Ground System Architectures Workshop

GSAW

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Beyond the New Architectures –

Enabling Rapid System Configurations

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Session 7
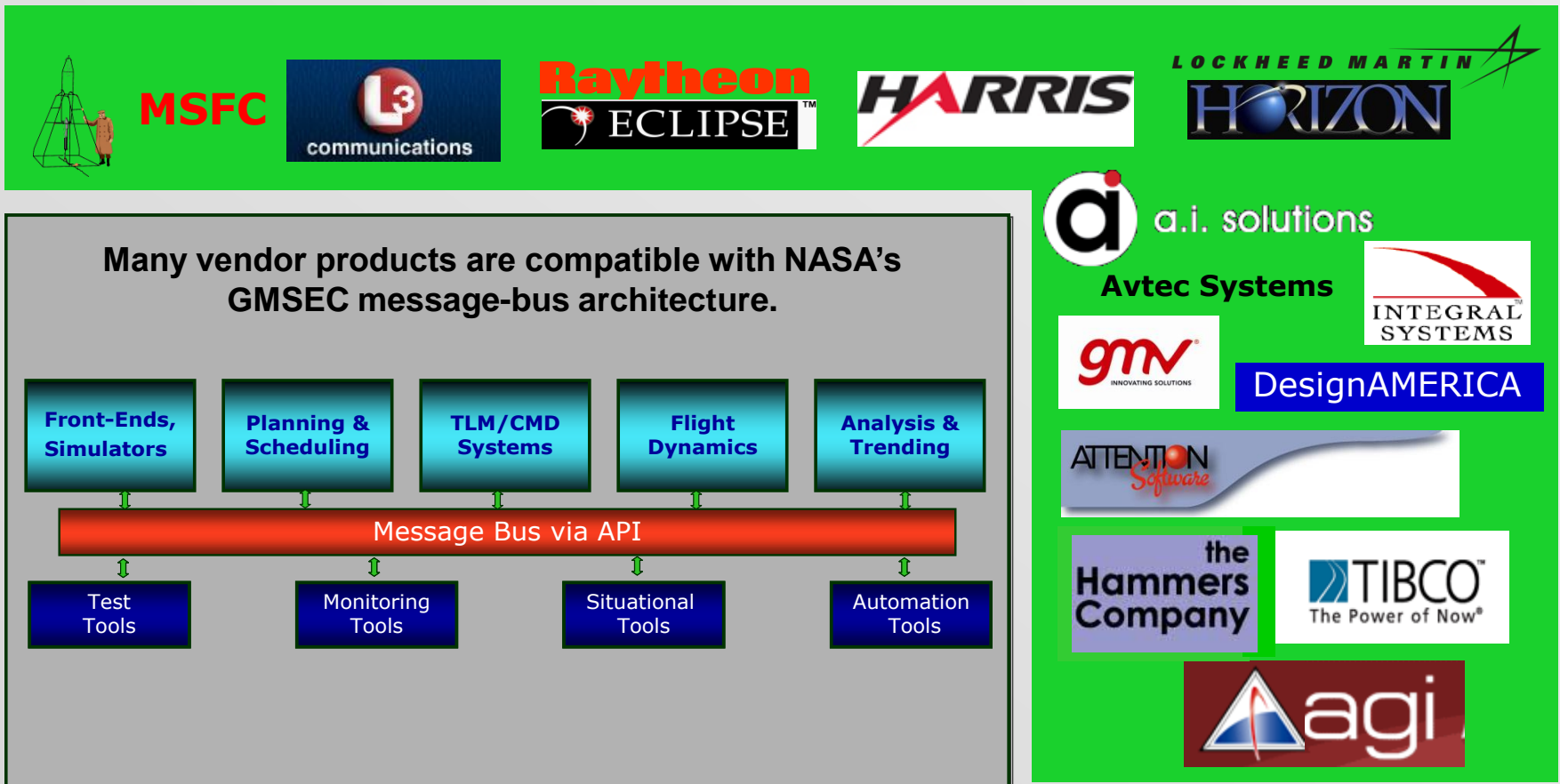*Standards as Enablers*
March 25, 2009

