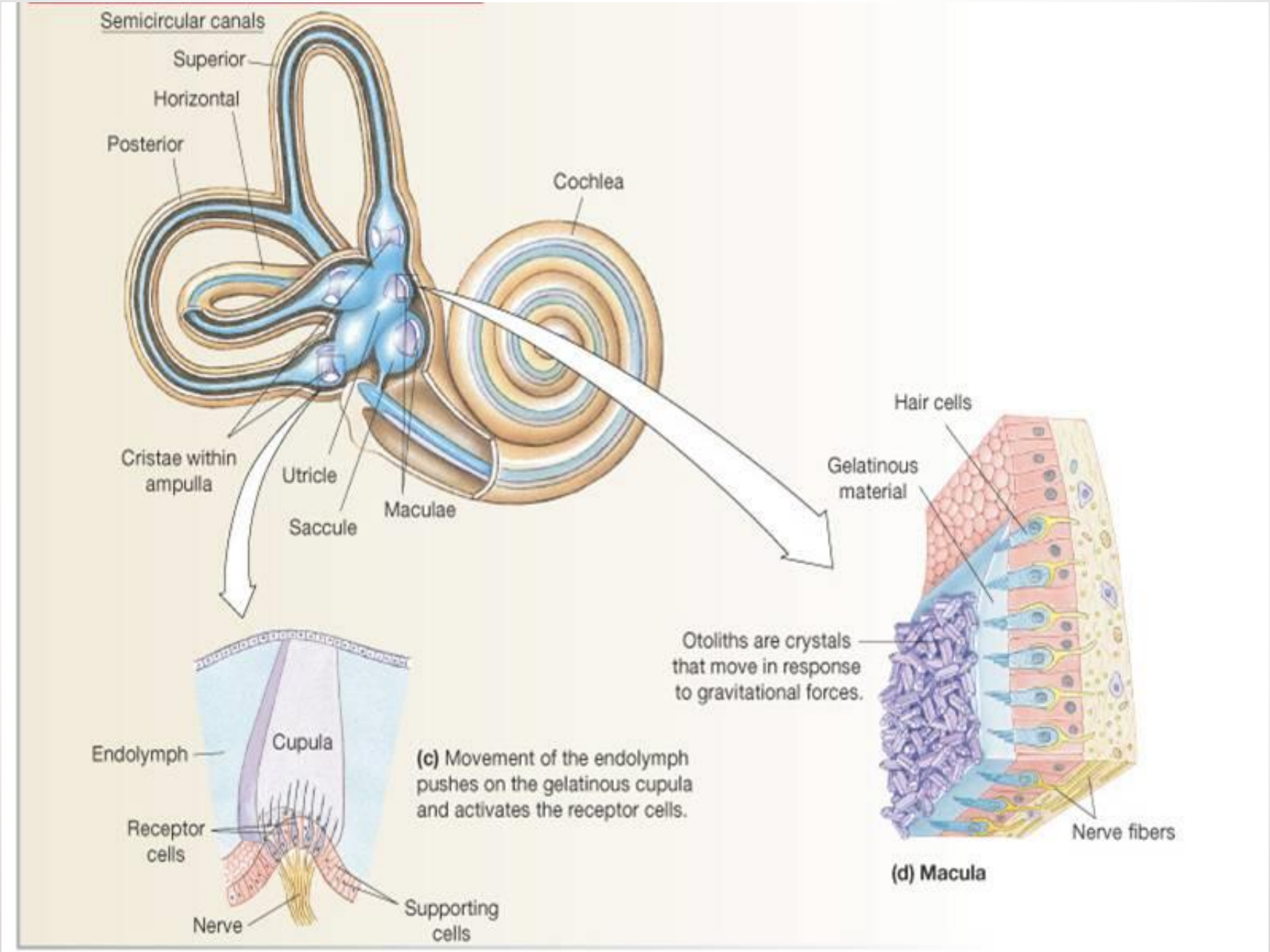
Career Stage-II
Neuro-physiology, Sensory Perception & Human Spaceflight

- Exit from nuclear physics and on to a new phase:
  - The physics of the human body: Physiology

My first day of 'work' . . .
The "Weightlessness" Laboratory

Career Stage-II
Neuro-physiology, Sensory Perception & Human Spaceflight

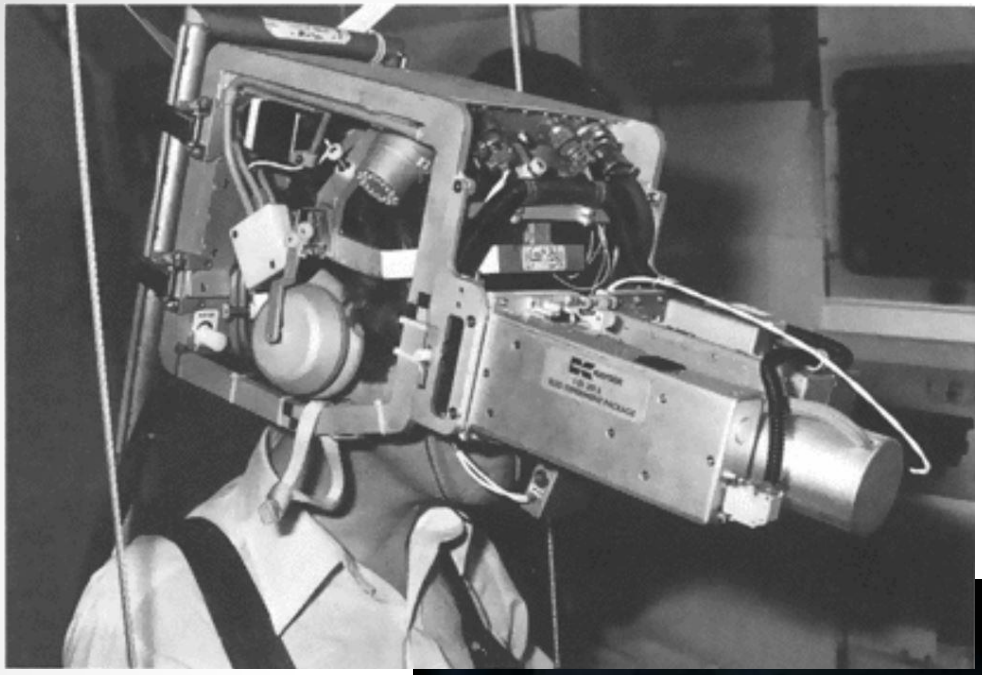
- New stage: Neurophysiology
  - Understanding our senses of orientation & motion
  - Motion sickness
  - Semi-circular canals and otoliths


