What Makes Space Traffic Different?

Why traffic lights and stop signs don’t work in space.

Brian Weeden
Technical Consultant
Secure World Foundation

Secure World Foundation

Seeking Peaceful Solutions for Global Security

Imagine...

...You are in a car travelling around the Beltway...

...A GPS unit shows your location and the roads...

...There are 500 other cars on the same roads...

...But there are no traffic signs, signals, or lanes...

...And your windows are blacked out so you can't see anything anyway (including the other cars)...

...Oh, and we are adding 50 cars a year to the roads.

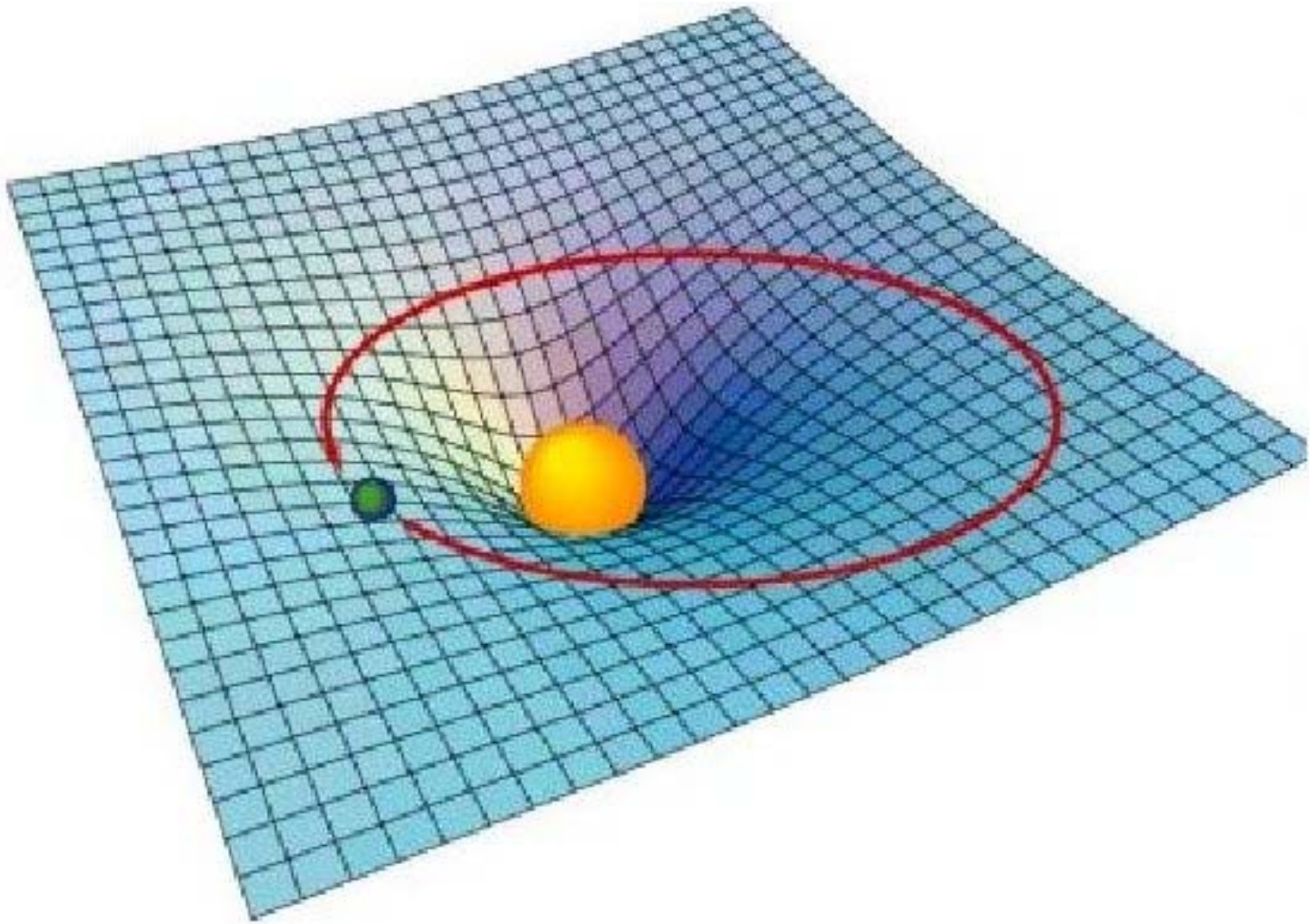
This is the current traffic situation in space.