We've made great strides in ground systems

- New architectures have led to many benefits for satellite missions

  – More rapid system integration

  – More options and flexibility in product selection

  – Simplified maintenance
    - Addition, removal, or upgrade of components

  – A move towards enterprise-level capabilities
    - Situational awareness, automation, services

The Goddard Mission Services Evolution Center (GMSEC) Architecture

MSFC

Many vendor products are compatible with NASA's GMSEC message-bus architecture.

Front-Ends, Simulators	Planning & Scheduling	TLM/CMD Systems	Flight Dynamics	Analysis & Trending

Message Bus via API

Test Tools	Monitoring Tools	Situational Tools	Automation Tools

Avtec Systems

DesignAMERICA

New architecture approaches have simplified integration efforts and allowed for the mixing of different COTS and GOTS products.
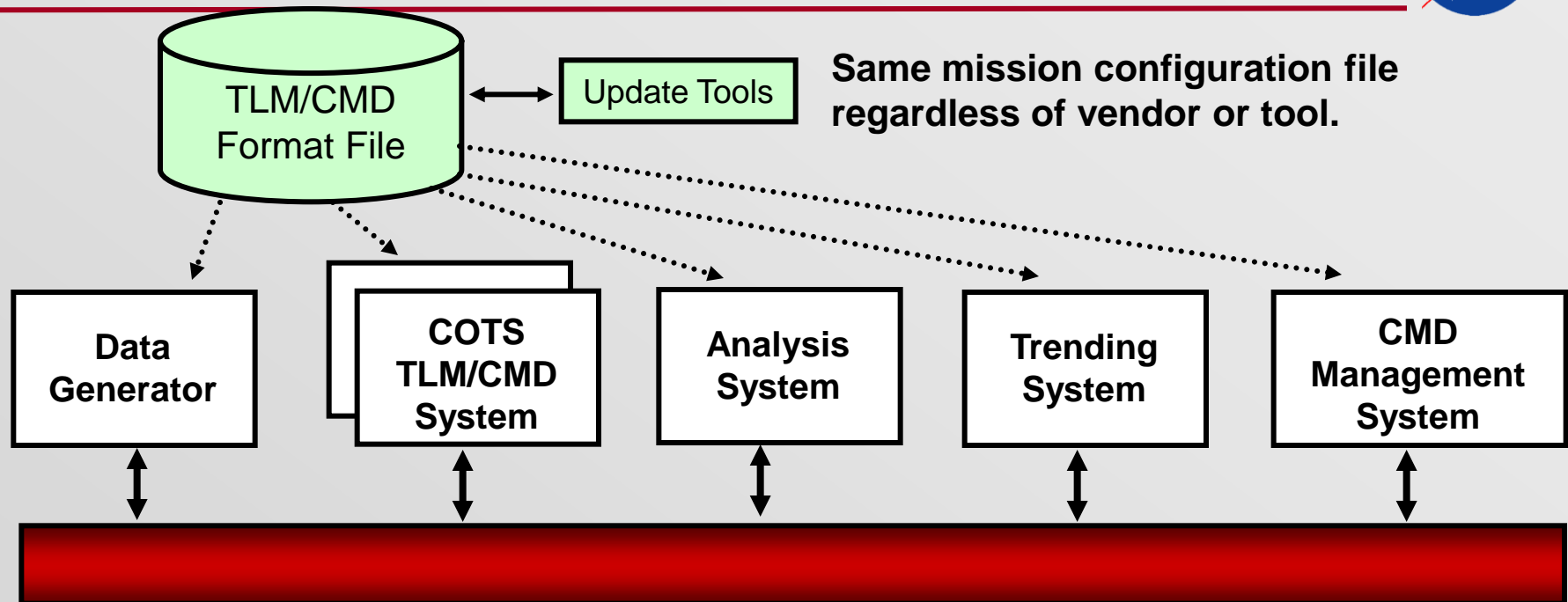
We still have a big problem!