Semicircular canals
Superior
Horizontal
Posterior
Cochlea
Cristae within ampulla
Utricle
Saccule
Maculae
Hair cells
Gelatinous material
Otoliths are crystals that move in response to gravitational forces.
Nerve fibers
(d) Macula
Endolymph
Cupula
Receptor cells
Nerve
Supporting cells
(c) Movement of the endolymph pushes on the gelatinous cupula and activates the receptor cells.

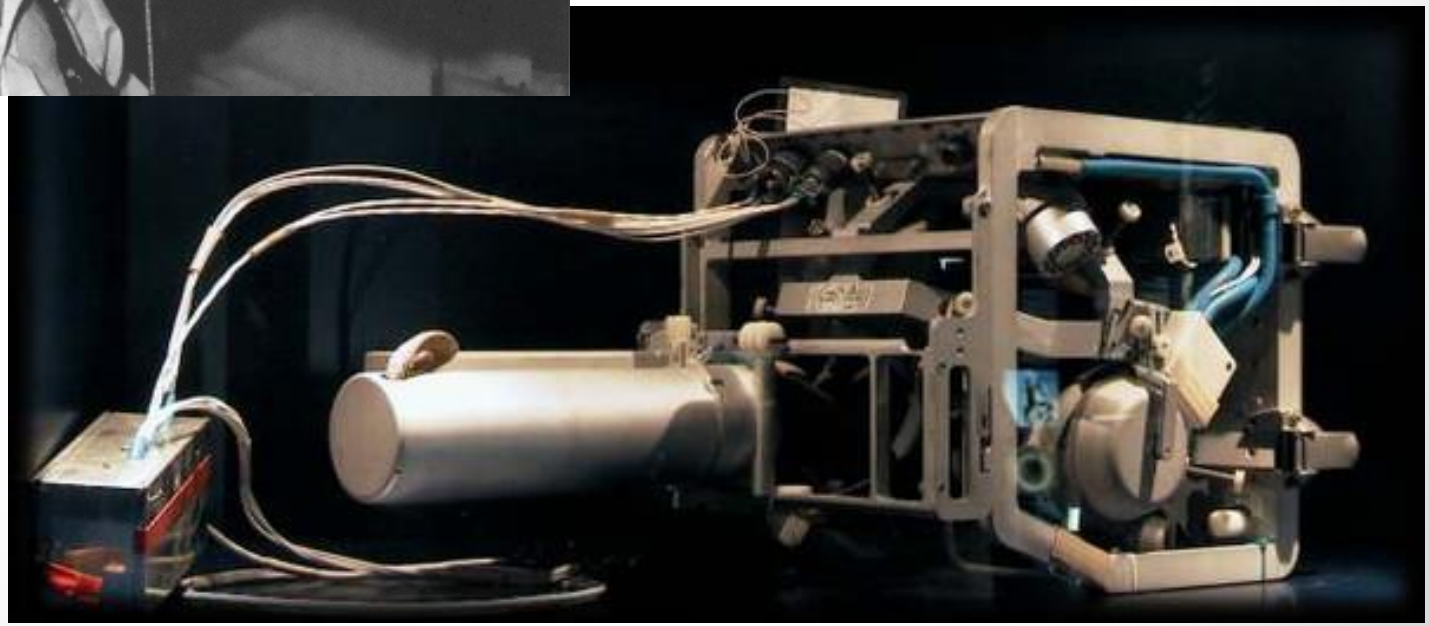
Career Stage-II
Neuro-physiology, Sensory Perception & Human Spaceflight

- Preparing for the First Spacelab mission
- Organizing the collaboration of European scientists Vis-à-vis our American counterparts
- The Human Sled
- The Vestibular Helmet
- Parabolic flight,
- Neutral Buoyancy
- Speeding ambulance in an air field
- A weightless training facility

