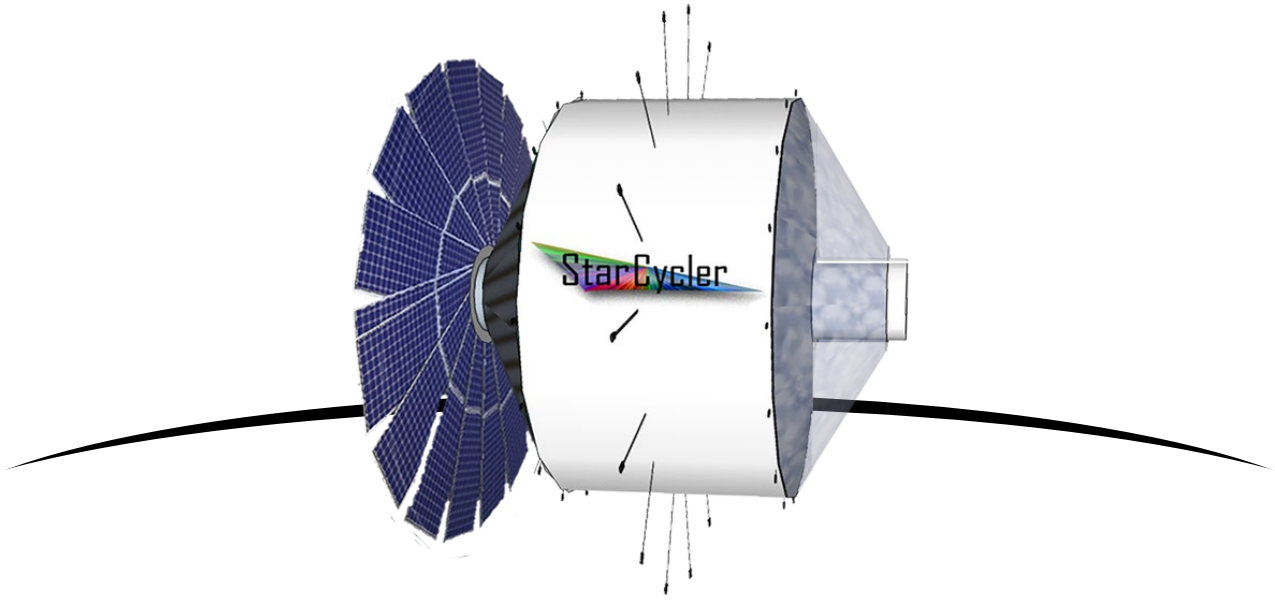
StarCycler 101

Proving the StarCycler



The Proof of Concept for the StarCycler is more of an investigative process, piecing together essential parameters from reputable peer-reviewed studies on rotating environments. Foundational principles were derived from Motion Mechanic's Laws of Conservation, which govern this isolated physical systems, making this a straight forward endeavor.

The uniqueness and challenges arise from the space environment. However, construction could be as straightforward as connecting spokes to the booster fuselage and wrapping a skin cover, reminiscent of the Conestoga Wagon that played a crucial role in pioneering new frontiers.

However, it's the human physiological response that propels this rotational endeavor, for which empirical evidence can only be obtained through on-site testing.

The objective of the StarCycler is to be the First in Class, paving the way for a diverse community to thrive. This community will include artists, farmers, trades workers, and engineers, who will tend to the flotilla of vessels accompanying the StarCyclers .

Join us, as we delve into our investigation, revealing how we arrived at the pivotal parameters.

PHYSIOLOGY

75 ft radius @ 5.2 rpm = 0.7 AG

The story starts with physiology.

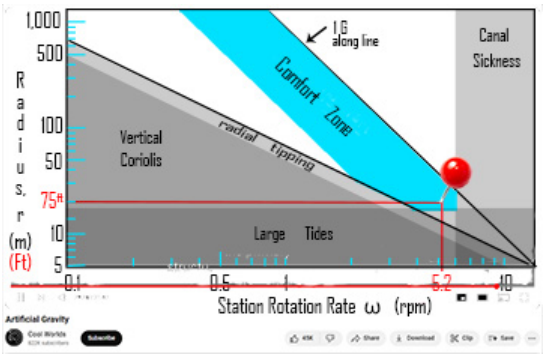
In the vast expanse of space, the human body grapples with a myriad of physical challenges most of which can be effectively mitigated through the implementation of Artificial Gravity (AG).

