

# XII. TECHNICAL MANUAL

*Spaceship Zero* is a modified Mark V Space Hopper. Three of the decks on the standard hopper have been removed to create one large bay, which is outfitted with the experimental Better-Than-Light Drive.

**Length:** 131 ft. (40 m) with sensors extended

**Weight:** 45 tons

**Range:** 30 hours at full thrust

**Thrust:** max 3 Gs (29.4 meters per second per second, or simply 30m/s/s)

**Speed:** After 15 hours of full thrust (in a vacuum without the aid of gravity wells), its base speed is 1006 miles (1620 km) per second. At 30 hours of full thrust, its base speed is 2013 miles (3240 km) per second. At full thrust, travel time from Earth to Mars (at their closest) is 29 hours (including braking time).

In Earth's upper atmosphere, the ship can reach 17,500 mph (28,163.5 kmph). Optimum maneuverability and fuel economy in low-to-mid altitude is 180-250mph (300-400 kmph). Top speed manageable in atmosphere is 2300 mph, with minimum maneuverability and poor fuel economy.

## Decks: Six in total

### Deck 1: Cockpit

- Guidance/Navigation Controls
- Workstation 1 (Pilot Station)
- Instrumentation & Monitors
- Access Hatch (Egress)

### Deck 2: Systems and Storage

- Atmosphere Processing
- Contaminant Control
- Pressure Control
- Temperature/Humidity Control
- Artificial Gravity System
- Water Recovery and Management
- Water Storage and Distribution
- Ventilation
- Equipment Cooling
- Fire Detection
- Thermally Conditioned Storage
- Computational System Core

### Deck 3: Deconstitutor

- Crew Storage (Decon)
- Food Storage (Decon)
- Biological Specimen Storage (Decon)
- Head
- Waste Management
- Workstation 2 (Remote)

### Deck 4: Engine Deck

- Atomic Reactor
- Electrical Power Systems
- Xenon Thrusters
- Xenon Fuel Tanks
- Lead-Acid Batteries