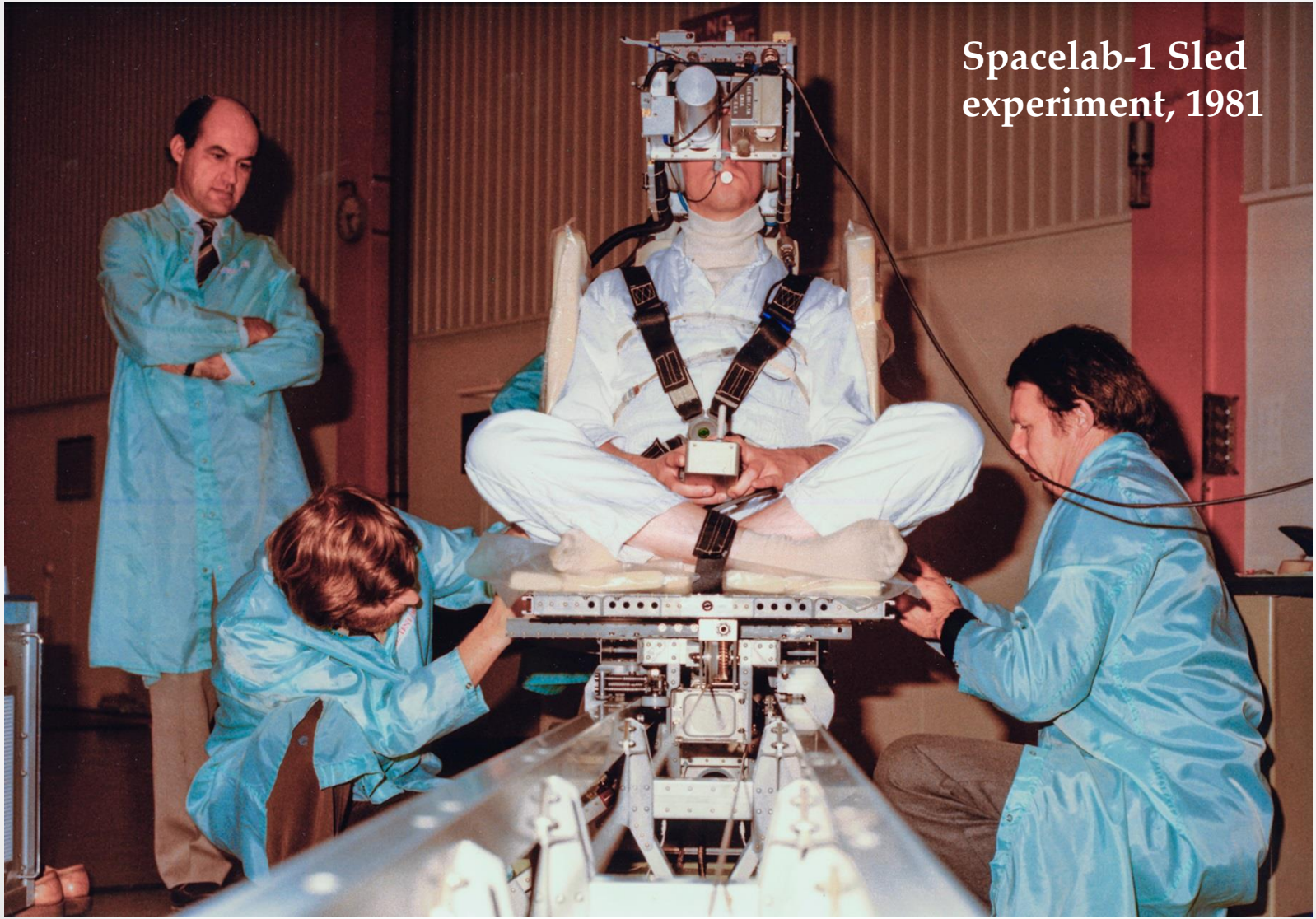
Human Spaceflight



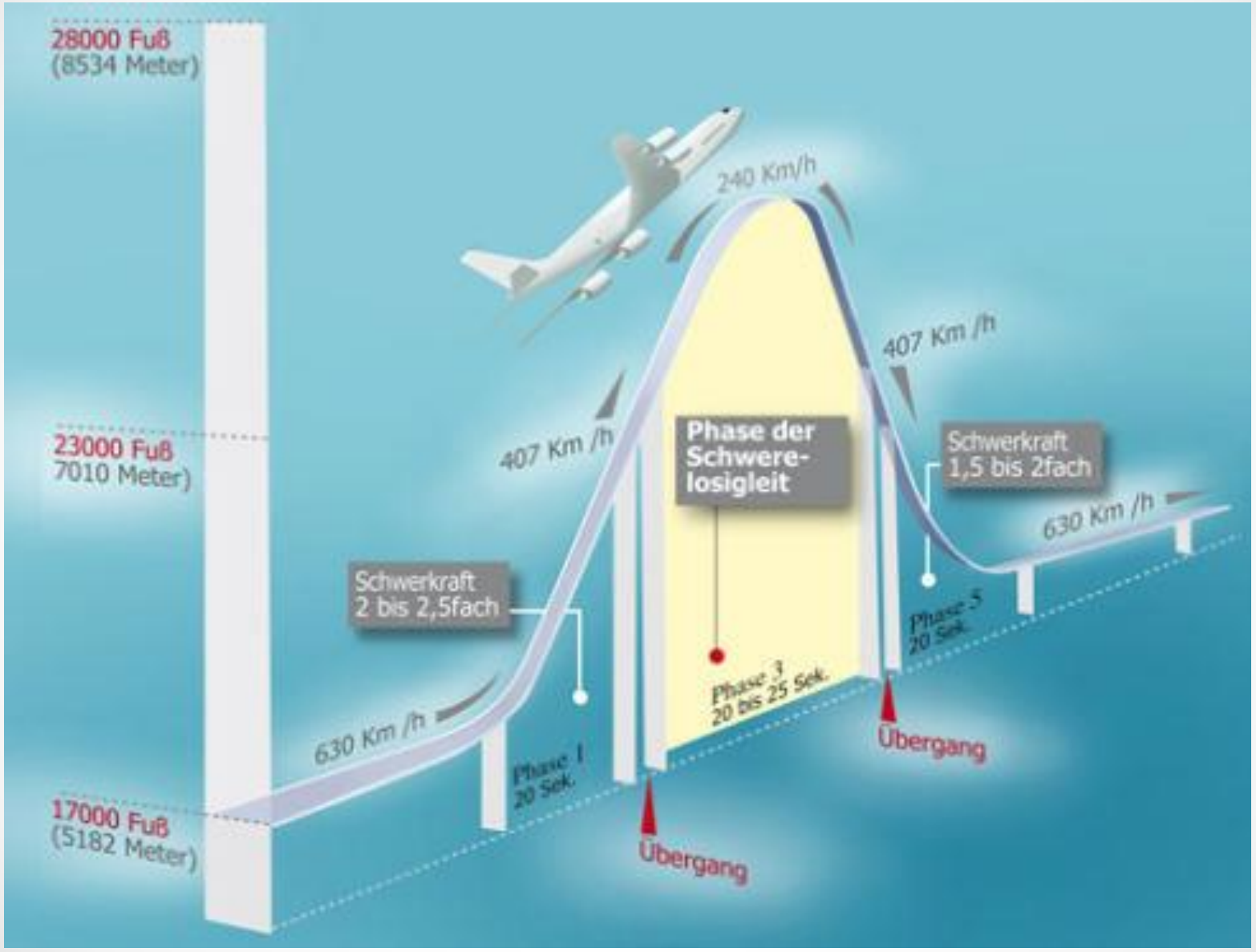
Vestibular Helmet



Human Spaceflight



Human Spaceflight



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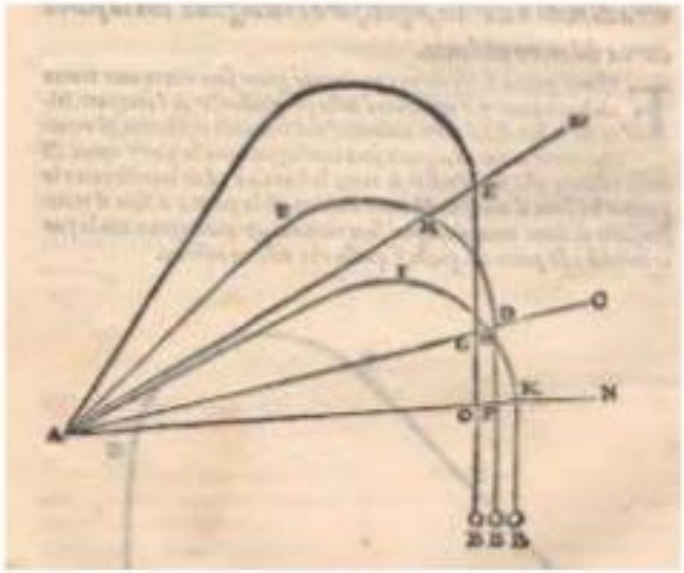
History of Ballistics [Galileo's period]

Galileo's role in Ballistics is prominent at ages, which centres around a basic statement of projectiles later led to "Ballistics Theory".

"When a projectile is carried in motion compounded from equable horizontal and from naturally accelerated downward [motions], it describes a semi-parabolic line in its movement."

-Galileo Galilei



In fact not quite a parabola . . .

Human Spaceflight

NASA-KC135

CNES Caravelle

Human Spaceflight

And 20 years later – the Dream begins to comes true

- I finally landed in the magic place of my dreams - NASA
  - Marshall space flight centre – MSFC (Redstone Arsenal)
  - Kennedy Spaceflight Centre – KSC
  - Dryden Spaceflight (Edwards Air Force Base)
  - Johnson Spaceflight Centre (Houston)

1982 - 20 years later - the Dream comes true

4 crew on Spacelab-1 with whom I worked:

- Owen Garriott
- Ulf Merbold
- Bob Parker
- Byron Lichtenberg
- NASA clip
- Candid clip

From academia to space industry

- Leaving the Ivory Tower
- A proposal competing against six major space consortia
- Door to the East – Russia
- MIR 97

