



# Framework for Compatible Satellite Command & Control



GSAW 2012

Tom Sullivan

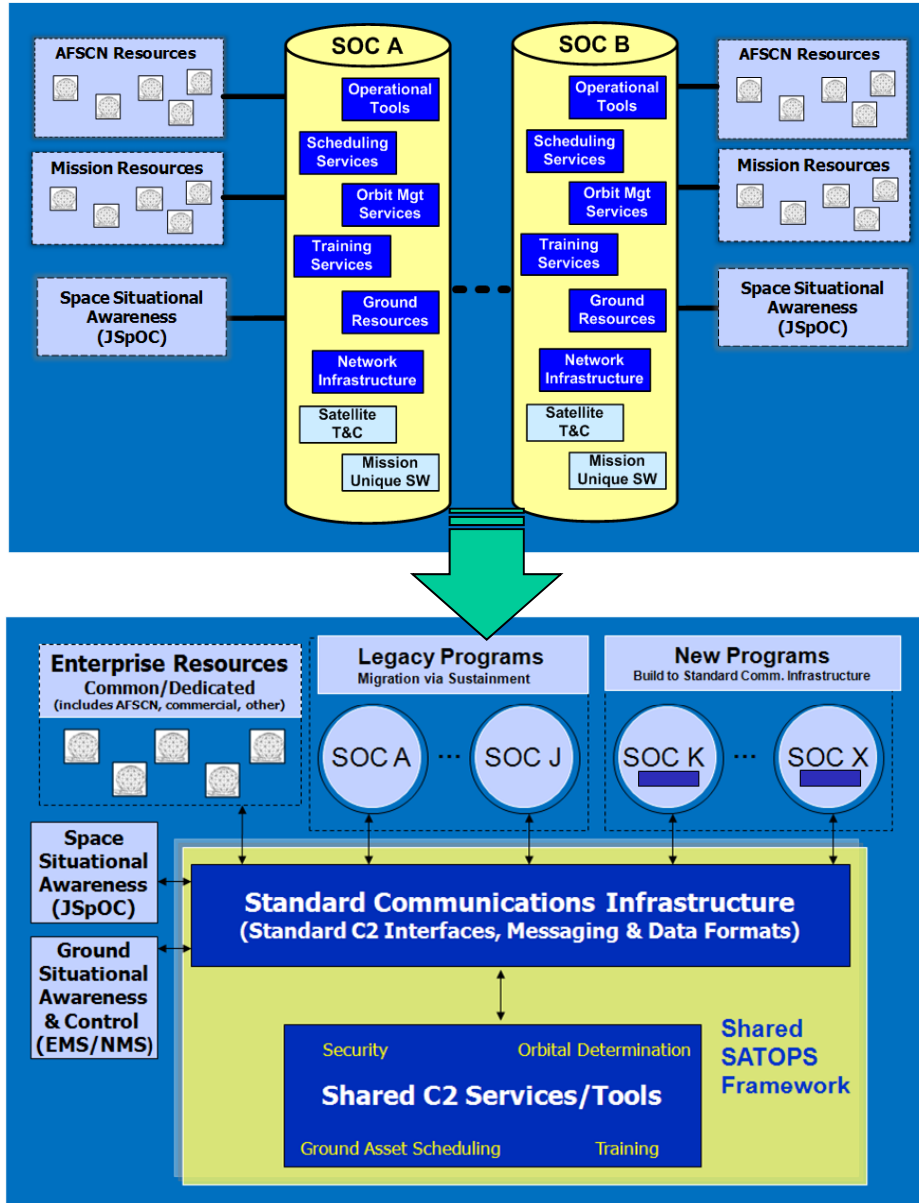
The Aerospace Corporation





# Compatible SATOPS Framework Approach

## Enabler for SATOPS Transformation



### Key Benefits

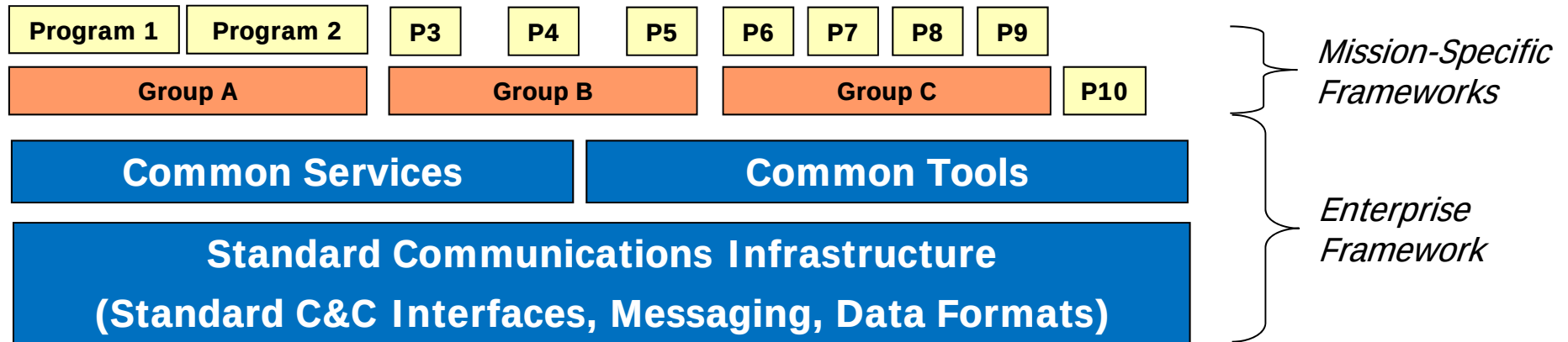
- Enables Architecture Evolution
  - Flexible CONOPS
  - Supports goals for commonality and/or interoperability
- Vendor neutral framework based on accepted standards
  - Promote competition
- Facilitates creation of shared tools and services
- Enables automation across legacy systems
- Enables greater 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

