Framework for Compatible Satellite Command & Control

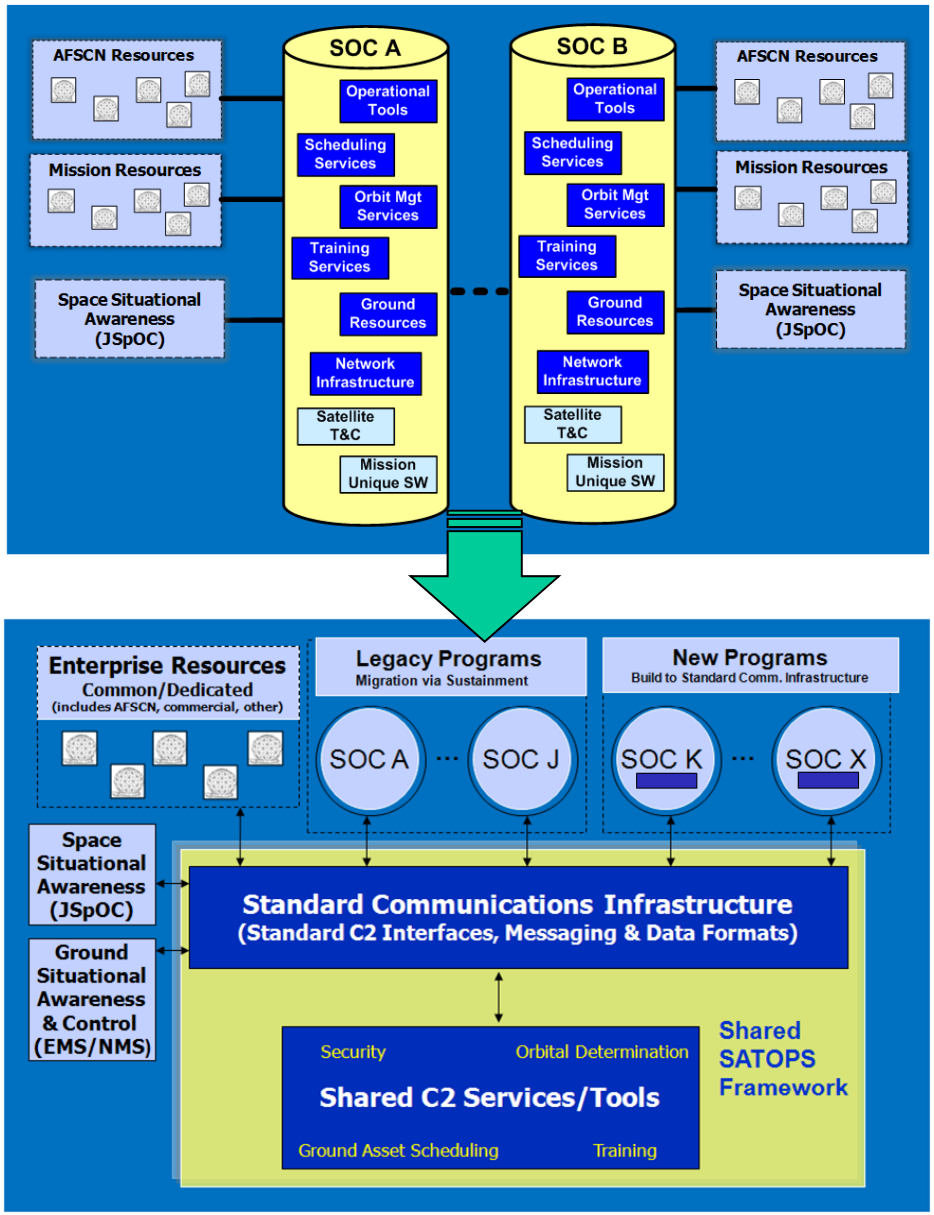
GSAW 2012

Tom Sullivan
The Aerospace Corporation

AEROSPACE

Compatible SATOPS Framework Approach

Enabler for SATOPS Transformation



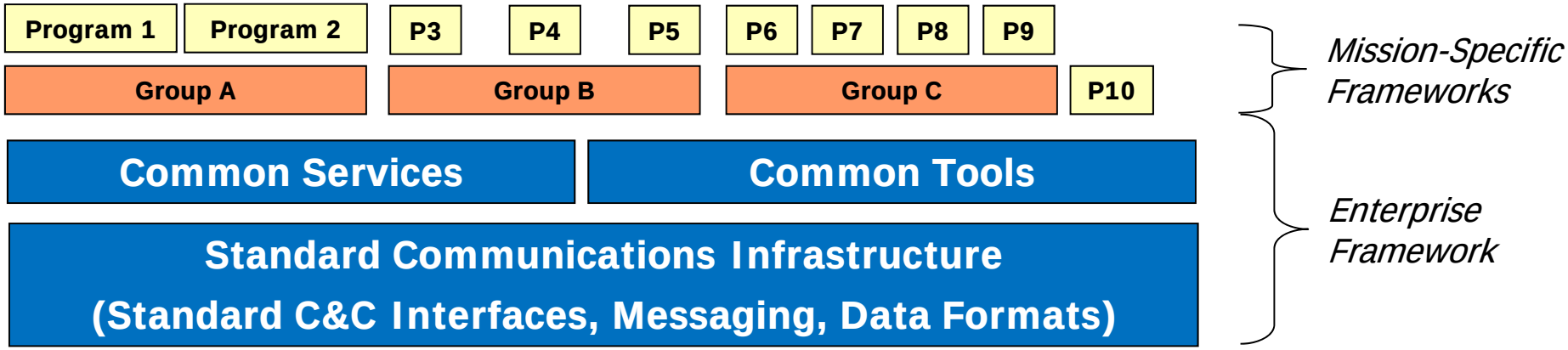
Key Benefits

- **Enables Architecture Evolution**
  - Flexible CONOPS
  - Supports goals for commonality and/or interoperability
- **Vendor neutral framework based on accepted standards**
  - Promote competition
- **Facilitates creation of shared tools and services**
- **Enables automation across legacy systems**
- **Enables greater ground and space situational awareness**
- **Potential savings in long term development & O&M costs**

What is a Framework?

