# Fly Me to the Moon
## Common Space-faring Technologies

### MicroSol Reactor

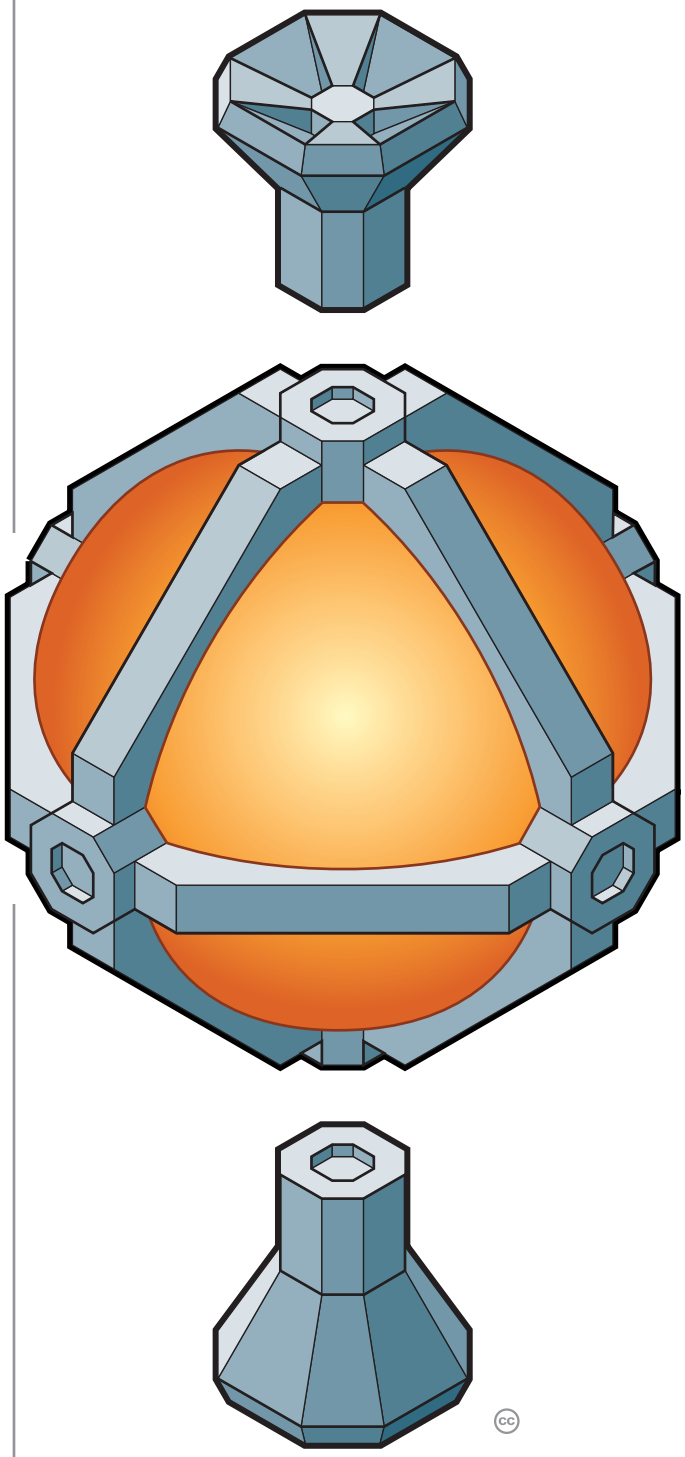
Several technological steps beyond a nuclear fusion reactor, the MicroSol **[mē·krɔ·'sɔl]** reactor can best be described as a miniature artificial sun —a caged star harnessed for its raw power, and for the custom-configurable magnetic field and gravity well that make modern spaceship designs possible. Once ignited, a reactor will not shut down for 100 years times the value of its level, but without regular refueling it will "dim" and not be usable as much more than a giant light-bulb. A MicroSol reactor can keep running "bright" for 100 days times the value of its level before needing to refuel.