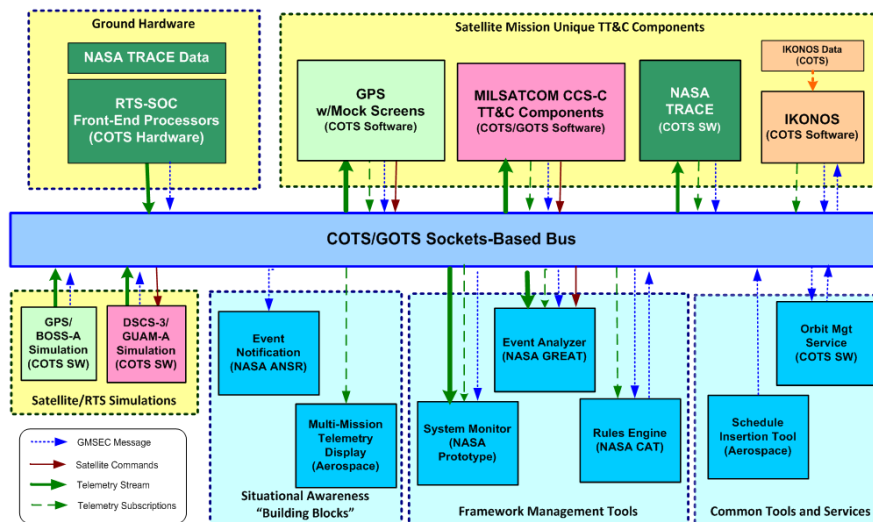


Frameworks are commonly used in industry. Examples: MS Windows, iPhone, 3G Network  
It is not an architecture, but can form the foundation for many!