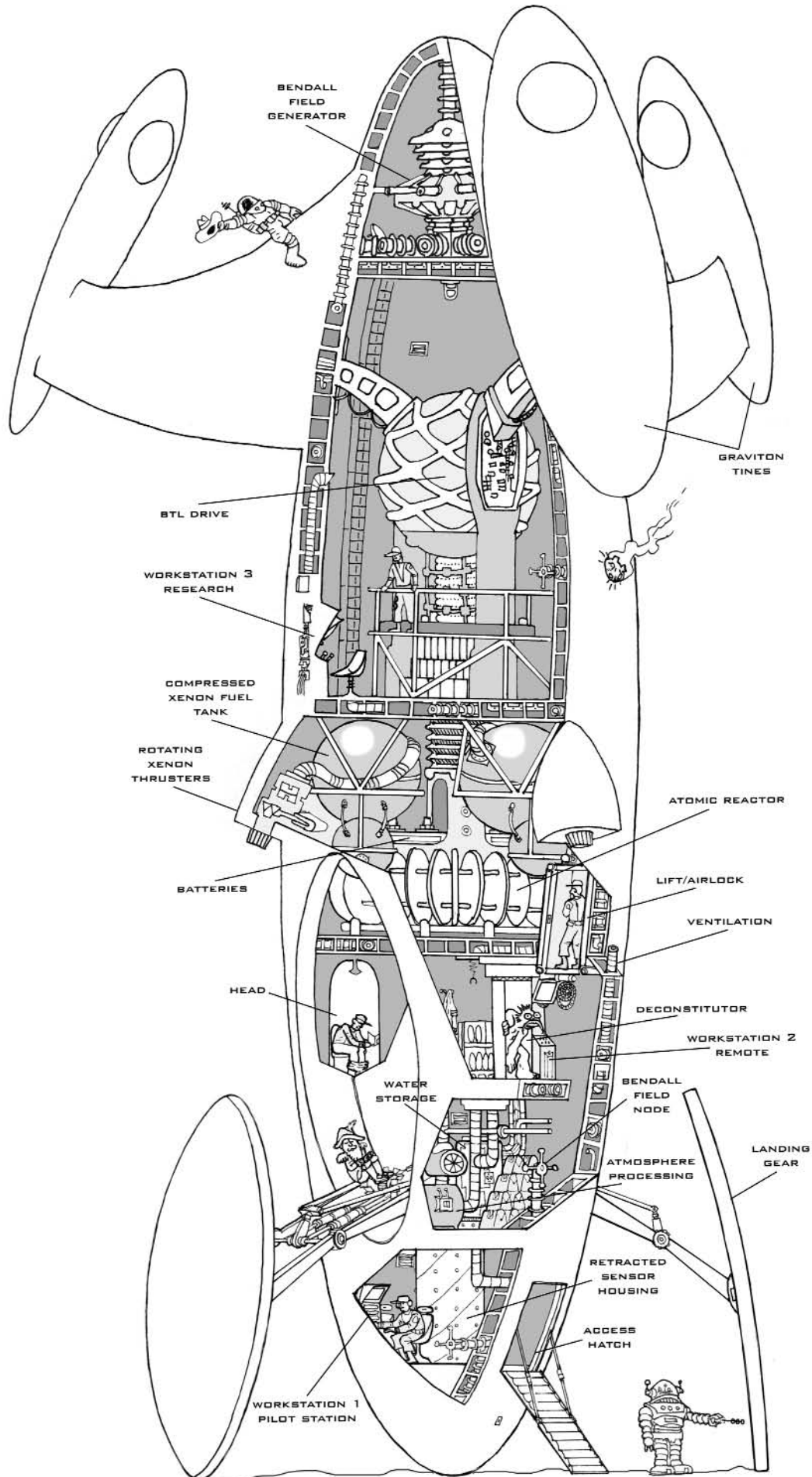
### Deck 5: BTL Drive

- Workstation 3 (Research Station)

### Deck 6: Bendall Field Generator

- Non-Deck: Lift (elevator)
- Airlock
- Hyperbaric Chamber
- Non-Deck: Instrument Cluster
- Radar/Radio Beam Transmitter-Receiver
- Radiometers
- Optical Telescopes & Cameras
- Gravity Scopes
- Gravity Meter/Accelerometer
- Spectrometers
- Spectroscopes
- Spectrographs
- Cosmic Dust Analyzer
- Magnetometers
- Microwave Receiver
- Heliometer
- Electrostatic Analyzers
- Galvanometer
- Inertia Meter
- Altimeter
- Static Space Tube
- Standard Propulsion System: Xenon Thrusters (Deck 4, see above)
- Test Propulsion System: Experimental "Better-Than-Light" Drive (Deck 5)





### Power System: Atomic Fusion Reactor (Deck 4)

*Spaceship Zero* uses a standard atomic fusion reactor, which has superconducting magnets to compress and contain an ionized xenon gas. Microwaves are then used to further heat the gas and initiate fusion. Barring any mishaps, the self-sustaining reactor generates plenty of heat. This heat powers the turbines, which generates electricity for the ship. Excess gas is shunted through the thrusters. After the (now cool) xenon leaves the turbine, it can be sent back through the heat exchanger on the reactor and into the turbine. The gas can alternately be cooled by running it through coils within the ship's hull and exposing it to the outside temperature of space, then returned to the fuel storage tanks. In this way, the xenon can be recycled indefinitely (until it is expelled as propellant).

### Lead-Acid Batteries (Deck 4)

The ship is outfitted with two rechargeable lead-acid batteries, each weighing 5550 lbs. They are stored inside the ring of the donut-shaped atomic fusion reactor.

