Risks

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National Aeronautics and Space Administration

NASA

SANS

Spaceflight Associated Neuro-ocular Syndrome

70 % Incidence

Space Station astronauts experience some amount of swelling in the back of the eye.

What is it?

Eye and brain changes during long-duration spaceflight

Most astronauts' eyes and brain structure change in space. The long-term health consequences are unknown, but are currently being monitored and investigated.

What is causing it?

Headward fluid shifts that occur in weightlessness

Weightlessness causes blood and cerebrospinal fluid to shift toward the head. This fluid shift is believed to be the underlying cause of the eye and brain structural changes.

Mission Impact

Long-duration astronauts may experience some or all of these changes; there is biological variation. Vision changes may impact an astronaut's inflight performance. The longer they are in space, the more they may be impacted. Many astronauts only experience effects in space, but some changes may be permanent in some astronauts. Researchers are studying ways, including fluid shift countermeasures, to prevent SANS during spaceflight and determine any long-term health effects in astronauts.

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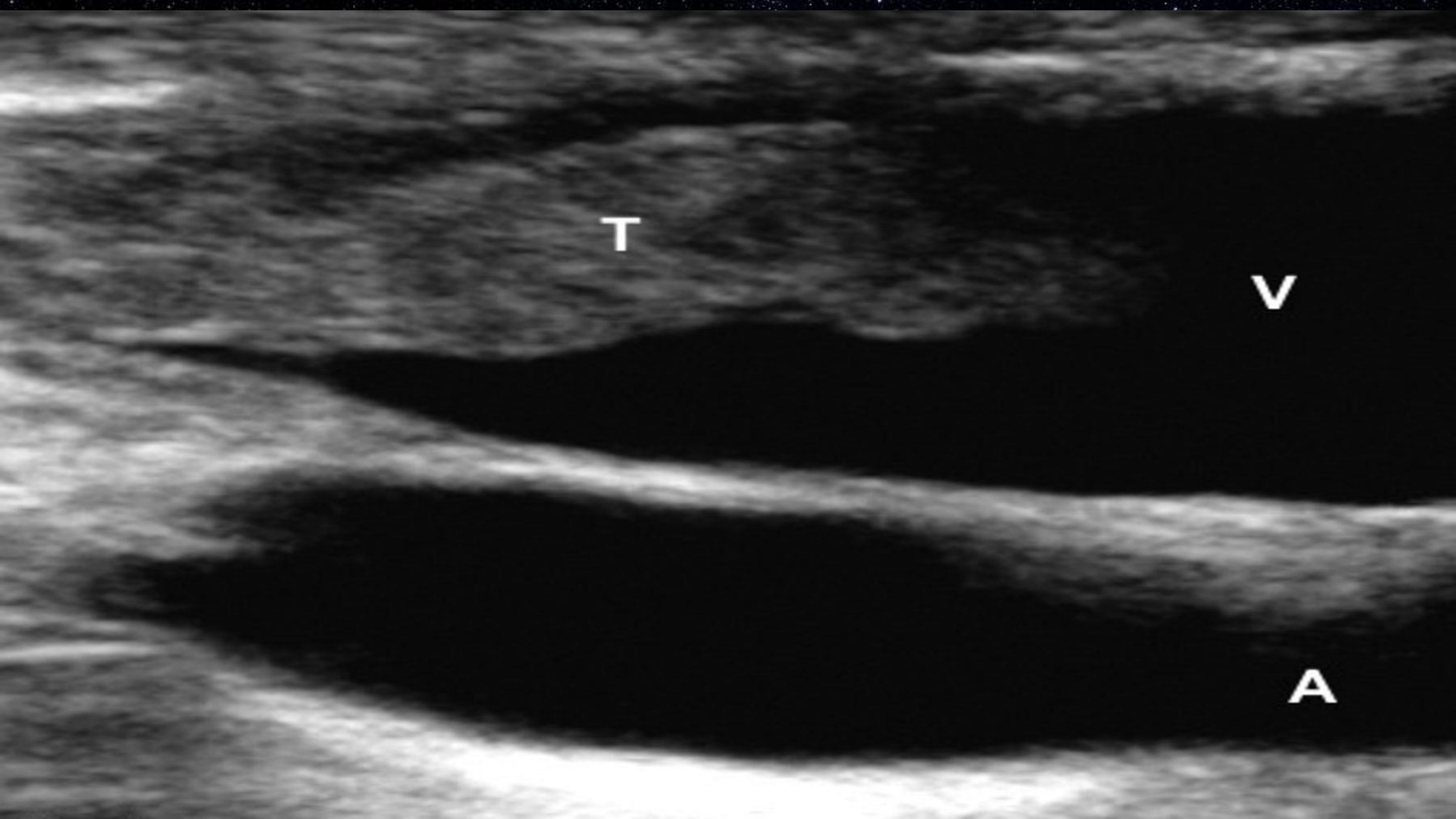
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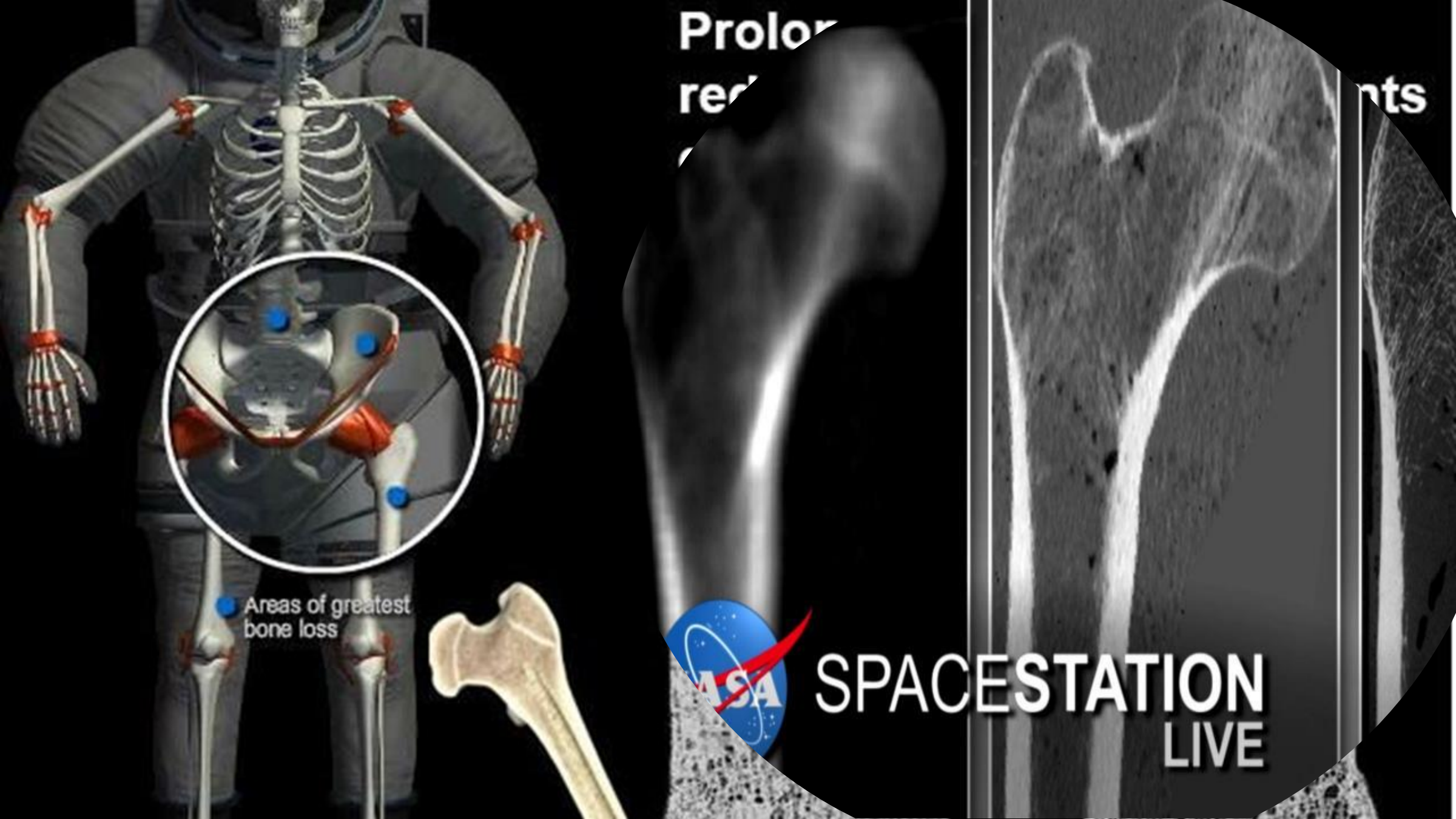
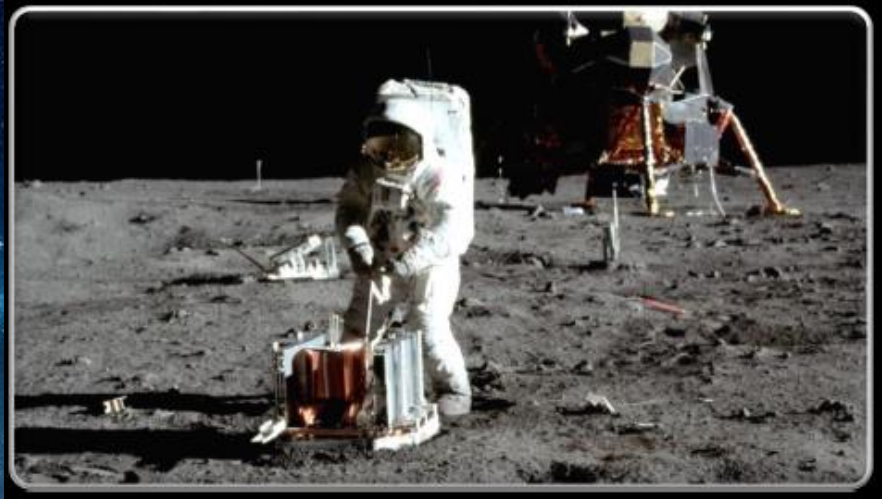

Areas of greatest
bone loss
SPACESTATION
LIVE

Radiation Exposure Career Limits – 600 mSv

	Typical Dose (rem)
Round-trip NY to London / Chest x-ray (1 film)	0.01
Natural background radiation per year	0.3
CT scan	3-10
Typical mission dose on ISS	**10-15**
Estimated dose for 3-yr Mars mission	100-150
Atomic bomb survivors	Up to 400
Human LD_{50}, no medical intervention	350-550
Human LD_{50}, with medical intervention	500-1000

1 rem = 10 mSv

Validating Crew Health and Performance *in Artemis Spacecraft* Will Help Prepare Us to Live and Work on Mars



Lunar Surface	5 Hazards of Human Spaceflight	Mars Surface
1/6 Earth Gravity	Altered Gravity	3/8 Earth Gravity
Galactic Cosmic Rays	Radiation	Galactic Cosmic Rays
Different Atmospheres, Environments, Dust	Hostile, Closed Environment	Different Atmospheres, Environments, Dust
Fast Communications, 2-3 Day return	Distance from Earth	20 min Comm. Delay, >9 month return
Small volumes, 2 days-30 days on Surface	Isolation & Confinement	Small volumes,~30 sols on Surface (first mission)