"**Framework:** An implementation of the foundation portion of the overall system architecture. It is a structured set of software components and standards, and possibly hardware, upon which to build additional functionality. Some examples are 1) an underlying communications infrastructure, 2) the basic utilitarian libraries of a subsystem, 3) the Microsoft Office Suite, or any other such set of foundational software intended to provide the means and mechanisms to develop other software applications, projects, missions, and enterprises."

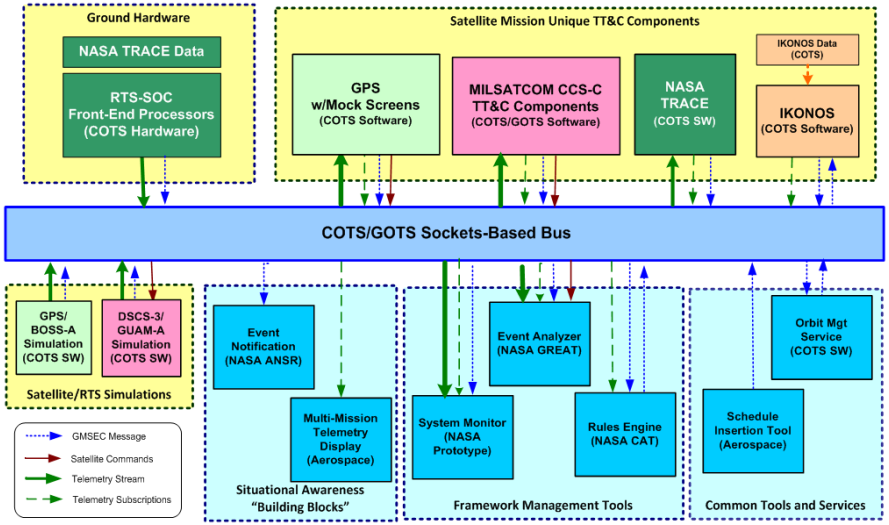
- NASA



Frameworks are commonly used in industry. Examples: MS Windows, iPhone, 3G Network
It is not an architecture, but can form the foundation for many!