It seems like each satellite built, each COTS package sold, and each tool developed handles basic configuration information in its own unique way.

- Primary example is the telemetry and command list information

    - At NASA GSFC, some control centers need the same information presented in 5 different formats (a different input format for each tool)

    - We re-write front-end software for several tools each time a new mission comes along with a new format

    - The risk of accuracy and completeness issues is high

The next step for ground system evolution

TLM/CMD Format File ←→ Update Tools

Same mission configuration file regardless of vendor or tool.

| Data Generator | COTS TLM/CMD System | Analysis System | Trending System | CMD Management System |

We should be able to configure our systems for a new mission's telemetry and command set within hours. Even initial display definitions can be auto-generated.

But what about custom software for time formats and parameter types?

A TLM/CMD List Exchange Format Exists - XTCE

- An XML-based joint OMG/CCSDS Standard for exchanging telemetry and command format information
    - XML Telemetric and Command Exchange (XTCE)
    - Consultative Committee for Space Data Systems/Object Management Group

- It is "ugly", groups have tried using it and have had issues with it
    - Too big,
    - Too many ways to do things
    - No limitations (100,000 character mnemonics? No problem!)
    - As written, one can't implement to the fully flexible standard
    - Works if parties agree to how to use it first – not really interoperable

- There hasn't been a business case
    - Why should anyone be the first to jump to a new standard?
    - Nobody is really requiring it anyway

- We must address both of these issues! XTCE is the best we have.

ISSUE:

Until it is a regular requirement or everyone moves in that direction, there is little reason for a vendor to invest heavily in new standards.

RESPONSE:

- Recognize that any single mission or even single group (like NASA/GSFC) does not control enough of the market to make the change happen.
- Gain alignment of the key U.S. government space organizations
  - NASA, Air Force, NRO, ORS, NOAA, USGS
  - Declare intentions to move this way, set dates
- Consider ways to demonstrate commitment, aid the vendors
  - Consider matching funds, create reference data sets, include new requirements in RFPs
- Be careful not to favor a single vendor or contractor

STEP 2 – Tailor XTCE

ISSUE:

- XTCE is too general purpose to allow common, interoperable implementation

RESPONSE:

- Pick single approaches where many alternatives are now possible
- Formalize how to handle CCSDS packets and major/minor frames
- Add field constraints
  - Don't need 100,000 character mnemonics or 53rd order polynomials

- Try a test case before declaring a tailored standard is ready

- Government to create reference populated XTCE file and data set
  - Allows for self-certification of products

STEP 3 – Add Standard Parameter Types

ISSUE:
- Missions sometimes have special parameter types
    - How many time formats do we really need?
- New parameter types = custom software

RESPONSE:
- Create a reasonable list of common parameter types
- Add list to standard
- Encourage product vendor compliance
- Satellite designers encouraged to work within the set
    - Additional types allowed, but must be highlighted as added-cost items for each data processing system
- New types could be considered for the standard list

One solution, many benefits

- I would like to deploy an initial operational capability for a new mission within 48 hours

- If someone puts a new instrument on the moon, I'd like to immediately be able to process its telemetry

- I want to mix-and-match vendor products with minimal effort and test new products with my mission's data

- I want an enterprise system where I can put any mission's data into any in-house or commercial tool on very short notice

- I want to be able to trade tools with others and to have others develop new XTCE visualization tools

XTCE Project Status
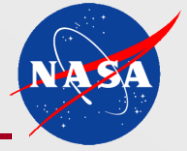
1. NASA has approved initial funding (standards and limited tool modification)

2. NASA-ORS Agreement signed (pilot project, follow-on)

3. Multiple government agencies have met and agreed in principal

4. Meetings held with several COTS providers – all supportive

5. Agreement from CCSDS to help structure and publish the XTCE guide

6. XTCE tutorial taught at GSAW 2009
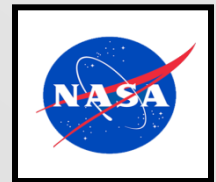
- Government/Industry discussion Wednesday evening at GSAW