Coriolis

This graph is a standard in peer-reviewed papers discussing the physiological response from the Coriolis effect in rotating environments.

Compiled by Cool Worlds, this graph is the most comprehensive to date, viewing their full video is highly recommended.

The rotation rate is the critical element with six rpms being the upper limit for most people. However, in a practical sense, an adaptability line exists within the Comfort Zone and may extend to faster rpm.



Full Video:

https://youtu.be/b3D7QlMVa5s

Other Ailments

At this point, the critical elements in determining the station size are the AG produced and constructability. Empirical evidence to determine the optimum AG for addressing other physiological challenges can only be obtained onsite in space, which the station's variable speed can address. Nevertheless, the primary concern remains the reacclimatization upon return to Earth.

For construction purposes, we begin with the smallest diameter within the comfort zone to assess its feasibility. A station with a 75-foot radius would require 60-foot beams or spokes if assembled atop the booster fuselage. This approach would significantly simplify space construction.

A 75 ft radius station rotating at 5.2 rpm would produce 0.7 percent of Earth's gravity. This level of AG is significant and well within the comfort zone, effectively mitigating most physiological challenges, except for Coriolis effects. The return to Earth would feel akin to carrying a heavy backpack. Additionally, at this size, it becomes feasible to enclose the entire environment, facilitating the creation of multiple gravity zones.

SIZE AND SHAPE

½ width x diameter

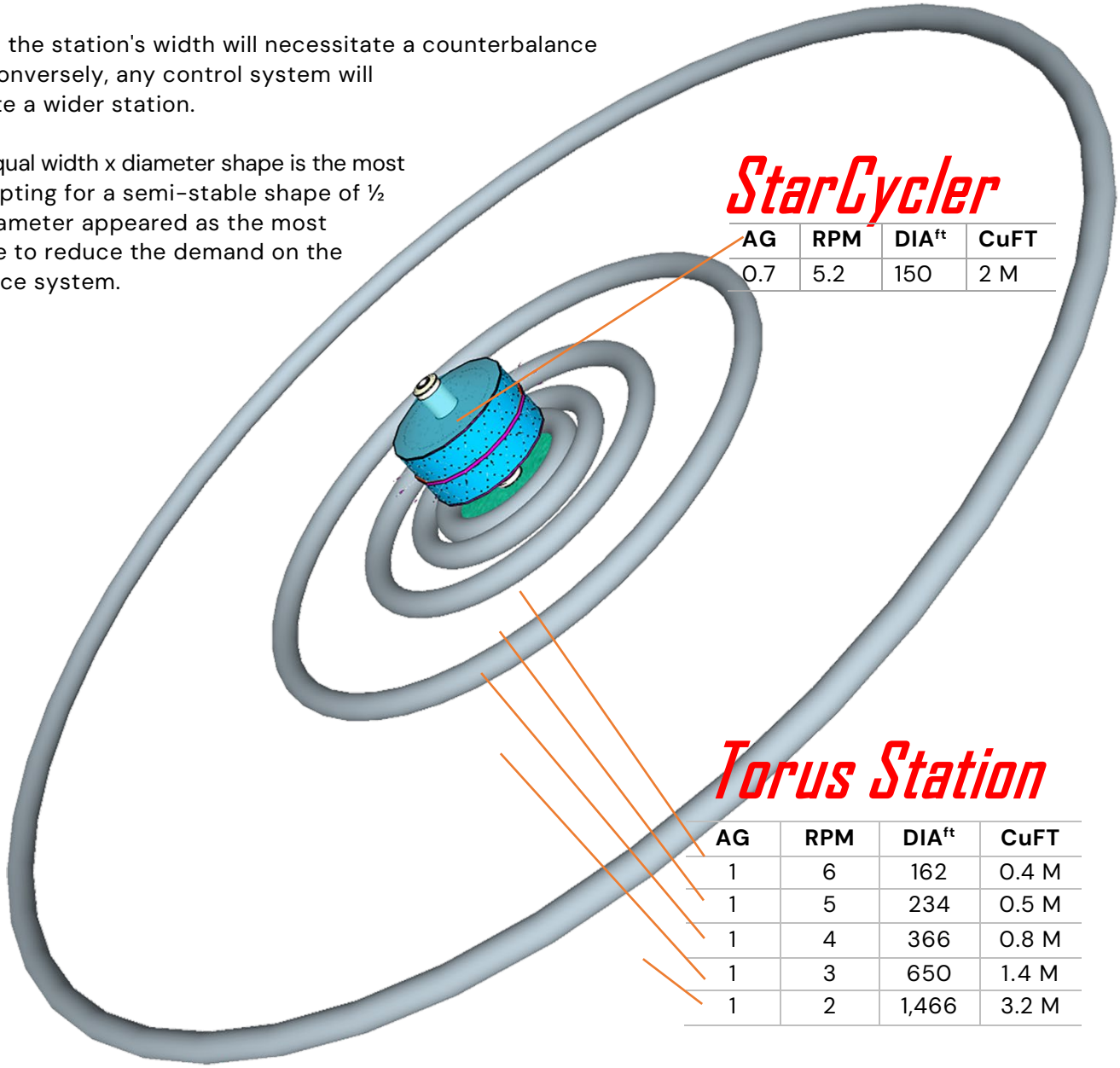
75′ width x 150′ dia.