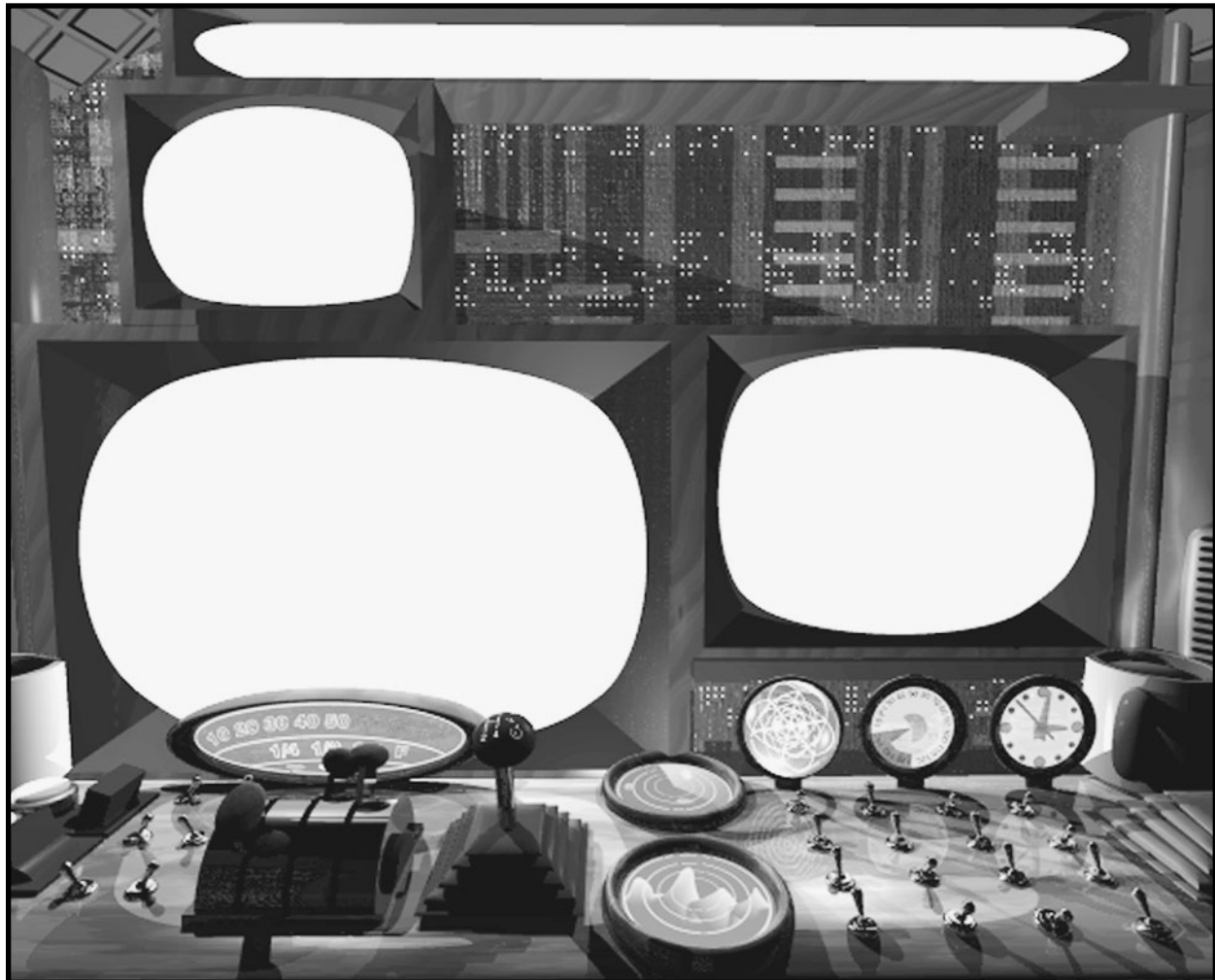
*Gearbox says:* "Don't overcharge the batteries! That can generate hydrogen, which can easily lead to an explosion!"

### Communications (non-deck system)

A large radio-beam transmitter extends with the sensor equipment from the stern of the ship. The communication system is a state-of-the-art shortwave radio.



*Gearbox says:* "The difficult thing about communication in outer space is the distances involved. The Earth is 8.3 light-minutes from the sun, and a signal from Earth to Jupiter would take between 35 and 52 minutes (depending on where the two planets are in their orbits). Even a transmission from Earth to the moon involves a 1.3-second delay. At worst, transmissions sent within the solar system are subject to several hour delays. Transmission delays between star systems are much larger."



### Sensors (non-deck system)

The instrument cluster that extends from the stern of the ship uses a myriad of scopes, receivers, and technological devices of all kinds to measure radiation, heat, distance, radio signals, gravity, etc. Radar is the primary tool for detecting other spaceships. Gravity scopes detect the distortions in gravity patterns that are the telltale signs of massive bodies in space.

### Airlock and Lift (non-deck system)

The airlock/lift is a 30 cubic foot space extending from Deck 1 through Deck 5. It does not reach Deck 6. Deck 6 is accessed via a utility ladder from Deck 5.