# 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

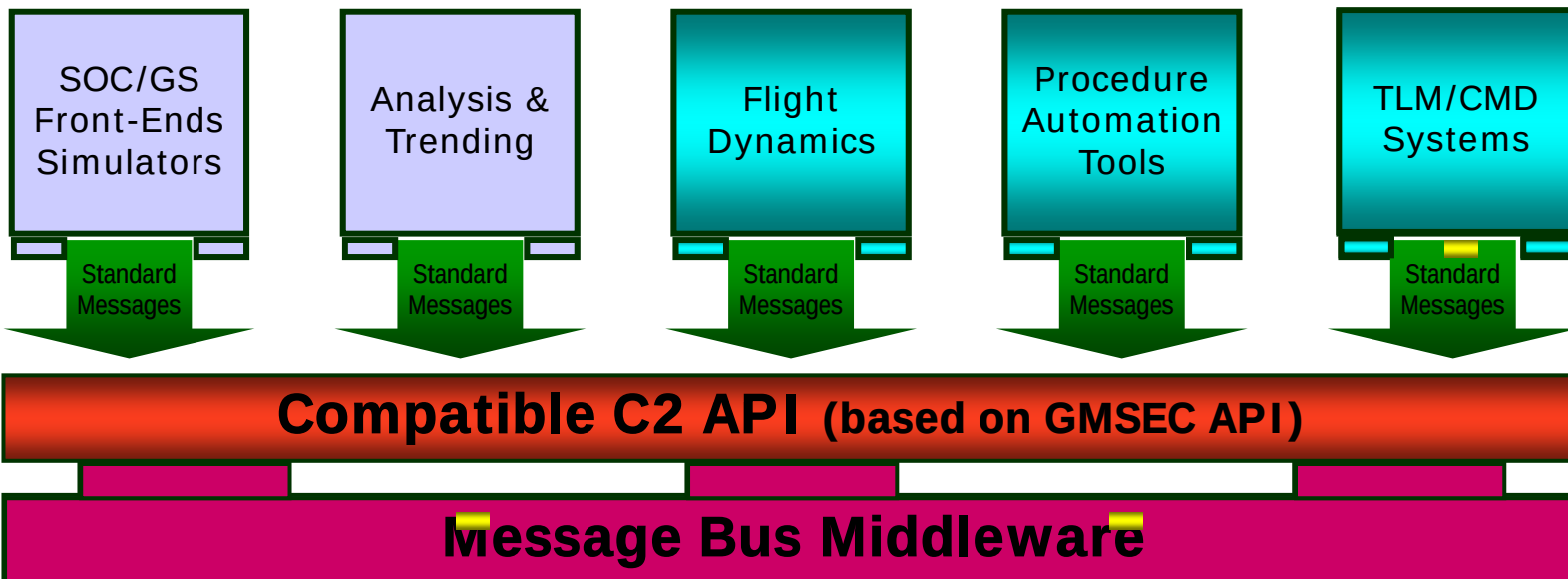


Messaging framework is composed of 3 elements that collaborate to change how systems are built:

- Publish/Subscribe API
- Middleware
- Message Standards

## Framework Standards

- Interfaces
- **Messaging**
- Data
- Security
- Infrastructure

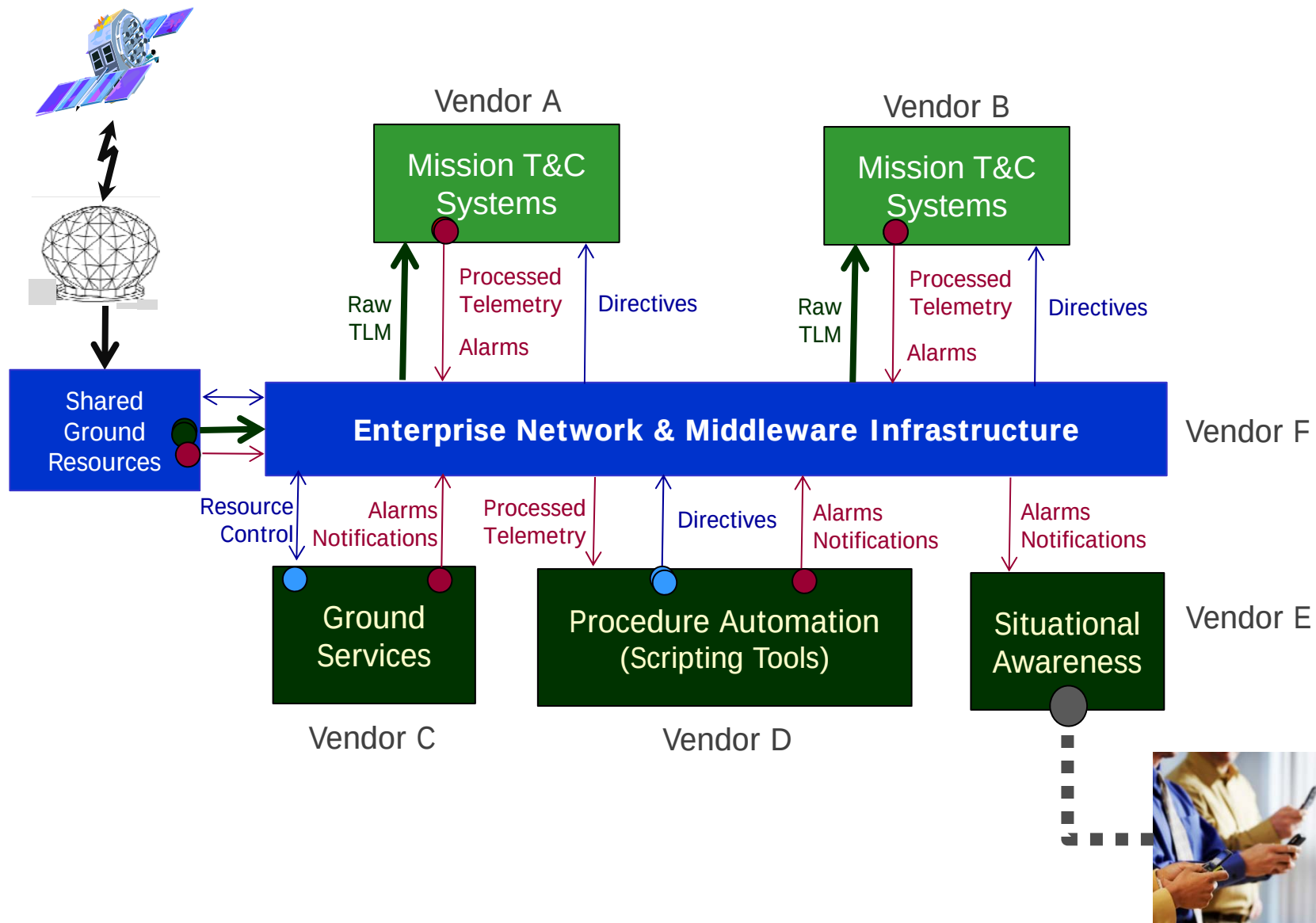


Modified NASA chart



# 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**





# 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

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