A 75 ft radius station is feasible, but if the shape is a Torus, the bio-habitat (0.4 Cu ft) is too small to warrant investment.

The current concern about a wider station stems from the potential loss of gyroscopic stability. However, this might be beneficial when considering that Gyro Stability is Inversely Proportional to Controllability

Expanding the station's width will necessitate a counterbalance system. Conversely, any control system will necessitate a wider station.

Since an equal width x diameter shape is the most unstable, opting for a semi-stable shape of ½ width x diameter appeared as the most logical size to reduce the demand on the spin balance system.



StarCycler

AG	RPM	DIA^{ft}	CuFT
0.7	5.2	150	2 M

Torus Station

AG	RPM	DIA^{ft}	CuFT
1	6	162	0.4 M
1	5	234	0.5 M
1	4	366	0.8 M
1	3	650	1.4 M
1	2	1,466	3.2 M

STRUCTURE

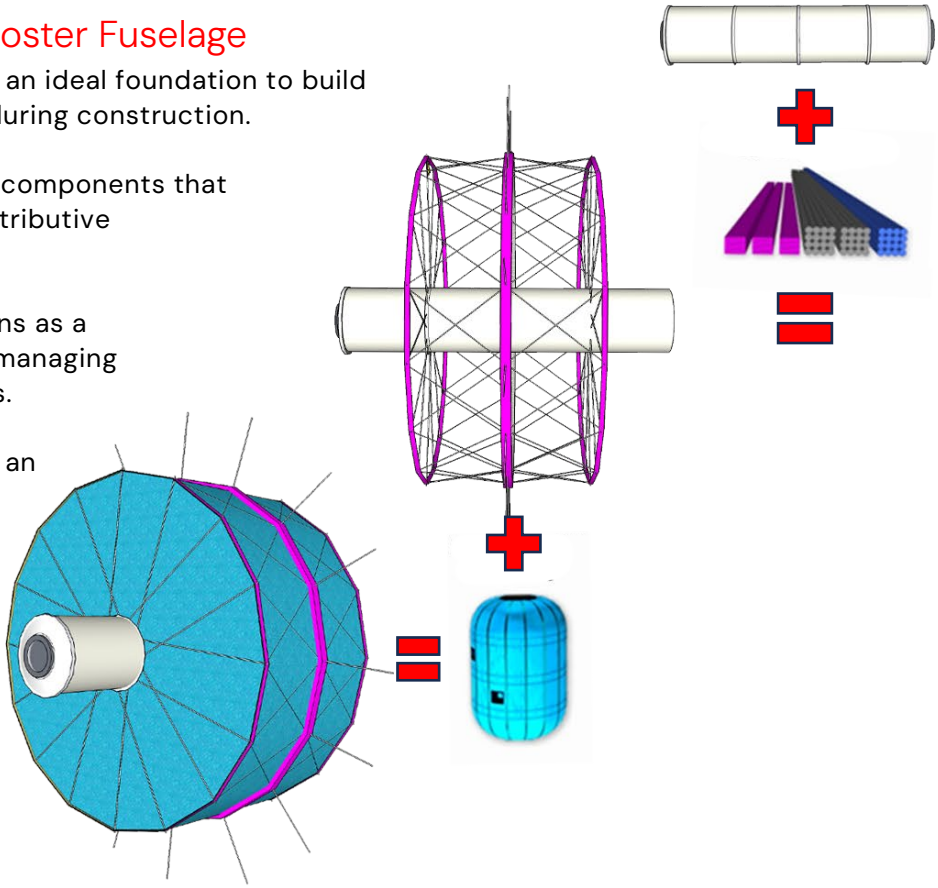
Spokes – Inflatable – Booster Fuselage

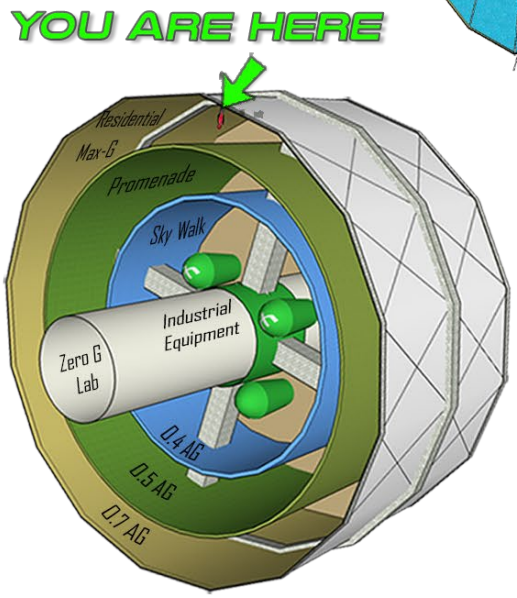
The booster fuselage serves as an ideal foundation to build upon and provides habitation during construction.

Spokes are the ideal structural components that can pop up to form a force-distributive geodesic structure.