Whether running dim or bright, the reactor automatically generates a torus-shaped magnetic field that protects its ship from stray particles that would otherwise tear right through it in the normal course of space travel. The field's north and south poles define the ship's "top" and "bottom" respectively, regardless of how the ship is physically configured. When a spaceship dives into a nebula, skims the upper atmosphere of a gas giant, or rides the tail of a comet, it can channel the ambient gases through its magnetic field into particle collectors at its poles. There, filters channel hydrogen and helium into the MicroSol reactor for fuel while diverting heavier elements into storage tanks, for later use in building defensive shields.

The reactor also generates a gravity well that warps and twists local gravity in ways that seem counter-intuitive when compared to the gravity well of a natural star. For example, in the geodesic chamber that surrounds most MicroSol reactors, "up" is always towards the reactor in the center of the room, and "down" is always away from the reactor towards the inner surface of the chamber. Outside the reactor chamber, "up" and "down" can be defined as a ship's designer sees fit, the most popular design being to stack decks perpendicular to a ship's north-south pole and have "down" be towards its south pole. Individual chambers can even be designed with lighter or heavier gravity than the rest of a spaceship, e.g.: low-gravity cargo holds and high-gravity brigs.

Beyond what it does to a spaceship's local gravity, a MicroSol reactor twists the effects that every other gravity well in the galaxy has on its ship. By reversing the effects of some wells, while embracing the effects of others, it pushes and pulls a ship through space with what is effectively a reaction-less drive. The reactor gives its spaceship a Speed trait equal to its level plus a special space speed listed in Table 1: MicroSol Reactor, which is still not fast enough for practical interstellar travel.

When a spaceship's crew anticipates an attack, the particle collectors can be run in reverse to saturate its magnetic field with ionized particles, while the gravity outside the outer hull can be changed to define the ship's entire outer surface as "up". The former defends against particle weapons and energy beams while the later defends against asteroids and missiles, the combination building a defensive shield around the ship.