Russian Ilyushin - Ilyushin parabolic flight

Ilyushin flight video clips

MIR 97

Reinhold Ewald,
(Jerry Linenger),
Vasily Tsibliev,
Aleksandr Lazutkin

MIR Adventures

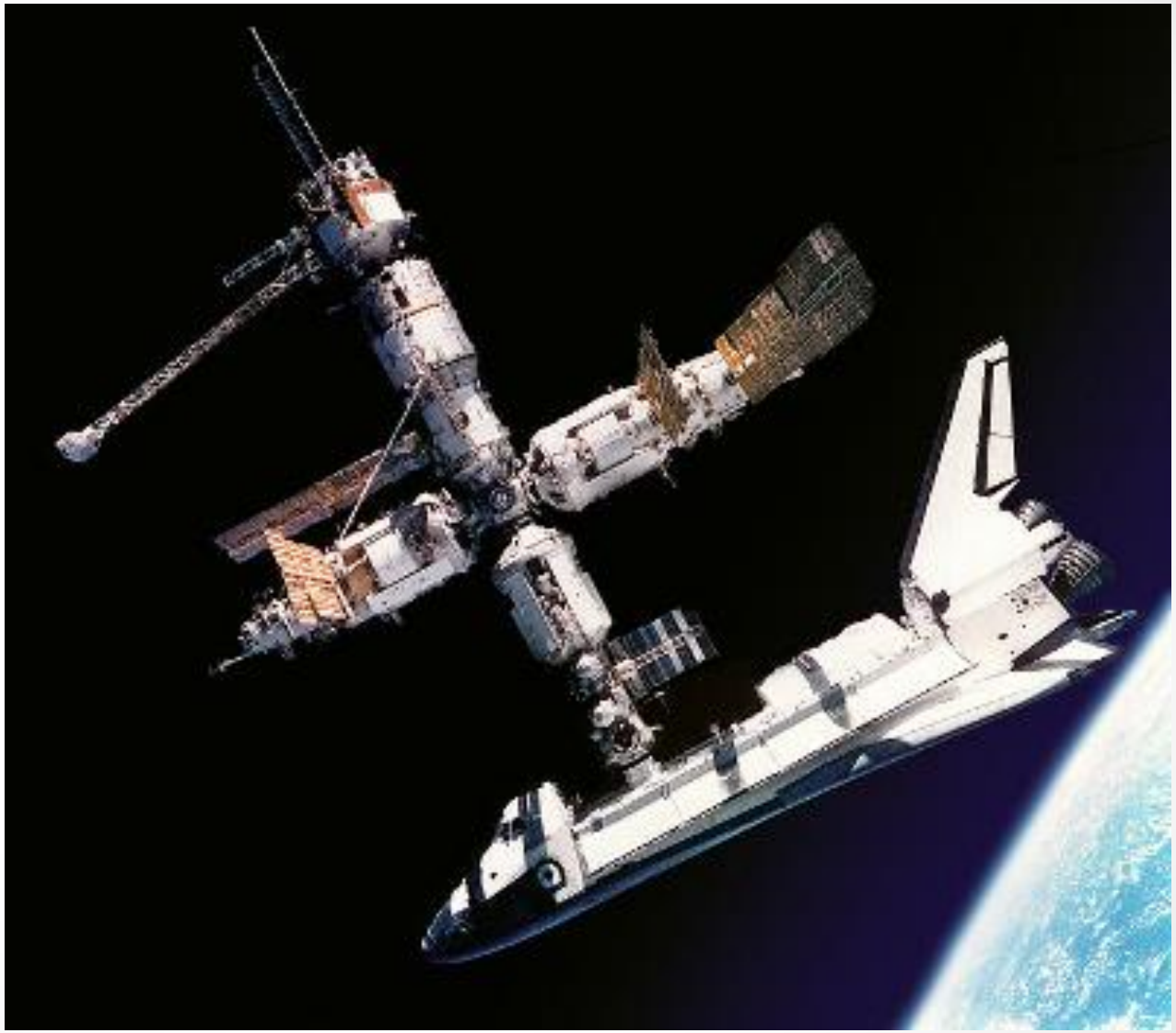
- Medex
  - Medex was a portable physiological laboratory for measuring various vital physiological functions of the human body, with the capability of being remote controlled. The project was supported by the German space agency and the facility flew on MIR-97, in 1997.
  - I supported the cosmonaut training and operations during spaceflight.
- MIR 97
  - By February 10, company was coming. Soyuz TM-25 launched from Baikonur, carrying the Mir-23 crew of **Vasily Tsibliev** and **Aleksandr Lazutkin**, and German astronaut **Reinhold Ewald** (10 February to 2 March 1997). Ewald would spend 20 days on Mir, performing experiments, and would return to Earth with the Mir-22 crew.
  - On February 11, NASA's Space Sh[Medex, a physiological laboratory: from spaceflight to terrestrial applications]ace, with seven astronauts onboard, on a mission unrelated to the Shuttle-Mir [illegible] **Earth orbit tied a record for the most humans in orbit at one time**.
  - **Jerry Linenger** on MIR 12-Jan-May 24 1997 (first American to space walk in a foreign space vehicle.
- Fire
  - A fire broke out during NASA-4 MIR (12-Jan – 24-May) with **Jerry Linenger** on board as well as Reinhold Ewald.
- Collision
  - Decompression – **Spektra**
- Difficulties & Accidents on MIR
  - A collision occurred later during NASA-5 MIR (15-May – 6-Oct 1997) with British/American **Michael Foale** on board. https://youtu.be/tM7fTLLmgbk

