Too Big To Succeed

GSAW 2016

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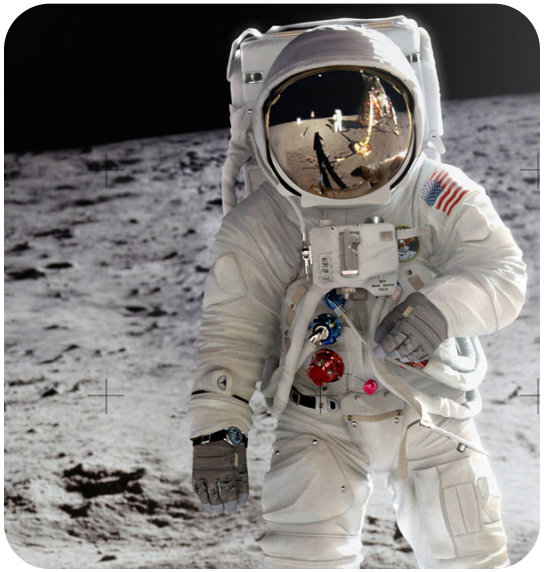
Understanding The Rapid Rate Of Change

1st Space Age



Going to the Moon

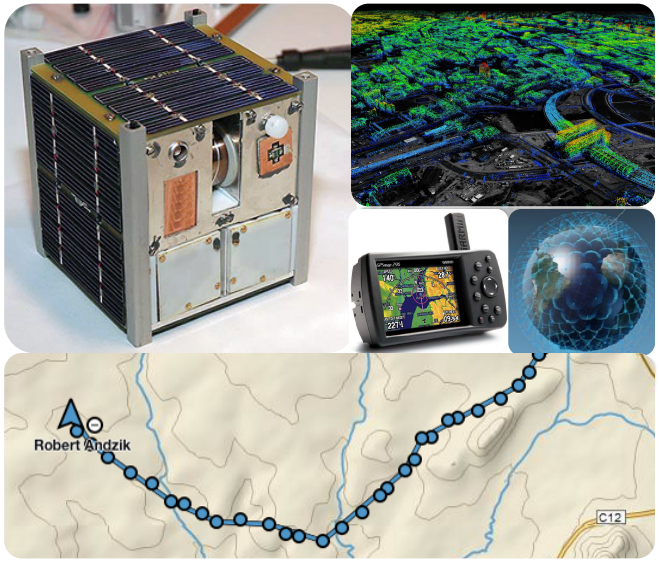
- Space was new
- Huge Budgets
- Figure it out!

2nd Space Age

Large Missions

- Big Challenges
- Big Satellites
- Big Budgets

3rd Space Age



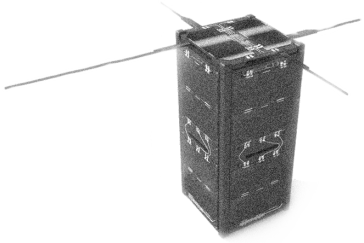
Commercialization of Space

- Smaller Focused Satellites
- Lower Overall Costs
- Focus on End-Product/User

The Space Industry Isn't Waiting For Us To Catch Up

SPACECOM 2016 -- Stuart Martin, CEO Satellite Applications Catapult

What Is Enabling The 3rd Space Age?