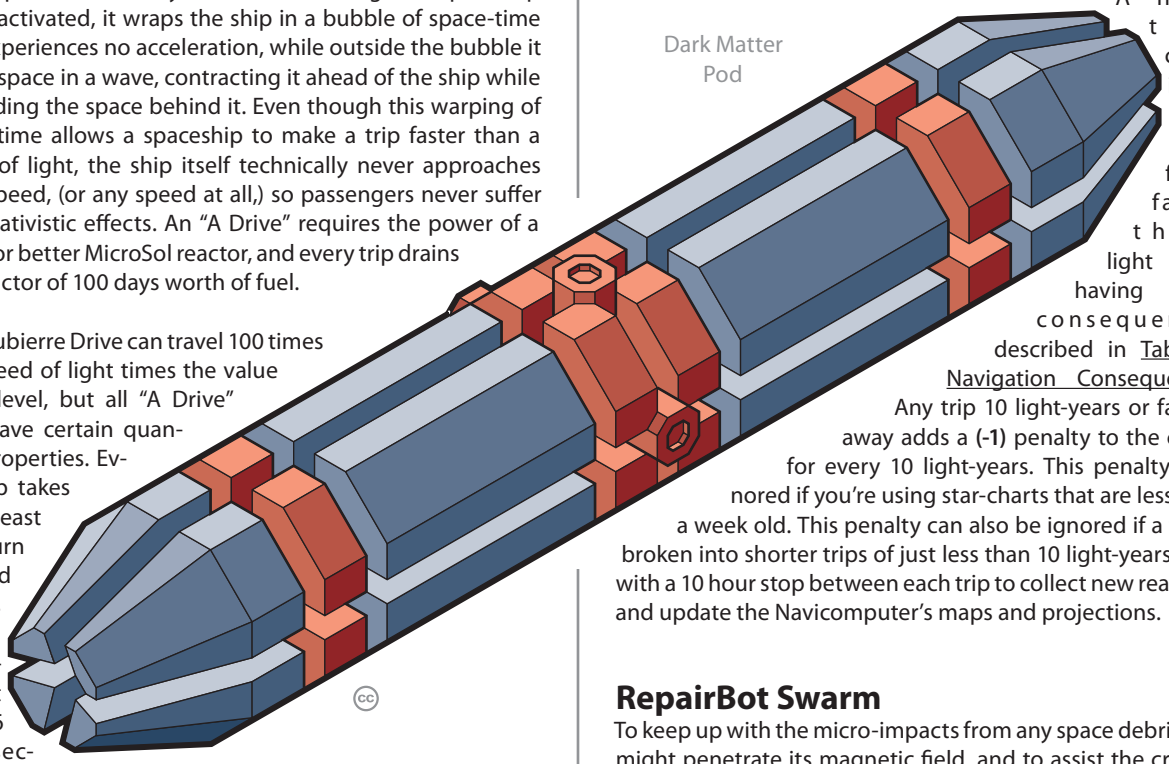


MicroSol Reactor and Particle Collectors

This essential piece of gear lends the powers of Protection from Energy Attacks, Protection from Physical Attacks, a Speed trait, and the equivalent of Power Source power, multiplied by ten. Some ships keep backup reactors, to use if the main reactor gets damaged, or to allow for more faster-than-light trips (see Alcubierre Drive, below). Multiple reactors can run together in tandem using the rules for a team action.

## Alcubierre Drive

Proposed as long ago as 1994 CE by Mexican physicist Miguel Alcubierre, this faster-than-light space drive did not become a reality until one was finally forged from dark matter itself. An Alcubierre Drive, or "A Drive", consists of one or more dark matter pods attached by masts/booms/wings to a spaceship. When activated, it wraps the ship in a bubble of space-time that experiences no acceleration, while outside the bubble it warps space in a wave, contracting it ahead of the ship while expanding the space behind it. Even though this warping of space-time allows a spaceship to make a trip faster than a beam of light, the ship itself technically never approaches light-speed, (or any speed at all,) so passengers never suffer any relativistic effects. An "A Drive" requires the power of a **Weak** or better MicroSol reactor, and every trip drains the reactor of 100 days worth of fuel.




An Alcubierre Drive can travel 100 times the speed of light times the value of its level, but all "A Drive" trips have certain quantum properties. Every trip takes at least one turn and moves a spaceship at least 6 light-seconds away, immediately taking it out of distance combat —and avoiding all manner of causality paradoxes. Every trip moves a ship in increments of 6 light-seconds, so with bad navigation or bad luck, a ship could end up just shy of 6 light-seconds, or **M4 \ Wo** distance (2,000,000 km / 1,200,000 mi), from its final destination, and may need up to another week to finish its trip at sub-light speeds using its reactor. See Table 1: MicroSol Reactor for a list of sub-light travel times for a 6 light-second distance, and Table 2: Alcubierre Drive for a summary of faster-than-light travel times using an "A Drive".

For drives that consist of more than one dark matter pod, every pod damaged or destroyed reduces the power of the drive by one level. If anything with a mind comes within **Dreadful** range (20 m / 60 ft) of a dark matter pod during a faster-than-light trip, that creature will suffer the equivalent of both a **Wondrous** Telepathic Mental Overload plus a **Wondrous** Vampirism attack to the Willpower, Intelligence, and Perception traits —every turn. This is the main reason that dark matter pods are kept away from the main body of a ship.

## NaviComputer

One problem with navigating to a star 10 light-years away is that your best information on its position and condition (e.g.: did it go nova last week?) is 10 years old. A NaviComputer lends the skill of Astronavigation, in addition to everything else a computer lends to a character, as it attempts to project a star's current position by extrapolating from past records. Even with a NaviComputer, there is no substitute for a star-map from a spaceship that just returned from your intended destination, and there's a big trade in current star-maps at many space ports, with most navigators trading for maps from multiple sources that include overlapping readings on their destination star.

A navigation check is required for all faster-than-light trips, having the consequences described in Table 3: Navigation Consequences. Any trip 10 light-years or farther away adds a **(-1)** penalty to the check for every 10 light-years. This penalty is ignored if you're using star-charts that are less than a week old. This penalty can also be ignored if a trip is broken into shorter trips of just less than 10 light-years each, with a 10 hour stop between each trip to collect new readings and update the Navicomputer's maps and projections.