The geodesic structure functions as a suspension bridge, effectively managing torsional, and stabilizing forces.

A sectional inflatable serves as an ideal solution for providing the initial layer to enclose the bio-environment.





BIO HABITAT

Residence

A StarCycler offers 2 million cubic feet of breathable atmosphere with various levels of artificial gravity.

The structure comprises five floors, each 15 feet apart, incorporating two free-floating Atriums (not depicted) and elevator service to the zero-G core.

To optimize momentum the fifth floor must remain lightweight and heavy machinery located near the core.

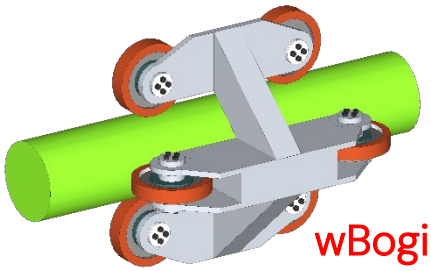
Frames of References

Floor	AG @ 5.2 rpm	Name	Purpose	Floor Area (Sq Ft)
5	0.7	Residential	Housing and other light weight amenities	35,000
4	0.55	Promenade	Open air for gatherings and shops	28,000
3	0.4	Sky Walk	Environmental system wind, filtration, rain	21,000
2	0.27	Faux	Large tanks, heavy machinery - "Inertia Ballast"	-
1	0 to 0.13	Inside Core	Zero G lab, Docking port, Navigation room	-
Bow	Free Floating	Atrium	Equipment room and wet wall	-
Aft	Free Floating	Atrium	Transparent enclosure, Recreational	-

