# SAMPLE

## Cosmic Explorers: The International Space Station

A Home in Space

Aira Astralis

Free sample: Introduction & Chapter 1

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This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

# Introduction

Two hundred and fifty miles overhead, moving faster than a rifle bullet, the International Space Station crosses the sky every hour and a half, and this book is the story of the machine doing the crossing. It is the largest structure humans have ever flown, assembled over more than a decade of missions by fifteen nations who had spent the previous half century pointing rockets at one another, and it has been occupied without a single empty day since the turn of the millennium, the longest continuous human presence off the planet.

The account opens with how such a thing came to be built at all, follows the engineering piece by piece, trusses, modules, solar arrays, and the plumbing of power and air, and then follows the people: the crews who keep it flying, the scientists who use its fall around the Earth as a laboratory, and the mission controllers who watch its screens from four continents. It closes with the station's second act, the commercial modules and private visitors now riding its flanks, and with the honest question of what the station's successors will inherit.

Read as engineering, the station is a lesson in how big things get built in vacuum, bolt by bolded bolt, by people in gloves. Read as politics, it is stranger still: a project that survived four changes of government on two sides of a Cold War, held together partly by treaties and partly by the simple fact that no partner can let the shared house fall. Read as a home, it is a small bright laboratory where sunrise comes sixteen times a day and where, for a quarter century, someone has always been awake to see it.

# Chapter 01: The Discovery of The International Space Station

The final mating of the spacecraft to the station is achieved using the robotic arm (a process known as berthing). Spacecraft using this semi-automated process include the American Cygnus and the Japanese HTV-X. The now-retired American SpaceX Dragon 1, European ATV and Japanese HTV also used this process.

Prior to a spacecraft's docking to the ISS, navigation and attitude control (GNC) is handed over to the ground control of the spacecraft's country of origin.

GNC is set to allow the station to drift in space, rather than fire its thrusters or turn using gyroscopes. The solar panels of the station are turned edge-on to the incoming spacecraft, so residue from its thrusters does not damage the cells. Before its retirement, Shuttle launches were often given priority over Soyuz, with occasional priority given to Soyuz arrivals carrying crew and time-critical cargoes, such as biological experiment materials.

Orbital Replacement Units (ORUs) are spare parts that can be readily replaced when a unit either passes its design life or fails. Examples of ORUs are pumps, storage tanks, controller boxes, antennas, and battery units. Some units can be replaced using robotic arms. Most are stored outside the station, either on small pallets called ExPRESS Logistics Carriers (ELCs) or share larger platforms called External Stowage Platforms (ESPs) which also hold science experiments.

Both kinds of pallets provide electricity for many parts that could be damaged by the cold of space and require heating. The larger logistics carriers also have local area network (LAN) connections for telemetry to connect experiments.

In the latter case, the root cause was found to be condensation inside electrical connectors leading to a short circuit. During STS-120 in 2007 and following the relocation of the P6 truss and solar arrays, it was noted during unfurling that the solar array had torn and was not deploying properly. An EVA was carried out by Scott Parazynski, assisted by Douglas Wheelock.

Extra precautions were taken to reduce the risk of electric shock, as the repairs were carried out with the solar array exposed to sunlight. The issues with the array were followed in the same year by problems with the starboard Solar Alpha Rotary Joint (SARJ), which rotates the arrays on the starboard side of the station.

Excessive vibration and high-current spikes in the array drive motor were noted, resulting in a decision to substantially curtail motion of the starboard

SARJ until the cause was understood.

This perceived weightlessness is disturbed by five effects:

Drag from the residual atmosphere. Vibration from the movements of mechanical systems and the crew. Actuation of the on-board attitude control moment gyroscopes. Thruster firings for attitude or orbital changes. Gravity-gradient effects, also known as tidal effects. Items at different locations within the ISS would, if not attached to the station, follow slightly different orbits. Being mechanically connected, these items experience small forces that keep the station moving as a rigid body.

Sleep is regularly disturbed on the ISS because of mission demands, such as incoming or departing spacecraft. Sound levels in the station are unavoidably high. The atmosphere is unable to thermosiphon naturally, so fans are required at all times to process the air which would stagnate in the freefall (zero-G) environment.