## RepairBot Swarm

To keep up with the micro-impacts from any space debris that might penetrate its magnetic field, and to assist the crew in handling catastrophic damage, most spaceships have a semi-autonomous swarm of miniature repair robots. These robots come in various sizes, from thumb-sized to microscopic, and travel the ship in their own "circulatory system", deploying across damaged sections like blood cells at a wound. The swarm operates as if the ship had the Regenerate power.

## Other Systems

Modern spaceships all have sensor suites that include, at the very least, a telescope, spectrometer, densiometer, and radar, whose combined input can be layered together, filtered, and enhanced in multiple ways by its computer. The most common communications protocol switches between four different modes —text, graphics, audio, video— depending on the distance between the sender and receiver, and delivers its message via coded microwaves. Living oxygen gardens are the basis for modern life-support systems on most ships, lending the power of Self-Sufficiency. Besides particle and

**Table 1: MicroSol Reactor**

| Level | Space Speed | | | | | Travel Time: 6 Light-Seconds | "Bright" Run-Time |
|---|---|---|---|---|---|---|---|
| **Dr(-3)(1)** | 2,000 m/turn | 1,200 kph | ( 6,000 ft/turn | 750 mph ) | Mach 1 | 10 weeks | 100 days |
| **Wk(-2)(2)** | 4,000 m/turn | 2,400 kph | ( 12,000 ft/turn | 1,500 mph ) | Mach 2 | 5 weeks | 200 days |
| **Pr(-1)(4)** | 8,000 m/turn | 4,800 kph | ( 24,000 ft/turn | 3,000 mph ) | Mach 4 | 3 weeks | 400 days |
| **Cm(0)(6)** | 12,000 m/turn | 7,200 kph | ( 36,000 ft/turn | 4,500 mph ) | Mach 6 | 2 weeks | 600 days |
| **Gd(+1)(10)** | 20,000 m/turn | 12,000 kph | ( 60,000 ft/turn | 7,500 mph ) | Mach 10 | 1 week | 1,000 days |
| **Gr(+2)(15)** | 30,000 m/turn | 18,000 kph | ( 90,000 ft/turn | 12,250 mph ) | | 5 days | 1,500 days |
| **Ou(+3)(20)** | 40,000 m/turn | 24,000 kph | ( 120,000 ft/turn | 15,000 mph ) | | 4 days | 2,000 days |
| **Ex(+4)(30)** | 60,000 m/turn | 36,000 kph | ( 180,000 ft/turn | 22,500 mph ) | | 3 days | 3,000 days |
| **Ph(+5)(40)** | 80,000 m/turn | 48,000 kph | ( 240,000 ft/turn | 30,000 mph ) | | 2 days | 4,000 days |
| **Fa(+6)(60)** | 120,000 m/turn | 72,000 kph | ( 360,000 ft/turn | 45,000 mph ) | | 1 day | 6,000 days |
| **Wo(+7)(100)** | 200,000 m/turn | 120,000 kph | ( 600,000 ft/turn | 75,000 mph ) | | 12 hours | 10,000 days |

**Table 2: Alcubierre Drive**

| Level | Light-Speed Multiplier | Travel Times | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 Light-Hour | 1 Light-Day | 1 Light-Month | 1 Light-Year | 10 Light-Years | 100 Light-Years |
| **Dr(-3)(1)** | x 100 | 6 turns | 16 min | 8 hrs | 4 days | 40 days | 400 days |
| **Wk(-2)(2)** | x 200 | 3 turns | 8 min | 4 hrs | 2 days | 20 days | 200 days |
| **Pr(-1)(4)** | x 400 | 2 turns | 4 min | 2 hrs | 1 day | 10 days | 100 days |
| **Cm(0)(6)** | x 600 | 1 turn | 3 min | 1 hr | 12 hrs | 6 days | 60 days |
| **Gd(+1)(10)** | x 1,000 | 1 turn | 2 min | 40 min | 8 hrs | 4 days | 40 days |
| **Gr(+2)(15)** | x 1,500 | 1 turn | 1 min | 30 min | 6 hrs | 3 days | 30 days |
| **Ou(+3)(20)** | x 2,000 | 1 turn | 8 turns | 20 min | 4 hrs | 2 days | 20 days |
| **Ex(+4)(30)** | x 3,000 | 1 turn | 6 turns | 16 min | 3 hrs | 36 hrs | 15 days |
| **Ph(+5)(40)** | x 4,000 | 1 turn | 4 turns | 10 min | 2 hrs | 24 hrs | 10 days |
| **Fa(+6)(60)** | x 6,000 | 1 turn | 3 turns | 8 min | 90 min | 15 hrs | 6 days |
| **Wo(+7)(100)** | x 10,000 | 1 turn | 2 turns | 4 min | 60 min | 10 hrs | 4 days |