The access hatch to *Spaceship Zero* is normally used with the airlock set on Deck 1 (the cockpit). The crew steps from the exterior of the ship straight into the airlock/lift, and then to any deck from 1 to 5. The access hatch can be used without the lift in place on Deck 1, but compression/decompression is not possible without the use of the airlock/lift.

Spacesuits can be stored on hooks in the airlock, or in storage on Deck 2. The airlock also serves as a hyperbaric chamber.

### Crew Storage: Deconstitutor (Deck 3)

SpaceCorp rocket ships utilize the deconstitutor unit for all offworld missions. The decon unit safely extracts all liquid from a crewman's body, breaking down and compressing his physiology into an easily stored capsule. The crew and all organic material—such as food and biological specimens—can be stored indefinitely via this method. Cables connect the deconstitutor to the computational system (see below).

### Air Circulation System & Water Supply (Deck 2)

The atmospheric system has a CO<sup>2</sup> cracker that breaks down the carbon dioxide into oxygen and carbon, then recycles the oxygen. All indications point to indefinite oxygen replenishment via this technology. There are also four emergency O<sub>2</sub> tanks, each with two hours of oxygen for emergencies and special charges.

To prevent excess condensation on board the ship, a CHE (condensing heat exchanger) circulates air across cold metal plates, where the water vapor condenses and is collected and transferred into the H<sub>2</sub>O recycling system.

*Gearbox says:* "You won't believe it, but you'll drink your friend's sweat, and you'll like it!"

#### REMEMBER GOOD HYGIENE

Keeping your work areas clean. There are filters in every level of the ship as part of the Atmosphere Revitalization Unit (the ARU). Dust and other airborne particles, including dead skin, fingernails, hair and food particles all settle on the platform floor. Additionally, in such an enclosed environment, microorganisms eventually build up on all the surfaces. It is important to maintain a regimen of cleanliness to keep the environment healthy.



### Artificial Gravity System (Deck 2)

*Spaceship Zero* employs standard gravity tubing to maintain the effect of gravity on all decks. The tubing extends from the generator on Deck 2 throughout the floor plates of each deck. Gravity tubing also negates excessive G-forces from the inertia of takeoff.

### The Xenon Thrusters (Deck 3)

The ship's three thrusters, located on Deck 5, can rotate 360 degrees. They can point towards the aft or bow of the ship, or to the side, as needed.

Each thruster is fueled by a main tank of compressed, super-cold liquid xenon. To gain thrust, the xenon is heated by the atomic generator until it becomes ionized and gains sufficient pressure. The xenon is then expanded and accelerated through the exhaust nozzle, resulting in propulsion.

The xenon drive is efficient in both atmospheric and non-atmospheric (outer space) conditions. Maneuverability is limited in an atmosphere such as that of Earth due to the ship's rocket-like design, but greater speeds can be reached by increasing the altitude of the ship. It takes twenty to twenty-five minutes to escape the Earth's gravitational pull from lift-off.

Any gas can be adapted to fuel *Spaceship Zero's* thrusters, but the system is configured for xenon. It can be stored as a dense liquid (conserving space) and is exceptionally heavy, producing the greatest thrust. Additionally, since it is a noble gas, it won't readily react inside the various ducts on the ship, slowly dissolving its way out.

#### OUR FRIEND XENON

Xenon is a colorless, odorless, gaseous element (symbol Xe). It is one of the noble gases. Atomic weight is 131.3. Xenon melts at -111.8° C (-169.2° F) at 612 mm pressure, boils at -108.1° C (-162.6° F), and has a density of 5.897 g/liter. It is present in Earth atmosphere to the extent of about one part in twenty million. Xenon is present in the Martian atmosphere to the extent of 0.08 ppm.

In the world of *Spaceship Zero*, it also glows a fluorescent green. Most fans of the radio serial only remember this last fact.

Xenon by itself is not toxic, but its compounds are highly toxic because of their strong oxidizing characteristics. All thruster components are made of polyaluminite to reduce the already slim chance of corrosion. Fuel can be pumped from one cryogenic tank to another, but normally, they are independent. Underneath each main tank is a smaller spare tank.