MOTORS

momoX

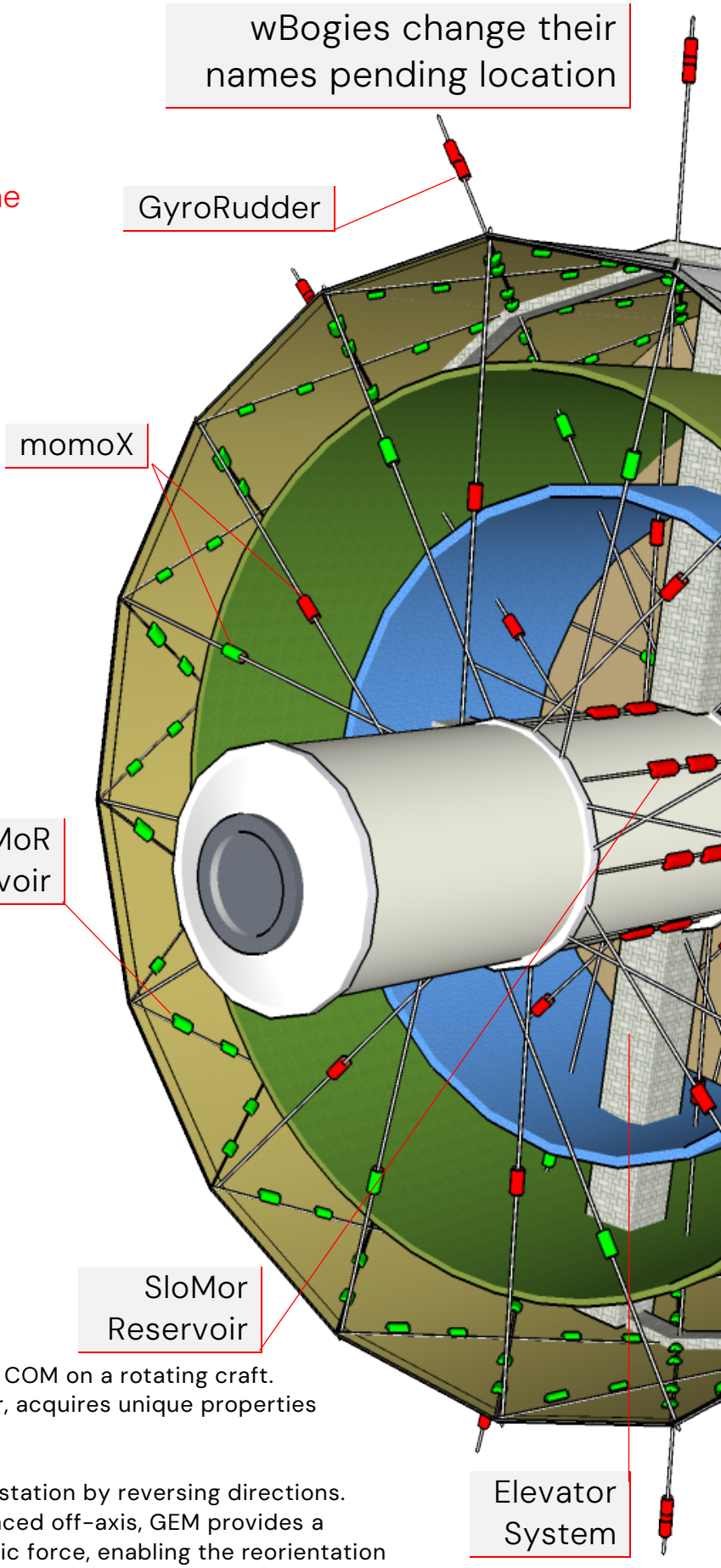
Motion ⇄ Momentum Exchange Engine



wBogies

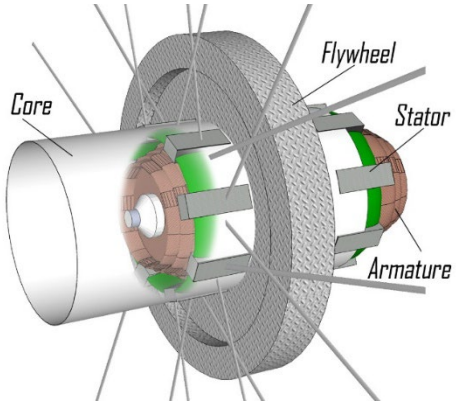
Spin balancing the station is achieved using mobile weights known as wBogies. These wBogies travel throughout the station on a looped webbed track, exchanging Motion ⇄ Momentum, thereby keeping the momentum profile radially balanced.

The robust elevator system will facilitate most of the transference, keeping stress loads localized



GEM

Gyro / Electro / Momentum Motor



Control Moment Gyros (CMGs) can only be placed COM on a rotating craft. GEM, being a massive CMG positioned dead center, acquires unique properties that can be exploited.

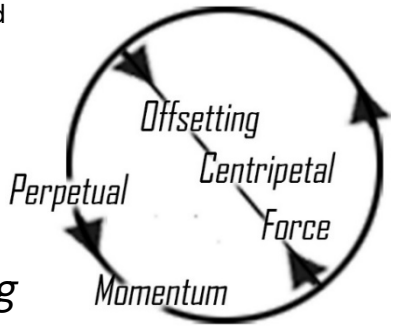
Starting as a reaction wheel, GEM can spin-up the station by reversing directions. On-axis GEM provides a stabilizing force. When placed off-axis, GEM provides a second axis with a substantial amount of gyroscopic force, enabling the reorientation of the station without contending with the station's rotational momentum.

PHYSICS

Motion Mechanic

According to the Laws of Conservation A StarCycler exemplifies an Isolated Physical System where energy, in the form of momentum, is dynamically linked to the motion of mass.