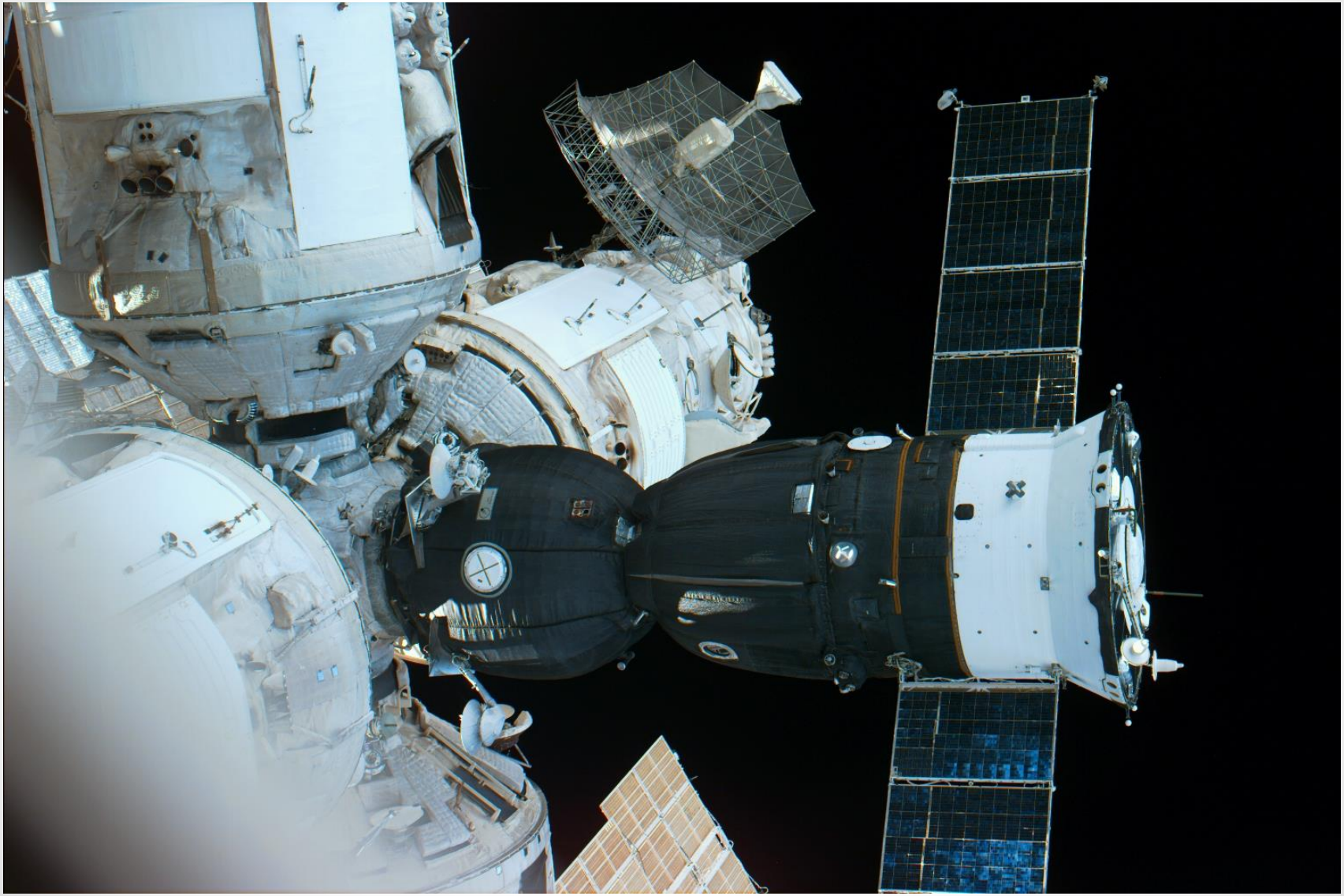

MIR Station
Complex 1998

Damaged Spektra and solar array

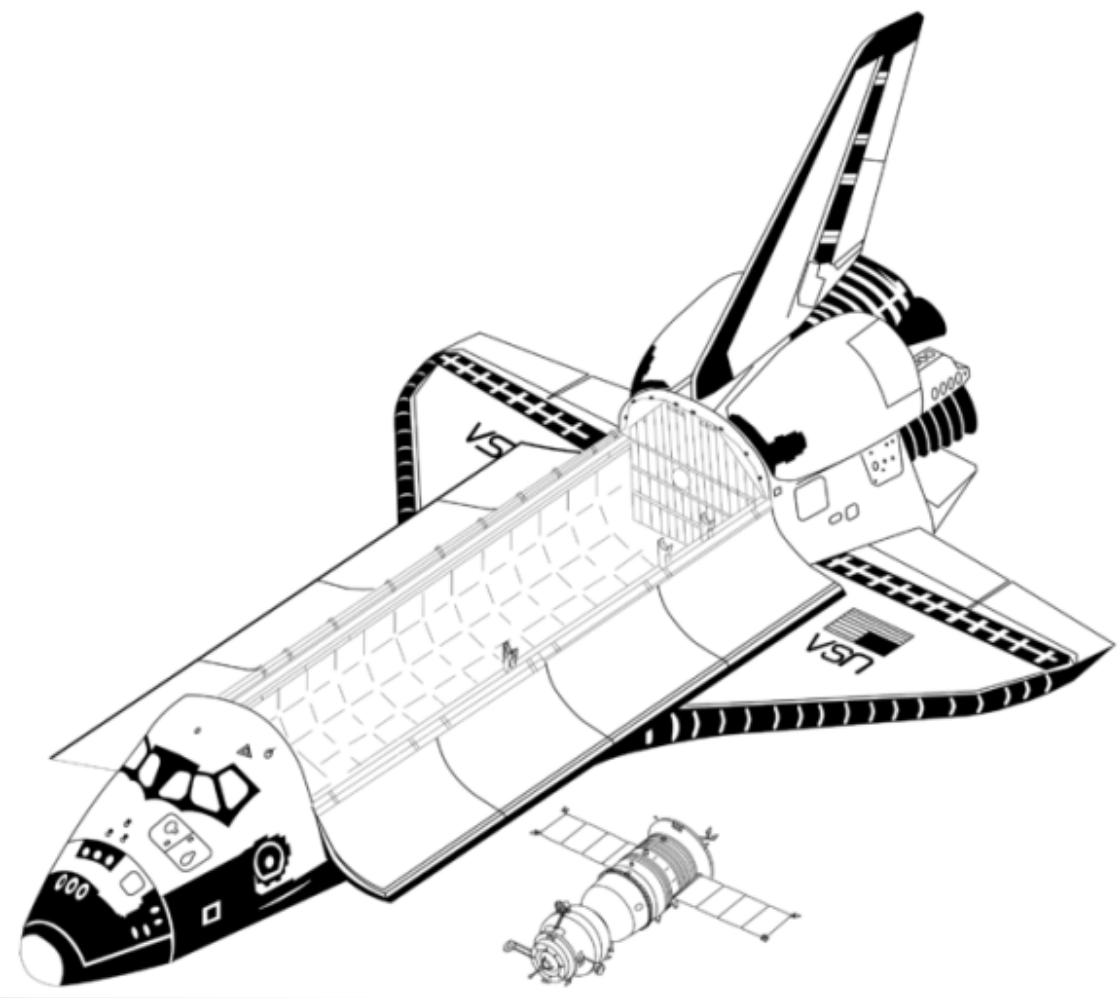
Human Spaceflight

MIR Station with Space Shuttle docked





Human Spaceflight



Comparing Soyuz and Shuttle!

2003

- Back on the Space Shuttle Columbia
- And a terrible end

The STS-107 crew, clockwise from top: Mission Specialist Kalpana Chawla, Commander Rick Husband, Mission Specialists Laurel Clark and David Brown, Pilot Willie McCool, Payload Specialist Ilan Ramon and Payload Commander Michael Anderson.