**Table 3: Navigation Consequences**

| Result Level | Result |
|---|---|
| **Dr** | Slammed into a solid object. |
| **Wk** | Arrived just under M6 \ **Wo** distance (2,000,000,000 m / 6 light-seconds) from destination. |
| **Pr** | Arrived M5 \ **Wo** distance (200,000,000 m) from destination. |
| **Cm** | Arrived M4 \ **Wo** distance (20,000,000 m) from destination. |
| **Gd** | Arrived M2 \ **Wo** distance (2,000,000 m) from destination. |
| **Gr** | Arrived M2 \ **Wo** distance (200,000 m) from destination. |
| **Ou** | Arrived M1 \ **Wo** distance (20,000 m) from destination. |

**(-1)** penalty for every 10 light-years crossed, when using star-charts that are a week or more old.

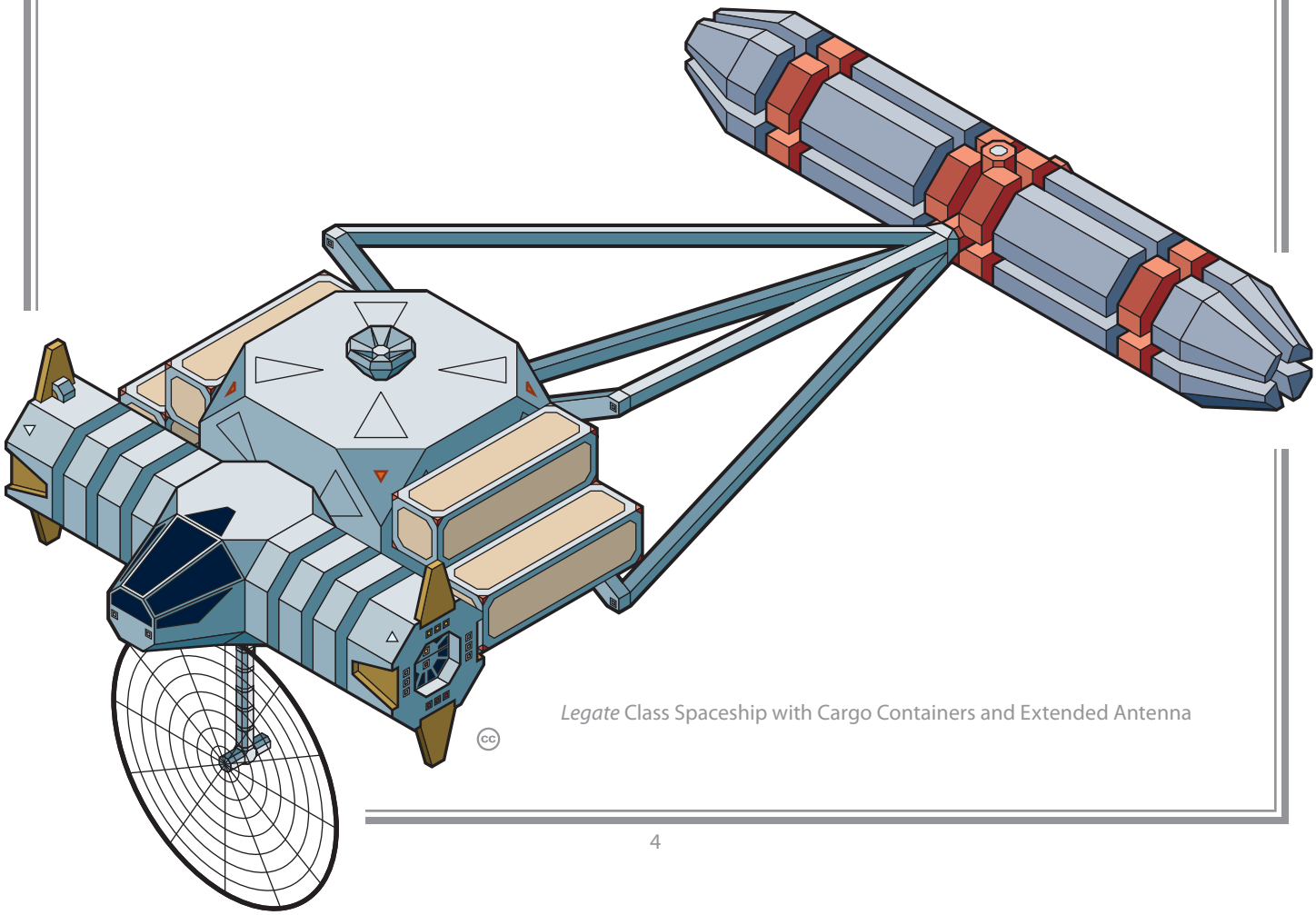
energy beam cannons, rail-guns, and missiles, military and pirate spaceships can also attack each other by transmitting computer viruses over their communication channels that perform the electronic equivalent of Telepathic Mental Blasts and Mental Overloads, though most ships fly unarmed. Magnetic grapples are also a popular multipurpose item kept on many spaceships, and most modern ship designs include at least one standardized combination air lock / docking clamp.