*Gearbox says:* “Remember, kids, when you’re in space, to account for all the fuel you burn trying to get somewhere. You have to burn the same amount of fuel to slow down, unless someone’s got a really big net to catch the ship. And by the way, velocity equals acceleration times time. Math should be your friend! If he isn’t, then it’s a good thing I’m your engineer.”

## Inter-Ship Systems

The modified Mark V Space Hopper’s communication system, instrumentation, environment controls, and so forth are controlled directly from Workstation 1 in the cockpit. However, they can be accessed remotely through Workstation 3 on Deck 5, as well as Workstation 2 on Deck 3.

Workstation 2 is a smaller, less functional workstation than WS1 or WS3. It can be removed to serve as a remote workstation anywhere on the ship, provided it is plugged in to the electrical systems or outfitted with an independent power source (such as the DIOP described below).

Crewmembers can use the intercom in each workstation to converse with anyone at another workstation, except the Remote Workstation 2 if it is not plugged into the intercom outlet on Deck 3. Each workstation can also access the ship’s public-address system, which has speakers on every deck.

## Tactical Weapons Systems

None. All Atomic Coil Turrets and related systems have been stripped from this Space Hopper to make room for the BTL Drive and project-specific sensor apparatus.

### CARBON DIOXIDE TOXICITY

Carbon dioxide ( $\text{CO}_2$ ) is a colorless, odorless gas that normally constitutes less than a third of a percent of the air humans breathe. In enclosed environments, such as a small space ship,  $\text{CO}_2$  inevitably builds up where humans and animals live and breathe. Concentrations above 7% are dangerous, and anything above 15% is decidedly fatal. Symptoms of acute, short-term  $\text{CO}_2$  poisoning include hearing and vision impairment, tremor, discomfort, dyspnea (labored breathing), hyperventilation, headache (after prolonged exposure), and intercostal (rib) pain, as well as dizziness and depression of the central nervous system (impairing attentiveness and performance). At higher rates of toxicity, drowsiness, stupor, and unconsciousness follow, with hemorrhaging and collapse of the lungs, with necrosis (tissue death) of the heart close behind.

## The Head

The Waste Containment system, also known as the head, serves not only as a place to relieve the crew, but also serves as a washing station and shower. Everything that goes through the plumbing of the ship has its water extracted and purified for recycling before it’s disposed. Normally, dry waste is jettisoned via the space torpedo tubes, but these have been removed to accommodate the BTL Drive.

## Hazards

Oxygen is your best friend. The greatest threats to the crew of a spaceship are fire, loss of air, and contamination. Know your emergency procedures!

Carbon dioxide ( $\text{CO}_2$ ) is your enemy. All spaceships have an Atmosphere Revitalization Unit (ARU) that measures and maintains the concentrations of  $\text{CO}_2$  and  $\text{O}_2$  in the atmosphere of the ship, as well as filters trace contaminants from the air. Unacceptable levels of  $\text{CO}_2$  cause illness, rapid breathing, or unconsciousness. Check your ARU frequently, and make sure your  $\text{CO}_2$  cracker is in perfect working order—unless you want to decorate the ship with a few hundred ferns.

*Gearbox says:* “I’d rather hear an air raid siren on Earth than a fire alarm on a spaceship.”

## Radiation

The Bendall Field keeps radiation out of the ship. If it is deactivated or inoperative, the polyaluminite hull can reflect most energetic particles that harm organic tissue, damage electronic components, and alter the memory of the computers. There’s a limit to the amount it can keep out, however.

*Gearbox says:* “Keep your peepers peeled for those nasty solar winds.”

## Food

Meals are stored in deconstituted form. Additionally, emergency stores of SpaceCorp brand food paste are kept in storage. Food paste comes in fat tubes (like bulk toothpaste). Popular flavors include chocolate, vanilla, strawberry, banana, and meat.

## Failsafes

The entire family of systems on board *Spaceship Zero* is designed to conserve energy. If the internal sensors detect a dangerously low level of charge in the batteries, power to systems on the ship is automatically shut off, including the gravity generator and atmosphere-support systems. The function of this failsafe is to maintain a power reserve for emergency situations. The crew has to manually recharge the batteries in such situations.

## Security

The airlock and main hatch can be locked to prevent unauthorized access to the ship. Access can be gained with a key. Access to the computational system on board *Spaceship Zero* is password protected.