So why can’t we just add stop signs and speed limits to space and call it good?

Unique Properties of Space

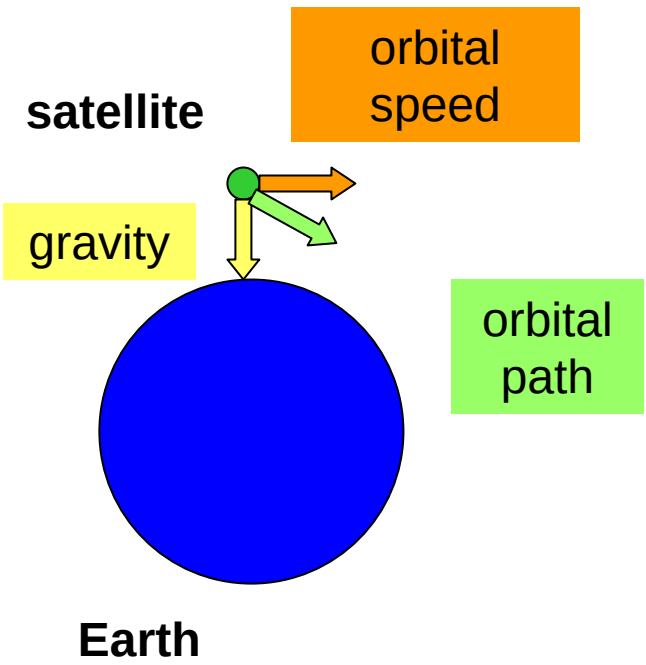
1. Objects in orbit move ***very*** fast
2. Space is ***really*** big
3. Very few slowing forces

Mass Causes Gravity



Gravity Causes Speed

The Myth of “Zero Gravity”



- Gravity exists in space and extends to infinity from the Earth
- Objects in orbit are pulled towards the Earth by gravity but miss because of their orbital speed (i.e. “freefall”)
- Space booster performs two functions:
  - Lifts payload to appropriate height
  - Accelerates payload to the speed needed to maintain orbit at that height (~ 17,000 mph at 196 miles)

Space is Big

- Volume of oceans (avg depth 2 miles)

  400 million cubic miles

- Volume of atmosphere (sea level to 60 miles)

  12 billion cubic miles

- Volume of space out to GEO belt (21,472 miles)

