

Commission Discussion of WADA Anti-Doping Protocols (18 Mar 2025)

During the Commission Plenary, Mr. Neumann reported that the 2025 WADA anti-doping protocols had been provided to the Airsport Commission Presidents in September of 2024. As an international sports federation, the FAI adopted the WADA World Anti-Doping Code and has incorporated those obligations into the FAI Sporting Code General Section (para 4.4.2), published anti-doping rules, and implemented the “Fly Clean” initiative.

However, after a review of the 2025 protocols and banned substances, it appeared that some banned substances or procedures might be used on spaceflight missions. Mr. Neumann contacted FAI Medico-Physiological Commission (CIMP) president, Dr. Thomas Drekonja, the FAI Anti-doping Manager, and sought the advice of spaceflight medical experts. SpaceX Space Operations Physician, Dr. Amran Asadi, reviewed the 2025 WADA Anti-doping materials and concluded that several categories of substances would have routine or potential uses during a space flight to maintain crewmember health and ensure crew safety and effectiveness (see below).

The group discussed various approaches to adhering to anti-doping requirements in the context of spaceflight and acknowledged that space is a challenging environment for the human body and introduces complexities for following normal sport anti-doping procedures especially on extended missions away from the planet. After a thorough discussion, the sense of the group was that at this stage of development of spaceflight as an airsport, our obligation as a commission was simply to make competitors aware of FAI anti-doping procedures, and facilitate therapeutic use exemptions if requested.

Review of WADA 2025 Anti-doping Protocols with Respect to Space Medical Practices

Conducted by: Amran Asadi

SpaceX

Amran.Asadi@spacex.com

The WADA 2025 Anti-Doping protocols were reviewed for substances which would commonly be expected to have routine medical application in the care of astronauts.

FINDINGS:

Stimulants – This is likely the biggest current area of conflict between anti-doping standards & current spaceflight practice. It is *routine* to utilize stimulants for 3 main reasons.

- 1) Spaceflight often necessitates very abnormal shift-work schedules to be ‘mission-ready’ at times governed by orbital mechanics. Stimulants are often used to promote wakefulness during critical safety operations, especially when there has been an aggressive sleep shift involved (d-amphetamine, modafinil, etc.) .
- 2) Spaceflight is heavily nausea inducing. ~70% of flyers will develop Space motion sickness over the first 72 hours of flight, and again upon earth entry. The degree of nausea can absolutely become debilitating. Specific stimulants have been shown to help ameliorate space motion sickness on their own (typically d-amphetamine, ephedrine, etc.), and to have a synergistic effect when combined with efficacious (for nausea) anti-cholinergic medications such as promethazine or scopolamine. The combination stimulant + anti-cholinergic med is also in common use to combating the typically sedating side effects of the anti-cholinergic medication alone. Other non-sedating anti-nausea medications often used on earth (e.g. ondansetron) unfortunately don’t work for SMS, so it is unlikely we’ll get away from their use anytime soon.
- 3) microgravity leads to facial edema & sinus congestion, and abnormal function of the eustachian tube (causing difficulty with pressure equalization). This will generally cause head/face pain and discomfort, and so use of medication to ameliorate this issue is high. For space operations with planned EVAs, treatment becomes more important as the pressure changes involved could cause trauma due to inability to equalize. In either case, Sudafed (pseudoephedrine) is commonly used along with oxymetazoline. I note that Pseudoephedrine is only considered a prohibited substance at a threshold urinary concentration. We have some evidence that the absorption of oral medications in microgravity may be different (perhaps owing to changes in gastrointestinal transit), leading to plasma (& thus urine concentrations) that may exceed limits at standard doses even if typical terrestrial use doses do not.

Narcotics – Microgravity induces spinal elongation due to swelling of intervertebral discs, which frequently manifests as muscular back pain & spasm. While this is often manageable with common over the counter medications (e.g. ibuprofen), it is a routinely expected indication for use of hydrocodone/oxycodone or diazepam (valium).

Glucocorticoids – There is substantial evidence of immune dysregulation occurring in astronauts while on mission. This is theoretically attributed to microgravity induced changes in gene expression, but other factors such as disrupted sleep, stress, etc. could plausibly be playing a significant role. A manifestation of this dysregulation is a substantial increase in the number of atopic rashes & latent viral reactivations encountered on orbit relative to the normal population. For atopy specifically, dexamethasone, hydrocortisone, & prednisone are regularly included among provisioned medical supplies. While topical ointments would generally be preferred over systemic corticosteroids, constituents within topical formulations may not always be compatible with the spacecraft environment favoring use of orally administered medication vs lotions, creams, etc. The limited mass / volume constraint to which supplies must adhere also tends to favor providing oral pills over tubes, so it would not at all be unexpected for an astronaut to use a short course of an oral steroid.

Diuretics & plasma expanders – Microgravity is thought to induce diuresis spontaneously (although this is somewhat debated) due to shifts in fluid distribution ‘towards the head’ from the feet. As a consequence (and due to cardiovascular changes that occur in microgravity), astronauts are generally orthostatic upon return to earth with postural intolerance and frequently undergo intravenous plasma expansion as a routine part of care upon recovery (prior to recovery, they consume oral rehydration solutions). Right now the parenteral solutions are typically crystalloid fluids (e.g. LR, Normal Saline, etc.) and not albumin, Dextran, etc. However, those would be reasonable to use in this circumstance. The only other call out I’d make here is Acetazolamide. There are future vehicles or habitats in which relative hypobaric hypoxia may become the norm to reduce the decompression risks associated with performance of frequent EVAs. Acetazolamide *could* become part of altitude prophylaxis or AMS treatment in such vehicles, but this is not part of any ‘standard’ practice today. A similar argument *could theoretically* be made about HIF inducers, but like I mentioned not currently in use.

Anabolic & Androgenic Steroids, Peptide Hormones & Releasing Factors, & Myostatin Inhibitors – There is no current routine use of these medications as a standard part of astronaut care, even in long duration spaceflight (6 months – 1 year). It is quite plausible that, as mission durations continue to grow in length or vehicle architectures change, chemical means to maintain muscle & skeletal mass could become necessary to prevent adverse health effects on mission or return (e.g. skeletal fractures, severe atrophy, etc.)

Beta-2 agonists – No routine spaceflight specific use, but drugs in this class could theoretically help counteract microgravity induced urinary retention / bladder atony, which is a frequently encountered problem. As such, there may be some investigation into their use on a research basis.