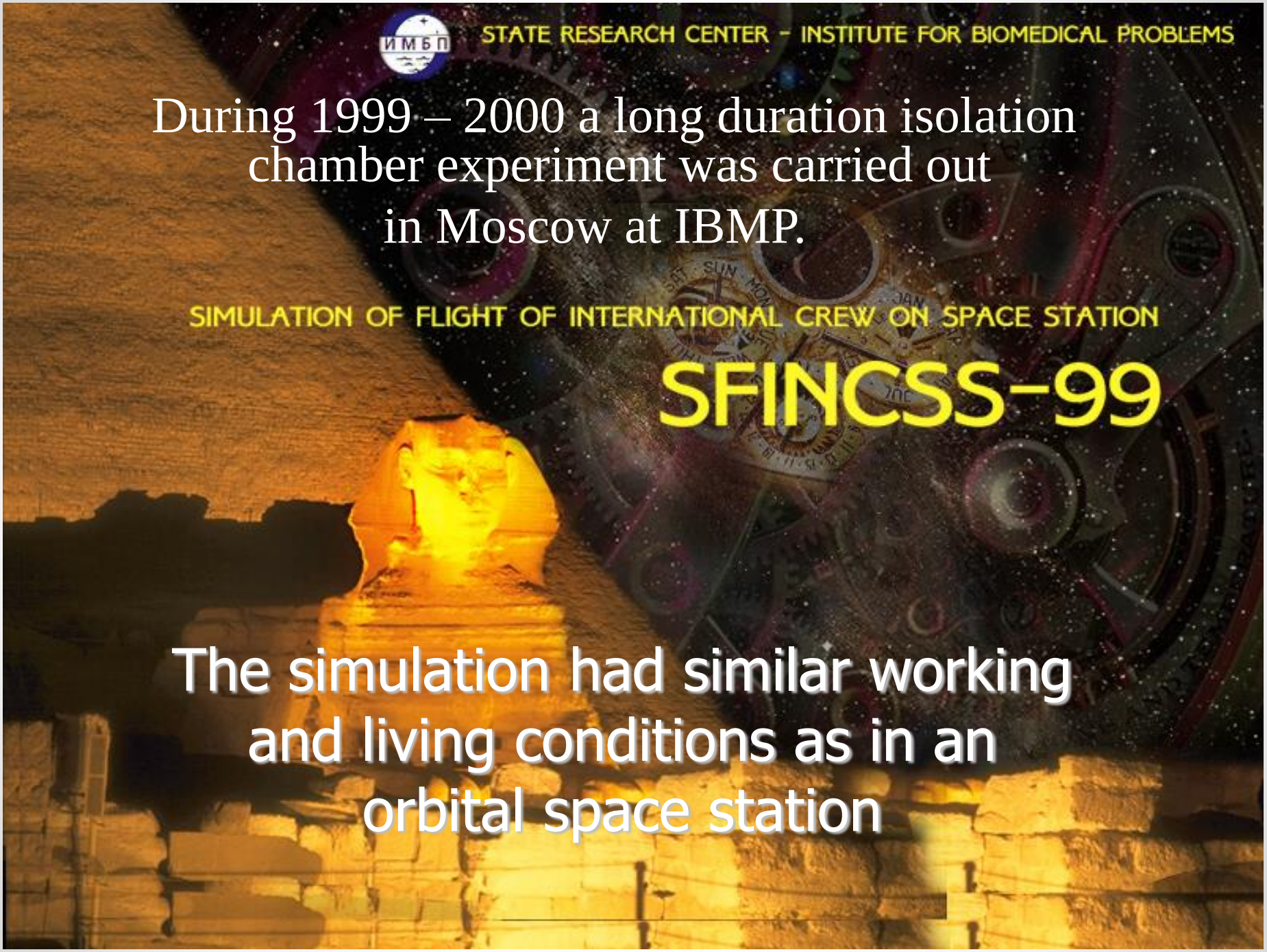
The Future

- Spaceflight whither to?
- Moving forward after difficult times
- Learning Lessons from the past

Dawn of a new space age

Dawn of a new space age

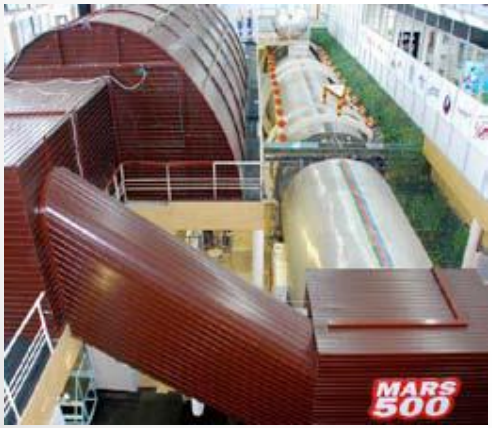
- And on to the Moon (again) and Mars?
  - Why Mars?
  - How can we prepare?