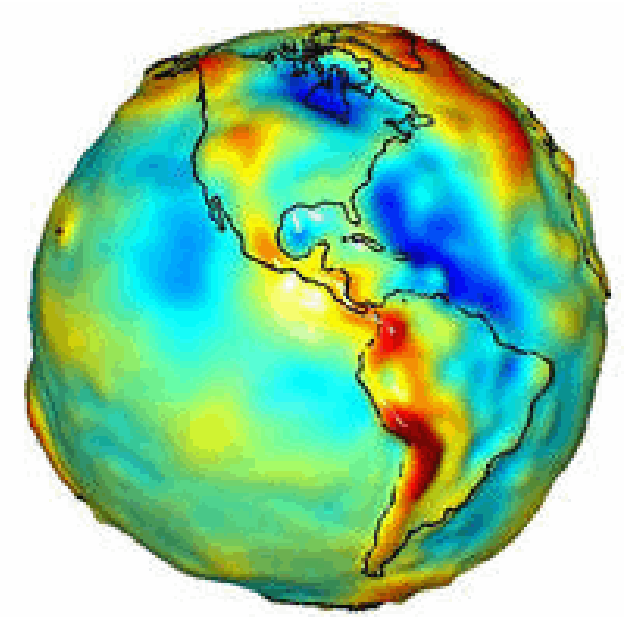
  70 trillion cubic miles

Objects in orbit don’t slow down

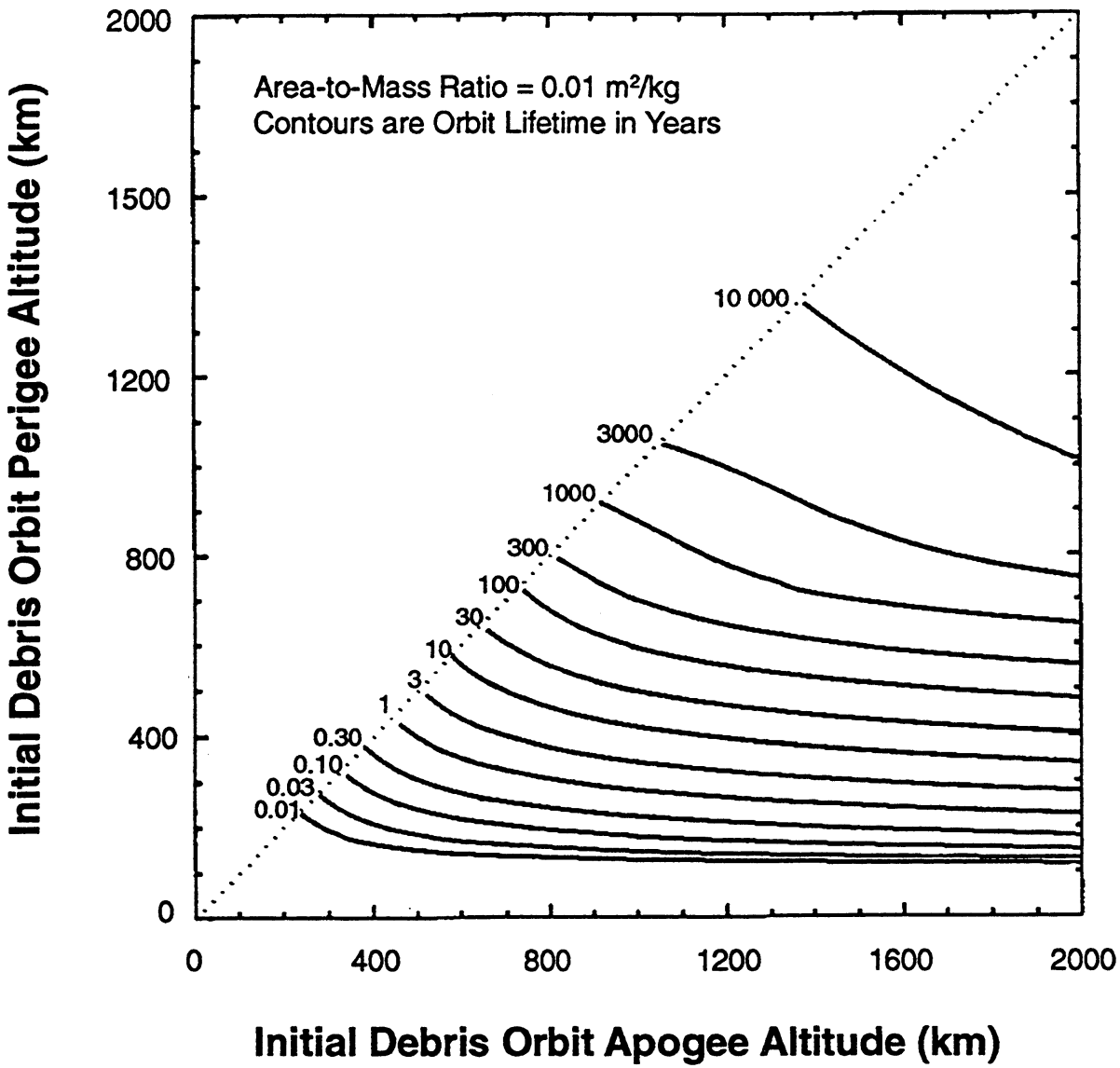
- On Earth, friction and drag slow things down
  - No friction in space
  - Drag in space very reduced and only affects satellites < 600 miles
- In space the forces change an orbit but don’t slow it down very much

Earth’s Gravity Field

(via GRACE satellite mapping)



Lifetime in orbit vs Altitude



Effects of these properties

- Cannot change the speed of an object (easily)
- Cannot track everything everywhere all the time
- Almost always instruments (IFR) providing information instead of human senses (VFR)
- Objects can stay on orbit for a long time, depending on altitude

½” BB into a solid metal block at 4.3 miles/sec

Orbital Population

- Trackable objects (greater than 4 inches)

  20,000

- Untrackable objects (½” to 4 inches)

  300,000

- Tiny particles (less than ½”)

  20 billion (guesstimate)

So space is big, there is lots of stuff, and stuff moves fast.

Why is it an important issue for policy makers?