Background

- **Sat C2 Framework Study: June 2008 – Oct 2009**
  - Evaluated Compatible Sat C2 architecture based on Goddard Mission Services Evolution Center (GMSEC) framework



NASA's GMSEC is suitable standard for a Compatible Satellite C2 Framework

- **Compatible SatC2 Prototype: Nov 2009- Sept 2011**
  - Representative Enterprise Architecture
  - Information Assurance Integration
  - DOD Operational Systems

SMC/SN RFI to Industry

- **RFI for applicable industry research & comments**
  - RFI released May 2010 and Industry Day held August 2010
  - White papers on proposed architecture, approach, and cost savings
  - Industry research capabilities that can support prototyping objectives
- **25 Companies responded to RFI in 2010**
- **9 Companies of most interest to the Government agreed to provide capabilities to the prototype**

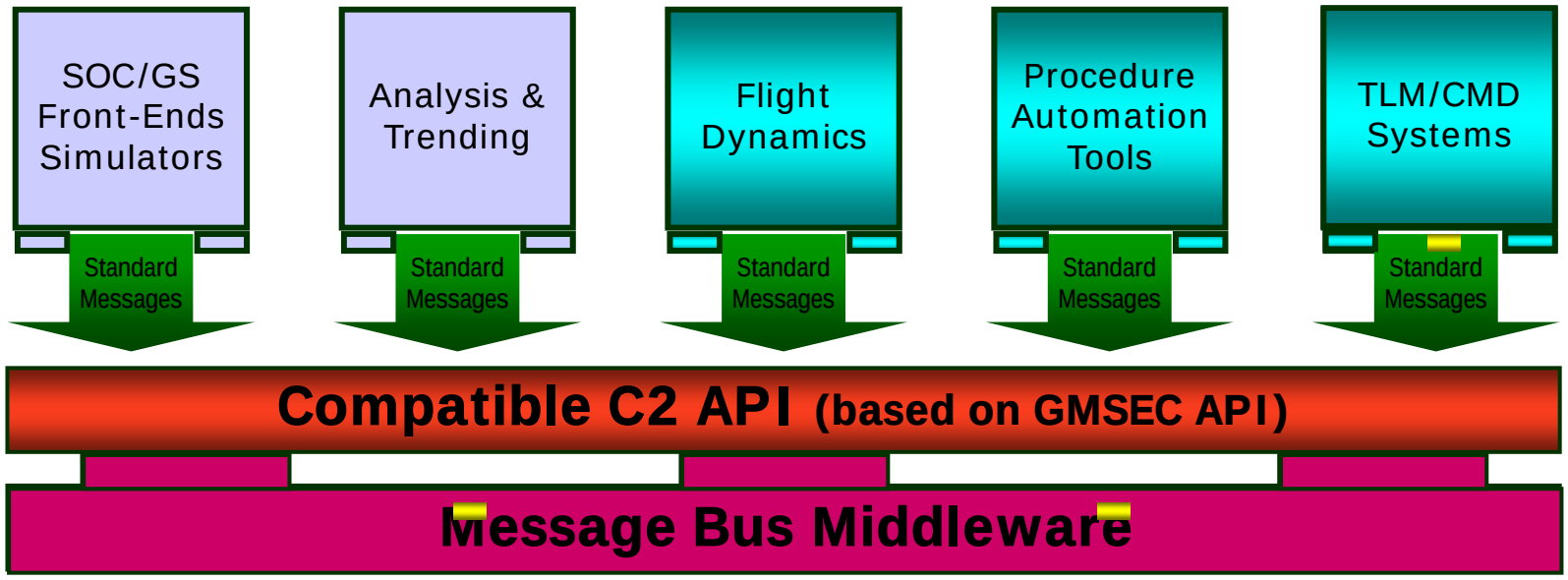
Compatible Satellite C2 Framework

Messaging Standard

Messaging framework is composed of 3 elements that collaborate to change how systems are built:

- Publish/Subscribe API
- Middleware
- Message Standards

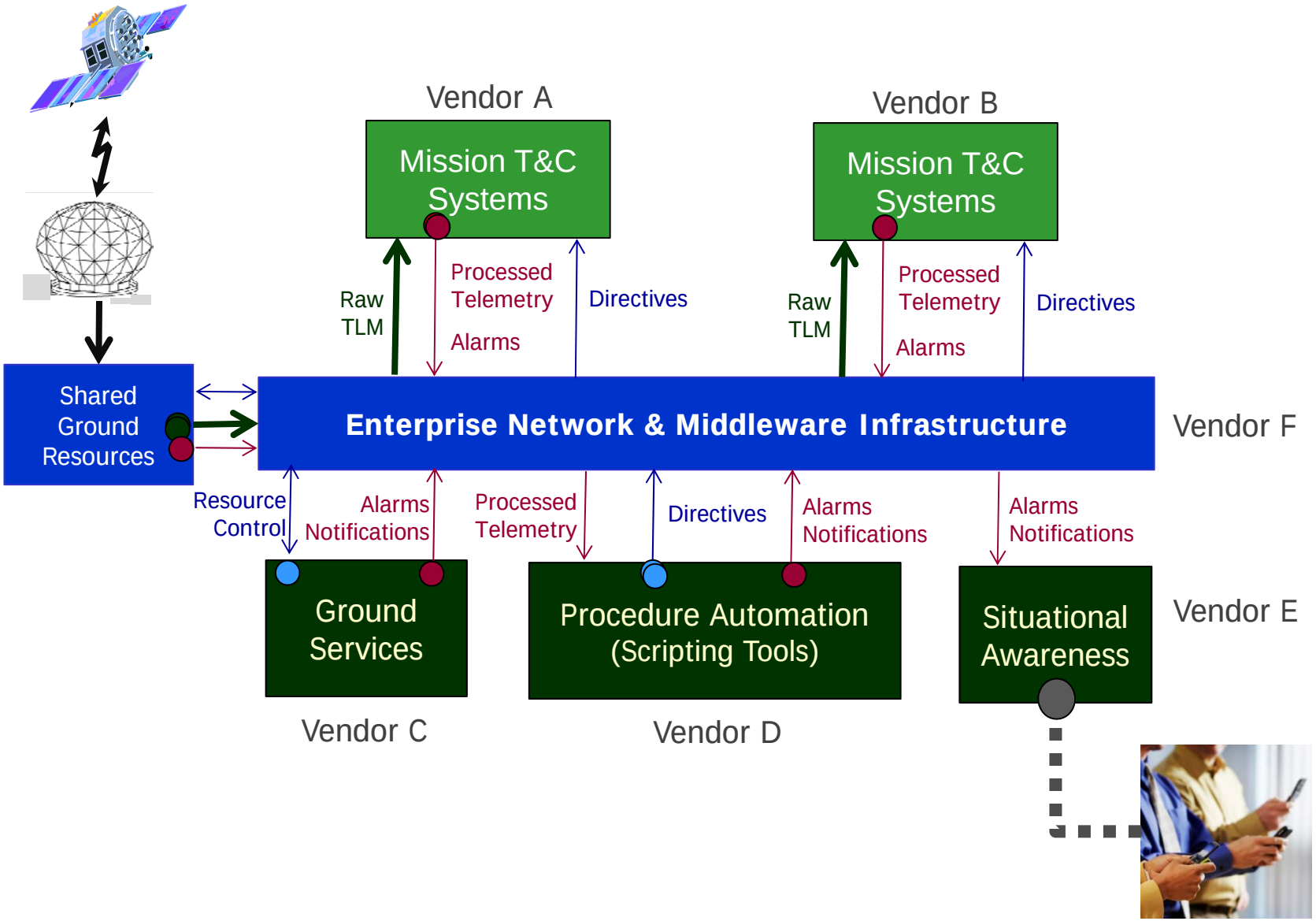
Framework Standards
- Interfaces
- Messaging
- Data
- Security
- Infrastructure



Modified NASA chart

Compatible Satellite C2 Framework

Applied to Enterprise Automation & Situational Awareness



Prototyping Conclusions (Sept 2011)

1. The Compatible Satellite C2 Framework based on NASA's GMSEC can be applied to an Enterprise Architecture

2. Standard IA methodologies and tools can effectively be added to secure a Compatible C2 Framework

3. The publish-subscribe CONOPS in Compatible SatC2 can effectively support

- Automation of Operations
- Situational Awareness

Joint SATOPS Compatible Committee (JSCC)

- **Multiple organizations have recognized common evolutionary challenges**
  - Reduce life cycle costs
  - Increase interoperability of satellite control between systems and organizations
  - Provide enterprise-wide space and ground situational awareness
  - Enhance current SATOPS capabilities & availability
- **JSCC collaboration formed among AFSPC, NRO, ORS, NAVSOC and NASA organizations**
  - Investigate methodologies & architectures to address challenges
  - Need mature technical alternatives and industry acceptance

JSCC shares lessons learned on defining a SATOPS framework and associated standards that foster compatibility

OPERATIONALLY RESPONSIVE SPACE
ORS

Summary

- **The Compatible Satellite C2 Framework is an enabler for SATOPS Transformation**

- **The Compatible SatC2 Prototype has effectively demonstrated a number of key concepts with the aid of industry**
  - Common Services, Situational Awareness, Common Ground Interfaces, Security & Cyber Defense