It is almost impossible to determine the level of a ship's Micro-Sol Reactor or Alcubierre Drive from the size of either. While larger reactors and dark matter pods are more powerful than smaller ones, newer, more efficient models tend to be smaller than the older ones. The strength of a ship's magnetic field and the density of its dark matter pods are better indicators.

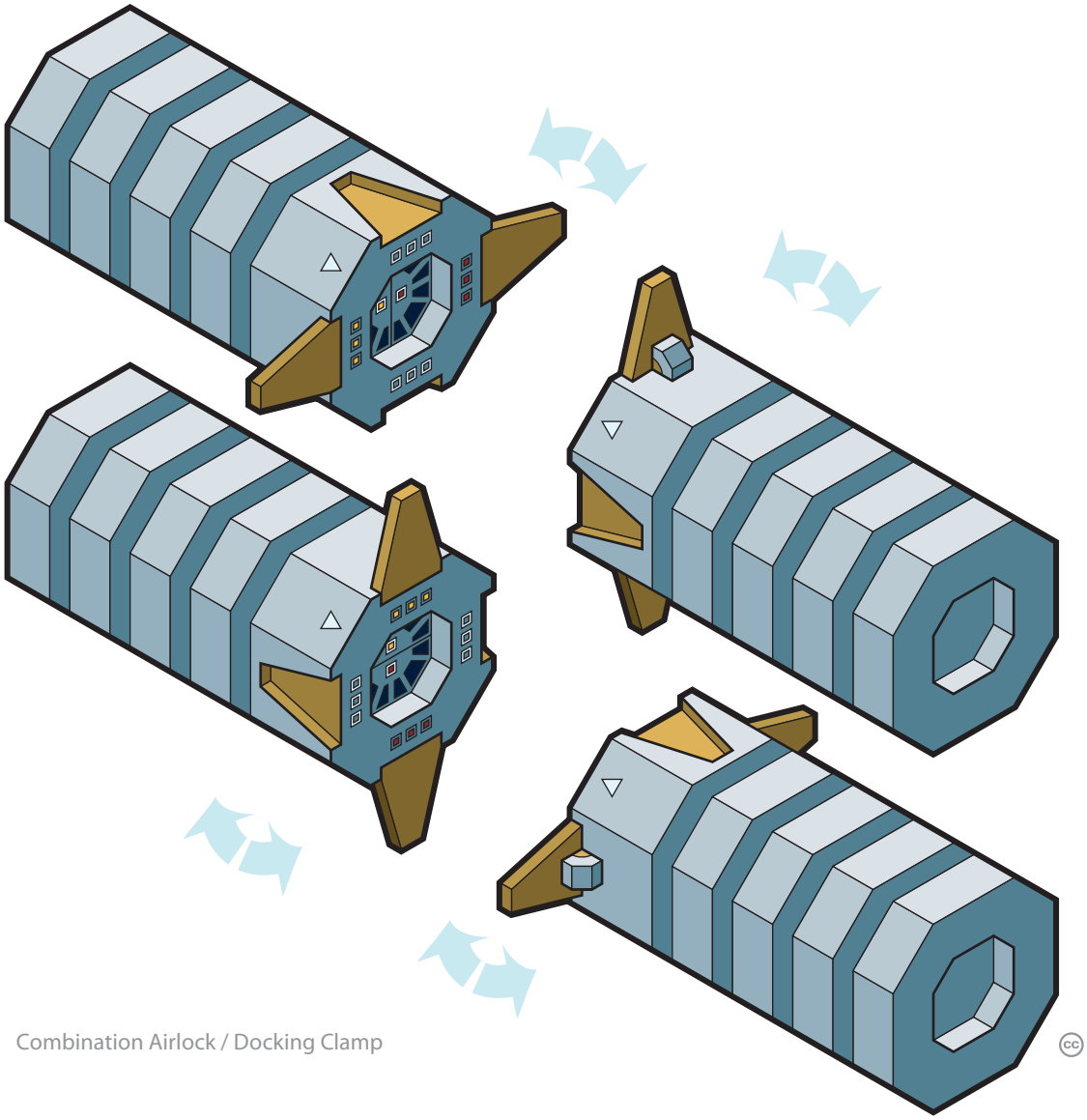
## Example Spaceship

One the oldest spaceship models still in service, the *Legate* class is used by various courier services. Each ship is barely more than a crew cabin, reactor, dark matter pod, antenna, and clamps for attaching shipping containers —all held together with scaffolding or pipes. Some are configured for specific types of cargo or include a one-person "forklift". Most have no planet-side landing gear, armor, weapons, or even magnetic grapples.

***Legate* Class Spaceship**
Price: **M1 \ Ex(+4)(30)**
- **Structural Subsystem**
  - Price: **Wo(+7)(100)**
  - · Material: **Fa(+6)(60)**, carbon composite matrix
  - · Seats: 2, cover
