SURFACE TO SPACE
VERTICAL COMBAT ZONES

AN ANALYSIS

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Unlike their brothers in Starfleet, or their counterparts in the pure ground combat branches, in any combat situation that the Starfleet Marines are involved in, the concept of Vertical Combat Zones must be taken into account. In essence the SFMC is concerned with 4 vertical layers of combat: Ground, Atmospheric, Inter-Atmospheric, and Extra-Atmospheric or Space.

Ground Combat is simply defined as that combat which is limited to Subsurface (subterranean and/or sub-aquatic), Surface, and that height above the Surface attainable by jump-jet capable troops and mechs. This height is best expressed by the limiting equation 200m/xG^.5, whereas m=meters, xG=the Multiple of Earth normal gravity at the surface, and ^.5 = the square root of xG. For example on a planet that has a surface gravity of 1.44G, the Ground Combat Zone would = 200m/1.44^.5, which = 200M/1.2, which = 166.67M. Thus the ground combat zone would top out at 166.67 Meters above the surface.

Atmospheric Combat is simply defined by that combat which is above the Ground Combat Zone, and reaches up to the limit of the atmospheres ability to affect the control surfaces of the Atmospheric Craft. This is also referred to the Aviation Zone as opposed to the Aerospace Zone of Inter-Atmospheric craft. The Atmospheric Zones upper limit is set not by the gravity of the planet, but by the density of its atmosphere, which is different from planet to planet, and is determined by many different factors including gravity well, distance from planet's primary, amount of surface water, and even the speed of rotation of the planet. The ground level atmospheric pressure on a planet is not fixed by any of the standard planetary data such as gravity and temperature. It depends on just how much atmospheric gas is available and has not yet escaped into space. For example, Venus is a little smaller than Earth and has slightly lower gravity, yet its atmospheric pressure is about 90 times that of Earth. Our atmospheric pressure standard for our example will be 98.25 Kilo-Pascals or the atmospheric pressure on Earth at sea level (this is equal to 14.25 psi or 740mm HG). For an atmospheric craft to work it must have some airflow over the control surfaces. With 1999 combat aircraft the minimal combat airflow is 25%, the minimal flight airflow is 6.7%. On Earth, that would equate to an atmospheric combat zone of 10,000 meters. The full equation $P = P_o$ raised to the power of $(-g_{o*} h / (214600 \text{ meters} * \text{Atomic Mass Units} / M))$ will determine the pressure at the chosen altitude. Or $h = (.25 / P_o\text{^}(-g/215{,}600 \text{ Newton AMU}/M))\text{^}(1/P_o)$

Where P_o = the ground level pressure

                 g_o = the surface gravity/divided by 9.8 Newtons

                 h = the altitude in meters)

                 M = the mean molecular weight of the planet's atmosphere

For breathable nitrogen-oxygen atmospheres, *M* will be close to 29.

So for our above planet with the Gravity of 1.44, we will assume a near breathable atmosphere of 31 AMU, and a surface pressure of 115.5 kilopascals, the Atmospheric Zone would then range from 166.67 meters to 7,442 meters.

The next zone is the Inter-atmospheric combat zone. This zone is a transitional zone that crosses over the boundaries of atmospheric and extra atmospheric. Inter-atmospheric craft otherwise known as Aerospace Vehicles are capable of behaving as Aircraft with atmospheres, and as Spacecraft outside of Atmospheres, and are able to transition in that zone that is too high for the conventional atmospheric vehicles but yet still too low for the starship. Thus, this transition zone reaches from the upper limit of the Atmospheric Zone explained above to the lower limit of the Space zone, explained below. Once again Inter-atmospheric craft (Aerospace) can operate in all three combat zones.

The extra-atmospheric combat zone reaches from low planetary orbit to deep space. Low planetary orbit is defined by the equation: $O=(.376R + 2H) * (g_o{}^\wedge.5)$

Where $O =$ is the height of the low planetary orbit

$g_o =$ the surface gravity/divided by 9.8 Newtons

$H =$ the altitude in meters of the Atmospheric Zone Upper Limit

$R =$ the radius of the planet in meters.

Again for our sample planet whose surface gravity is still 1.44 G, and whose radius is 4,500 Kilometers the low orbit height would be 2048.208 Kilometers, or 2,048,208 Meters above the surface.

Thus are different combat zones would be

Ground Zone	0 – 166.67 Meters
Atmospheric Zone	166.67 – 7,442 Meters
Inter-atmospheric Transition Zone	7,442 – 2,048,208 Meters
Extra-atmospheric Zone	2,048-208 Meters – Infinity

These zones are set not by tactical considerations or weapon strengths, but by the laws of physics, as we improve the quality of our Aerospace capability the zones would mean less and less to these vehicles but for Starships and for pure Aviation assets, the zones are as rigid as glass, break the glass and the whole picture will shatter.

Scott