- Goal is for XTCE to be broadly adopted within 12 – 18 months

The government, the standards groups, the COTS vendors and the manufacturers are involved and supportive. Let's do it!
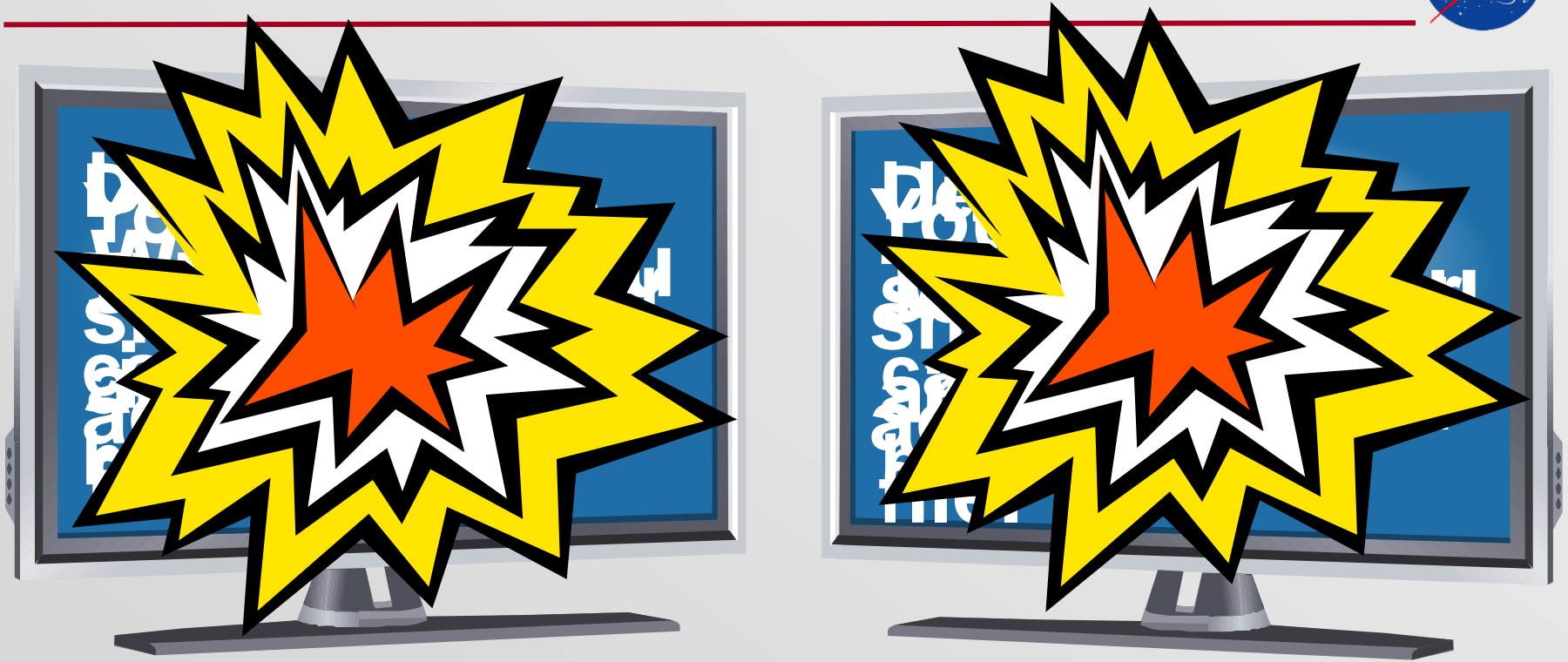
Common Standards for Missions
It's not impossible!

Can it work?

What are the barriers to standards adoption?

What is the best forum for industry and government collaboration to address common issues?

What standards areas are highest priority?

How should results be published?