  - · Capacity: **Ex(+4)(30)**, 60 tonnes (60 tons)
  - · Oxygen Garden: **Fa(+6)(60)** self-sufficiency
  - · RepairBot Swarm: **Gd(+1)(10)** regeneration
- **Power/Propulsion Subsystem**
  - Price: **Gr(+2)(15)**
  - · MicroSol Reactor: **Gd(+1)(10)**
    - · "Bright" Run-Time: 1,000 day Power Source
    - · Speed: 12,000 kph / 7,500 mph / Mach 10
    - · **Gd** Protection from Physical Attacks
    - · **Gd** Protection from Energy Attacks
  - · Alcubierre Drive: **Gd(+1)(10)**, light-speed x 1,000
- **Sensors Subsystem**
  - Price: **Fa(+6)(60)**
  - · Telescope: **Ex(+4)(30)**
  - · Spectrometer: **Ou(+3)(20)**
  - · Densiometer: **Ou(+3)(20)**
  - · Radar: **Gr(+1)(15)**
- **Communication Subsystem**
  - Price: **Fa(+6)(60)**
  - · Signal Range: **Fa(+6)(60)**, coded microwave emitter
- **Computer Subsystem**
  - Price: **Wo(+7)(100)**
  - · Data Storage: **Wo(+7)(100)**
  - · Intelligence Boost: **Ou(+3)(20)**
  - Programs: Astronavigation, Vehicle: Self



*Legate* Class Spaceship with Cargo Containers and Extended Antenna



Combination Airlock / Docking Clamp