+

= $200K

$100K CubeSats

$100K to launch a CubeSat

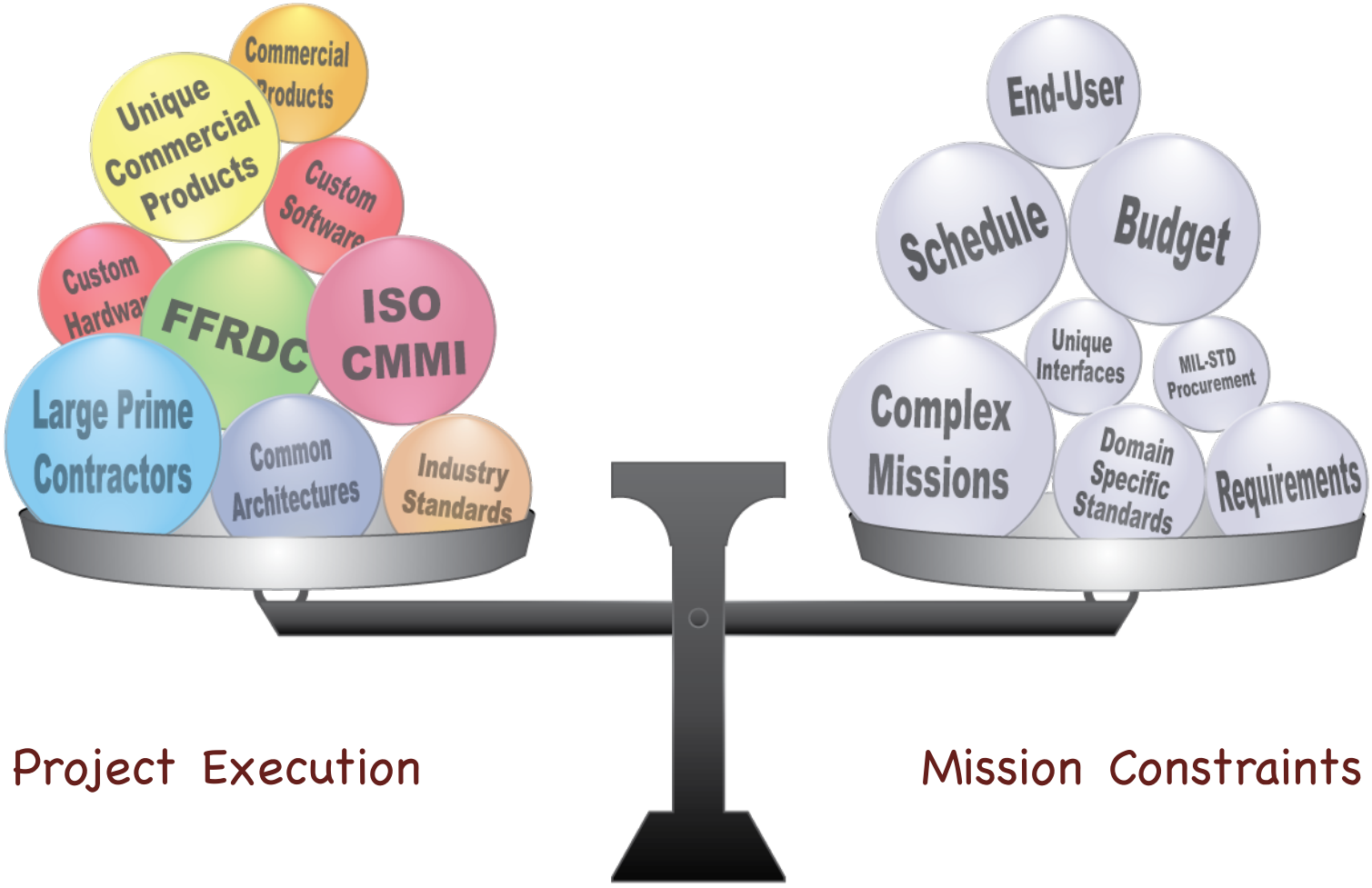
Creates Entirely New Opportunities For Space

Large Constellations
(600+ Satellites)

Short-Term Missions

More Commercial Uses

We created a balance for the 2nd Space Age



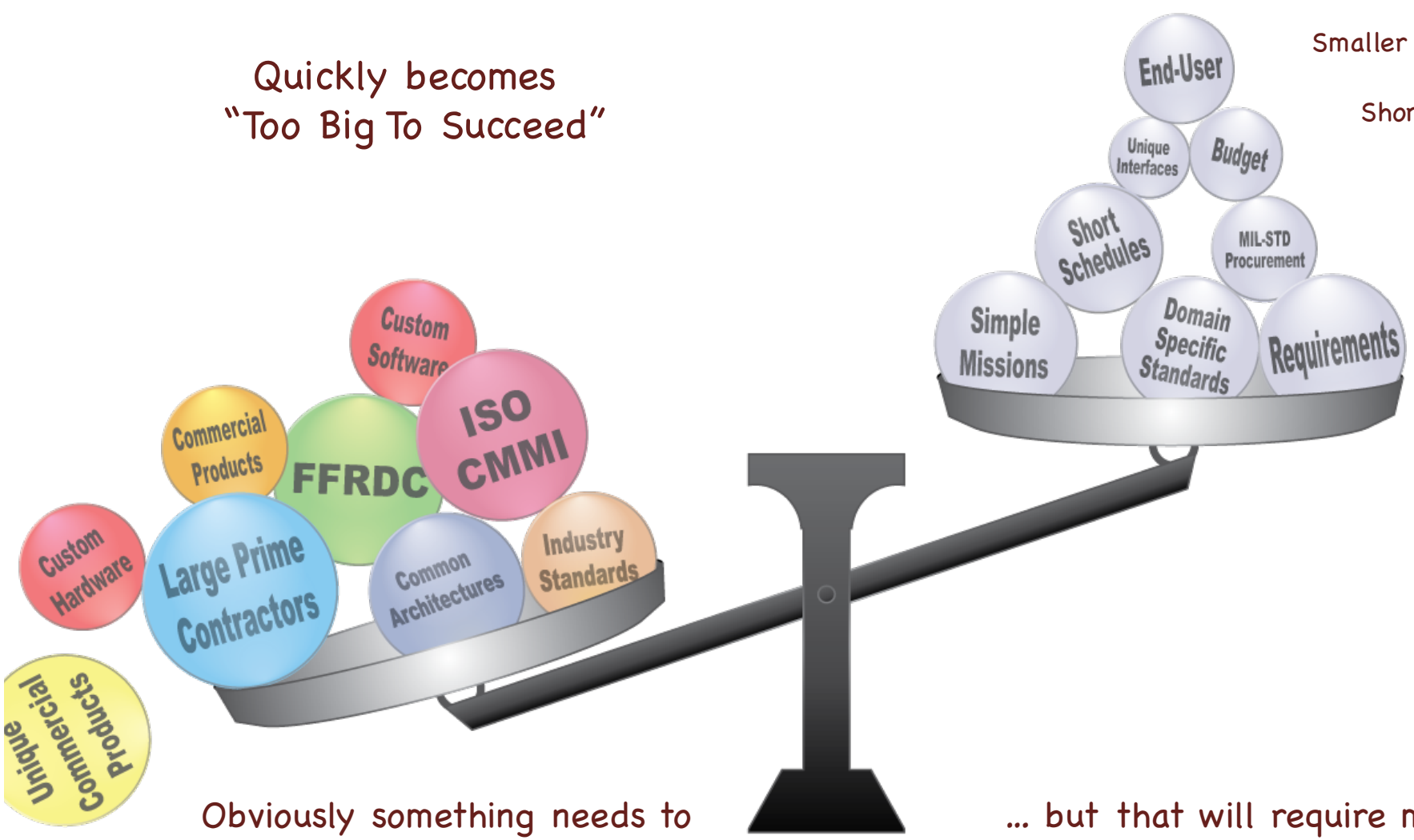
What Happens In The 3rd Space Age?