To prevent some of the adverse effects on the body, the station is equipped with: two TVIS treadmills (including the COLBERT); the ARED (Advanced

Resistive Exercise Device), which enables various weightlifting exercises that add muscle without raising (or compensating for) the astronauts' reduced bone density; and a stationary bicycle. Each astronaut spends at least two hours per day exercising on the equipment. Astronauts use bungee cords to strap themselves to the treadmill.

The living and working space aboard the International Space Station (ISS) is larger than a six-bedroom house, equipped with seven private sleeping quarters, three bathrooms, two dining rooms, a gym, and a panoramic 360-degree-view bay window. The station provides dedicated crew quarters for long-term crew members. Two are located in Zvezda, one in Nauka, and four in Harmony.

These soundproof, person-sized booths offer privacy, ventilation, and basic amenities such as a sleeping bag, a reading lamp, and storage for personal items.

The quarters in Zvezda include a small window but have less ventilation and soundproofing. Visiting crew members use tethered sleeping bags attached to available wall space or inside their spacecraft. While it is possible to sleep floating freely, this is generally avoided to prevent collisions with sensitive equipment. Proper ventilation is critical, as astronauts risk oxygen deprivation if exhaled carbon dioxide accumulates in a bubble around their heads.

The station's lighting system is adjustable, allowing for dimming, switching off,

and color temperature changes to support crew activities and rest. The ISS operates on Coordinated Universal Time (UTC). A typical day aboard the ISS begins at 06:00 with wake-up, post-sleep routines, and a morning inspection of the station. After breakfast, the crew holds a daily planning conference with Mission Control, starting work around 08:10.

Morning tasks include scheduled exercise, scientific experiments, maintenance, or operational duties.

Following a one-hour lunch break at 13:05, the crew resumes their afternoon schedule of work and exercise. Pre-sleep activities, including dinner and a crew conference, begin at 19:30, with the scheduled sleep period starting at 21:30. The crew works approximately 10 hours on weekdays and 5 hours on Saturdays, with the remaining time allocated for relaxation or catching up on tasks.

Free time often involves enjoying personal hobbies, communicating with family, or gazing out at Earth through the station's windows.

The crew can watch TV aboard the station. When the Space Shuttle was operating, the ISS crew aligned with the shuttle crew's Mission Elapsed Time, a flexible schedule based on the shuttle's launch. To simulate night conditions, the station's windows are covered during designated sleep periods, as the ISS experiences 16 sunrises and sunsets daily due to its orbital speed.

Reflection of individual and crew characteristics are found particularly in the decoration of the station and expressions in general, such as religion.

The latter has produced a certain material economy between the station and Russia in particular. The micro-society of the station, as well as wider society, and possibly the emergence of distinct station cultures, is being studied by analyzing many aspects, from art to dust accumulation, as well as archaeologically how material of the ISS has been discarded.

Food aboard the International Space Station (ISS) is preserved and packaged to withstand long storage times, minimize waste, and prevent contamination of station systems.

Because microgravity dulls taste, meals are often seasoned more heavily than on Earth. Crews particularly look forward to resupply missions, which deliver perishable items such as fresh fruit and vegetables. To reduce the risk of crumbs and spills damaging equipment, foods are prepared in specialized packaging, liquid condiments are preferred over powdered ones, and containers are secured with Velcro or magnets.

Drinks are delivered as powders to be mixed with water, while soups and

beverages are sipped from plastic bags with straws.

Harmony forward (with PMA 2 & IDA 2)

Harmony zenith (with PMA 3 & IDA 3)

Harmony nadir (CBM port)

Unity nadir (CBM port)

Prichal aft

Prichal forward

Prichal nadir

Prichal port

Prichal starboard

Poisk zenith

Rassvet nadir

Zvezda aft

List of International Space Station expeditions

List of International Space Station spacewalks

List of space stations

Politics of outer space

Science diplomacy

Space Station 3D (2002) - Canadian documentary

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# ABOUT THE AUTHOR

Aira Astralis is a science writer specializing in astronomy and space exploration. Her work spans the full breadth of humanity's relationship with the cosmos -- from the earliest naked-eye observations to the engineering marvels of modern space missions.

Her books are built on a foundation of primary sources: peer-reviewed research, mission archives, and direct engagement with the scientific community. She writes for readers who want to understand not just what we know about the universe, but how we came to know it.

She believes that the most important frontier is not out there but in the gap between what scientists discover and what the public understands. Her books exist to close that gap.