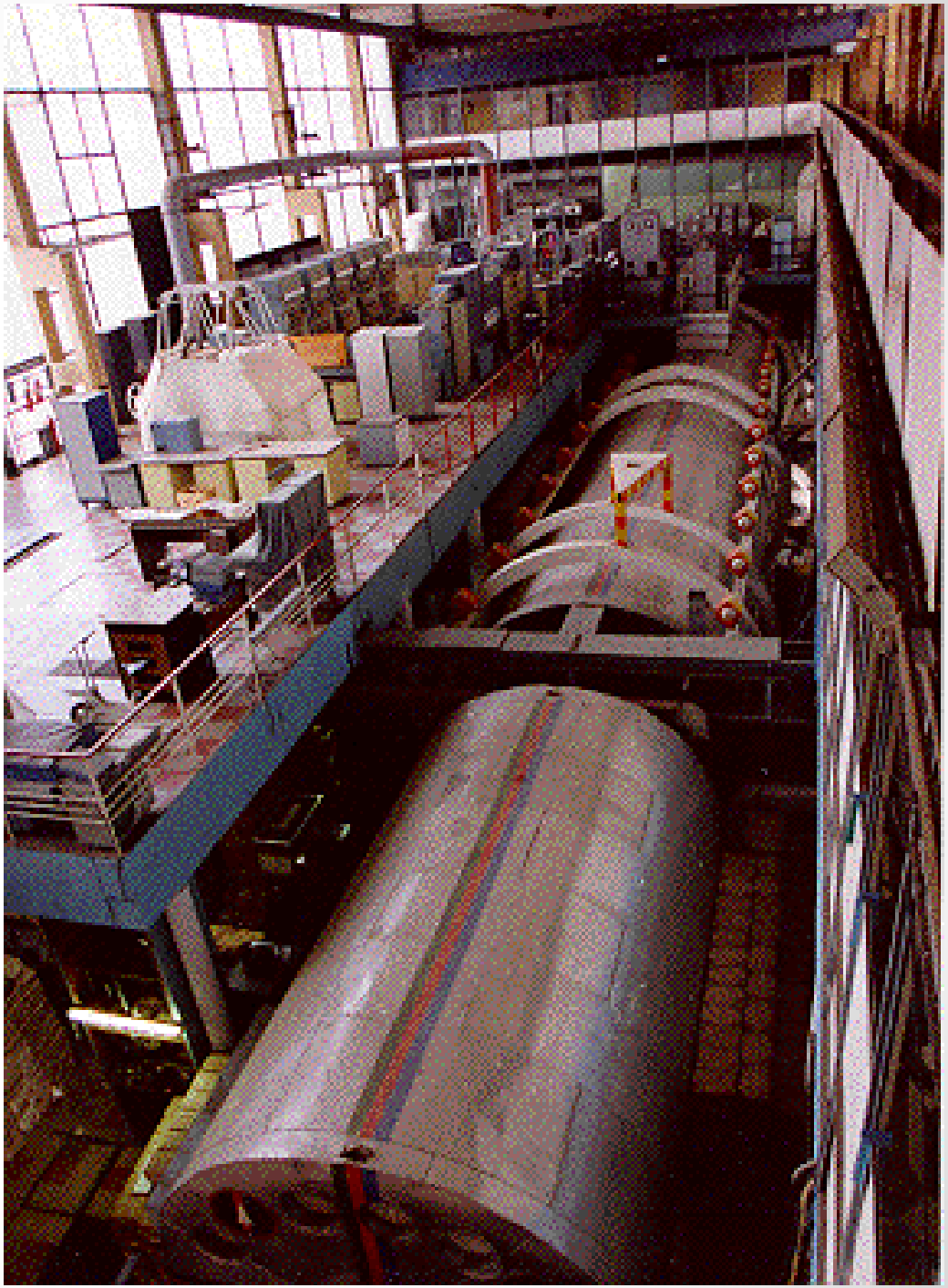

ИМБП
STATE RESEARCH CENTER - INSTITUTE FOR BIOMEDICAL PROBLEMS
During 1999 – 2000 a long duration isolation chamber experiment was carried out in Moscow at IBMP.
SIMULATION OF FLIGHT OF INTERNATIONAL CREW ON SPACE STATION
SFINCSS-99
The simulation had similar working and living conditions as in an orbital space station

SFINCSS

Airlock

Isolation Chambers – adapted for Mars 500



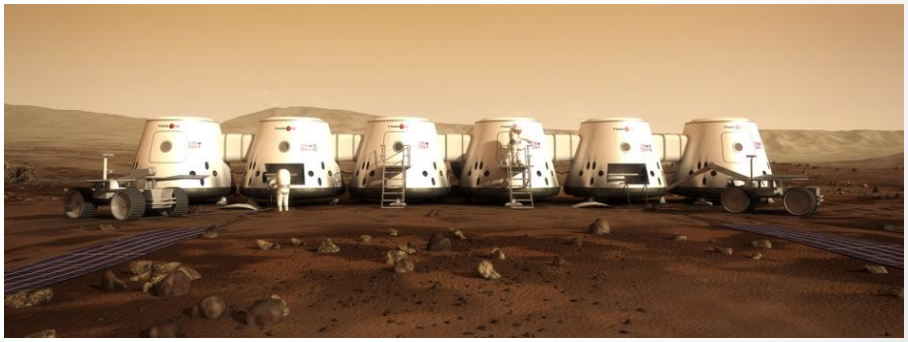


Beckoning of the planets

- Shall we go back to the Moon?

Beckoning of the planets

- Or shall we move on to Mars?
- Mars One?



Why do spaceflight at all?

- FAQs
  - Why bother? It is so risky . . . !
  - And so costly . . . !
  - Inspiration . . . ?
  - Don't we have better things to do on Earth !!??
- These are questions often posed
  - Do you wish to have some answers?
  - You are free to ask these and other controversial questions during Q&A

A special thanks
to
Concordia / Sir George Williams University

You offered the opportunities without which my adventure would not have been possible!

Why do spaceflight at all?

US ECONOMY FISCAL POLICY AND THE DEBT

How Much Does NASA Cost?

$1 of NASA Spending Is a Catalyst for $10 of Economic Benefit

Ads NASA Space Shuttle Satellite Funding Space Rocket NASA Fiscal ISS Orion Budget Money

The NASA (National Aeronautic Space Administration) budget for FY 2016 is $18.5 billion. This is a healthy increase over the $18 trillion Congress enacted in the FY 2015 budget. It's nearly $1 trillion more than what was spent in the FY 2014 budget.

The US now spens ~0.1% of its GDP on NASA, compared with the 60's, 4%

US | Thu Mar 14, 2013 12:53pm EDT

Iraq war costs U.S. more than $2 trillion: study

NEW YORK | BY DANIEL TROTTA

= ~US$ 200 billion / year!

And then there are other wars in addition . . . . !!!

Meanwhile in the EU

Q&A: Reform of EU farm policy - BBC News
www.bbc.co.uk/.../world-**europe**-11216... ▾ British Broadcasting Corporation ▾
Jul 1, 2013 - The **EU** is revamping its complex system of **subsidies** for **farmers** ... in the **EU** - accounting for more than 40% of its **annual budget** - and one of ...

= ~ US$ 50 billion /year

TOTAL ESA BUDGET FOR 2015: 4,433.0 M€

European Space Agency

= ~ US$ 5 billion /year

Total EU GDP = ~ US$ 18 trillion / year

Lessons Learned

- A space race is far cheaper than launching wars
  - Space flight, with all its risks, has killed some 2 dozen astronuats, who knowingly took the risk
  - Our unnecessary wars kill 1000's per month . . . Most of whom have not willingly participated
- International collaboration in space brings nations together to work peacefully for a common cause
  - Helps build trust and understanding
  - Clearly a win-win situation?