Shrinking Budgets

Smaller Missions

Shorter Schedules

Quickly becomes
"Too Big To Succeed"



Obviously something needs to change on this side....

... but that will require more changes on this side!

Maintaining The Balance

- **A New Balance Needs To Be Found**
  - There are a lot of things to consider
  - Each has benefits & consequences
- **Fundamentally**
  - We are all in business
  - A business case must exist
- **Reducing Mission Scope/Budget**
  - Means less overall $$
  - Large companies need lots of $$$$
  - Who is motivated to do this?

Will new efforts like
Enterprise Ground Services
Help or Hinder
This Balance?

Let's focus on
Commercial Products & Standards

How Can Standards Help or Hinder?

- **Standards Used On DoD Related Space Programs Evolved During The 2nd Space Age**
  - Consider legacy interface standards and MIL-STD Specifications
  - Most require extra staffing, time, and unique features not needed in commercial space programs
  - They all add to the overall cost of the program

- **Can This Be Changed For EGS?**
  - The biggest challenge will be determining which are truly necessary
  - Need to have the leadership to eliminate those that are no longer necessary

- **Some Guidelines For Technical Standards**
  - Use/Develop Widely Used Industry Standards
  - Standards should define common data transport and interfaces
  - Standards that create innovation rather than hinder it will succeed
  - Work with not against new commercial space efforts

If there are only one or two vendors providing products for EGS is the goal realized?

GEMS Example

- **GEMS (Ground Equipment Monitoring Service)**
  - Managed by the Object Management Group (OMG) Space Domain Task Force
  - Uses OMG's Model Driven Architecture (MDA) approach
  - Defines a simple model and protocol for device control and status
  - Can evolve as technology evolves by adding new PSMs
  - Latest Version 1.4 released December 2015
    - The entire specification is 47 pages
    - Standard XML Schemas and online examples

- **Definition of this specification was initiated and adopted by Industry**
  - Has not cost the government anything to develop this standard!
  - Saves product vendors money
  - Saves integrators money

← KEY POINT

- **Currently Operational On Many National, Civil, and Commercial Space Programs**
  - It is now appearing in new specifications -- ***Oh Look! A Business Case!***

So What About The EGS?

- **Admittedly Small Technical Standards Are Not The Complete Answer**
- **EGS Needs An Architecture That Stitches It All Together**
  - Should quickly adapt to meet changing technologies
  - Should offer mechanisms for extension
- **If Part Of The Goal Is To Utilize Commercial Capabilities and Products**
  - EGS must either provide enough business for those products or define the architecture/interfaces/standards around products that can be used elsewhere

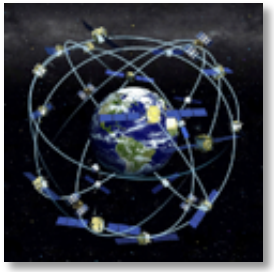
Remember the space industry isn't waiting for us

A Look To Industry For An Example

An Open Agile Architecture is currently operational supporting critical communication links in our nation's space programs using standards like GEMS

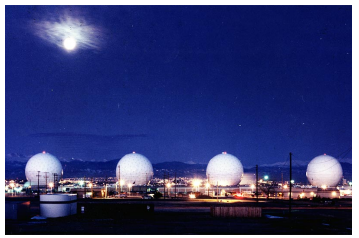
Software Front Ends process the **International Space Station's** Voice, Data, Video, Telemetry, and Commands using CCSDS protocols

Software Modems handle the TT&C links for the **GPS Constellation and many commercial satellites**



High Speed Data Recorders capture telemetry and image data from governement and commercial satellites

Agile FEP, Modem and **Gateway** systems are integral to the architecture of several **DoD and other Gov't programs**



Data Acquisition systems support low-latency, high reliability launch control of the **Atlas** and **Delta** launch vehicles

The 3rd Space Age represents a dramatic change in our industry

Are we ready for it or are we
Too Big To Succeed?

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