" This energy remains constant, interchanging but never diminishing."



Artificial Gravity

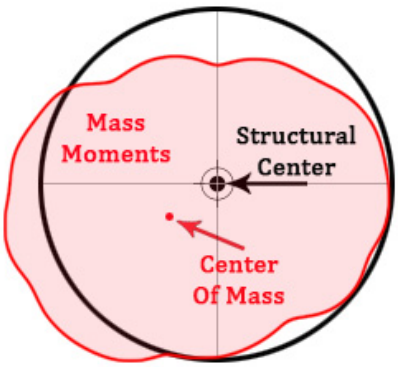
A continuous change in motion of mass can simulate gravity, and remarkably, a rotating environment can provide this change while conserving angular momentum.

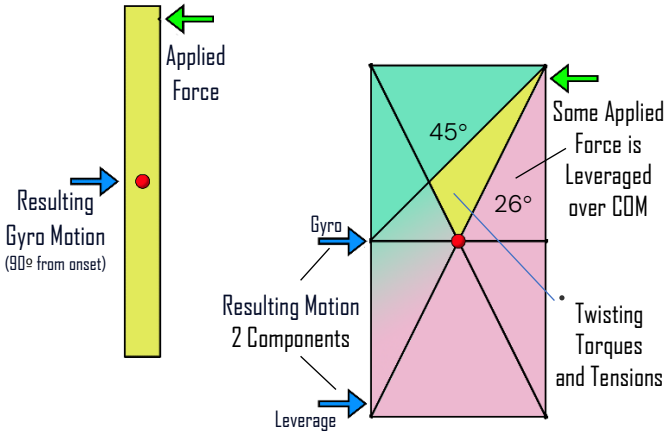
Momentum is largely imperceptible, while AG is ever-present. However, momentum transfers fluidly as Mass/passengers move about, altering structural force loads and the rotational momentum profile.

Momentum Profile

It's essential to recognize that the rotational momentum profile, rather than the physical shape of the station that plays the crucial role in determining rotational behavior.

The SpeedMoR reservoir, along with GyroRudder, can effectively change the momentum profile from maneuverable to gyroscopic.



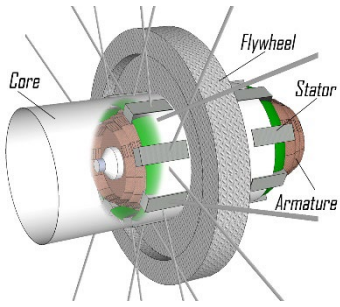


Rotation

Rotating mass displays unique characteristics determined by the momentum profile. A thin disc, for example, exhibits angular momentum that generates a gyro stabilization torque, effectively resisting external impulses and potentially nullifying control systems.

The wider shape of the StarCycler mitigates this force by repositioning the Center of Mass within a structure capable of redistributing reorientable force loads.

14,500 lbs/ft of
Ang Mom or Gyro Torque



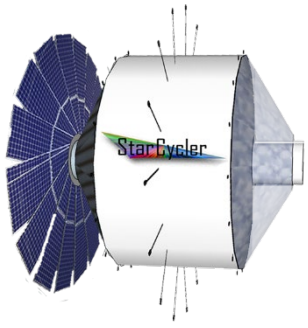
15,000 lbs - 30' dia - 20 rpm

GEM versus StarCycler

Since there are no external forces acting on the StarCycler, the Gyro torques remain dormant in the form of Angular Momentum. Additionally, Angular Momentum is latent at the Center of Mass.

Conversely, when GEM is placed at the centroid, it experiences the StarCycler as an external force, thereby manifesting Gyro Torque from GEM's angular momentum.

9,200 Slugs at
Center of Mass



300.000 Earth lbs

ROCKET

Repurposing

If StarCycler is to bring about the Astropocene Age sustainability needs to be built into the design to achieve mass production.

Repurposing is a priority in designs, as evident in the StarCycler's Rocket. The choice of multiple external fuel tanks aligns with the need for large tanks, which will be in high demand at the station.

The ejectable motor mount is to maximize what does achieve orbit and what doesn't.

The large center propellant tank will be repurposed as the control room due to the extra shielding and the engine can be refitted with smaller tanks for future maneuvers or Trans Planetary Injection.

Reusable
Core and Tanks

Payload
Inflatable
Spokes
GEM
175,000 lbs

Effective weight to Low Earth Orbit 300.000 lbs