GROUND SYSTEMS ARCHITECTURES WORKSHOP – GSAW 2010

GROUND SPACE TECHNOLOGY INNOVATION

GMV'S EXPERIENCE

INNOVATING SOLUTIONS

OVERVIEW

1. Introduction
2. The importance of technology innovation in industry
3. Difficulties deploying new technologies in Ground Systems
4. GMV's innovation strategy in Ground Systems
5. Technology innovation trends in ground systems at GMV

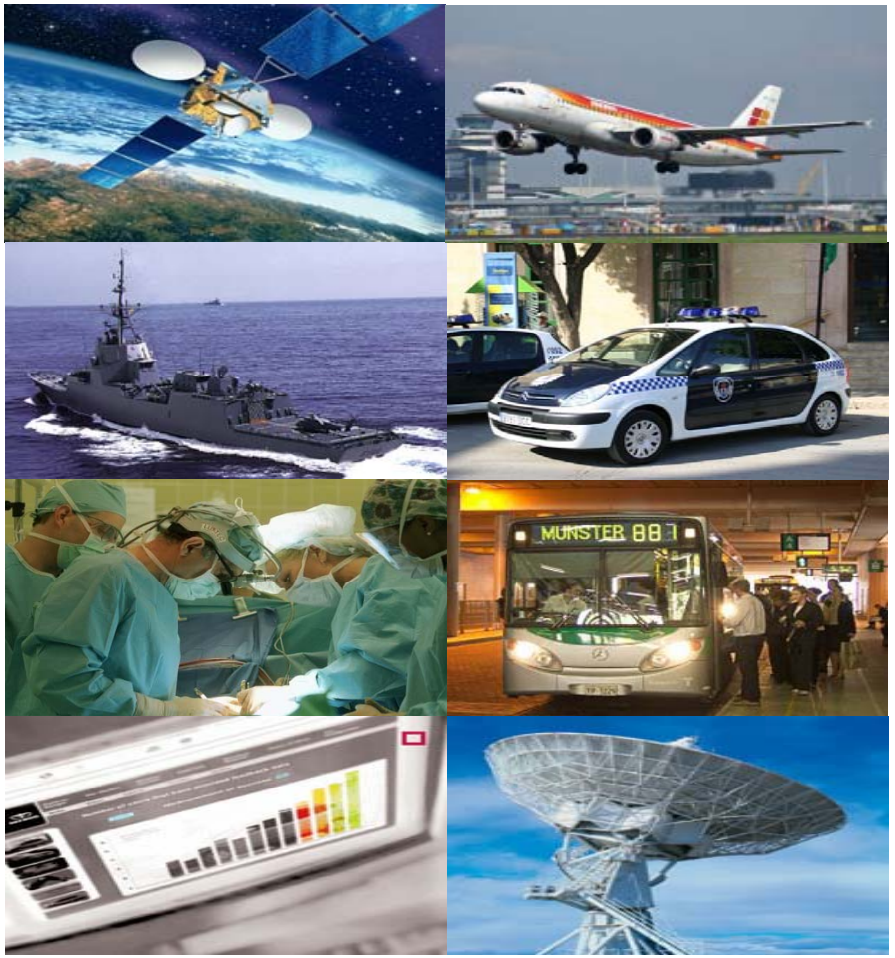
TECHNOLOGY INNOVATION

INTRODUCTION

INNOVATING SOLUTIONS

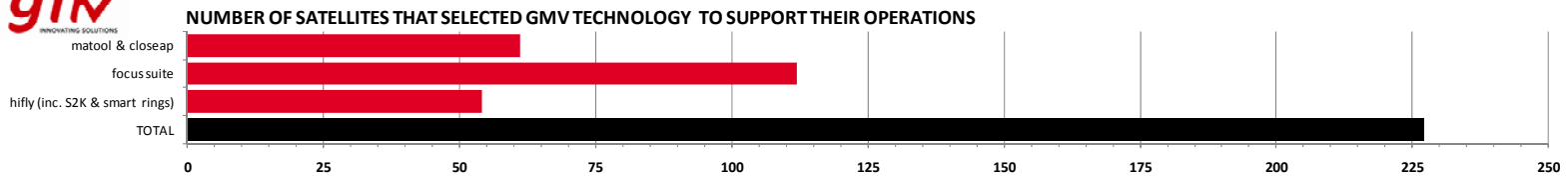
GMV BACKGROUND

- GMV is a privately-owned **multi-national** established in 1984
- **Offices** in USA (Rockville, MD), Spain (HQ), France, Germany, Portugal, South Korea, Malaysia. Over 1,000 employees.
- Company origins and largest business area is **space**
- One of the largest space Ground System suppliers in the world
- Engineering services and turn-key IT systems and solutions for
  - space
  - aeronautics
  - defense and security
  - healthcare
  - transportation
  - IT & telecommunications



GMV EXPERIENCE

NEXT USER'S CONFERENCE:
Rockville, MD, Oct 2010



GMV TARGET MARKET IN GROUND SYSTEMS

- GMV supplies ground systems and subsystems for all kinds of missions
- Specialized on
  - Telemetry & Command
  - Mission Planning & Scheduling
  - Flight Dynamics
  - Data Processing
  - Services (operations & mission analysis)
- 50% commercial, 50% institutional
- Small and highly competitive market. Few players.
- Highly sensitive to cost, even more lately
- Risk averse: reliability is key
- Customer base in commercial satellites has decreased significantly due to continuous consolidation

INNOVATION ONLY IF RISK IS LOW AND PRICE IS RIGHT

EVOLUTION VS REVOLUTION

TECHNOLOGY INNOVATION

THE IMPORTANCE OF TECHNOLOGY INNOVATION IN INDUSTRY

gmv®
INNOVATING SOLUTIONS

WHAT IS TECHNOLOGY INNOVATION?

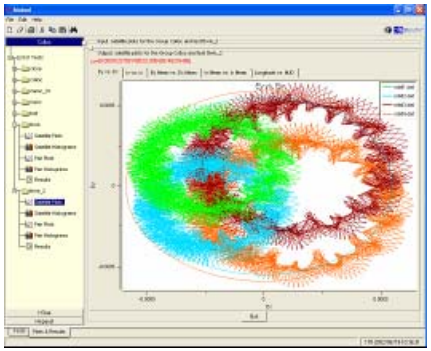
- In the **Ground Segment domain** and given the scope of GMV's activities, we will understand *technology innovation* as any new ideas or methods implemented regarding any of the following elements:
  - Custom application software
  - COTS software
  - Middleware, Operating Systems
  - Programming languages
  - Hardware
  - Development methods
  - Standards
  - Protocols
  - Operational procedures
  - Data formats
  - Paradigms

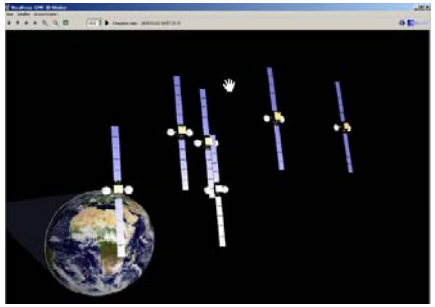
Innovation by itself is not the goal

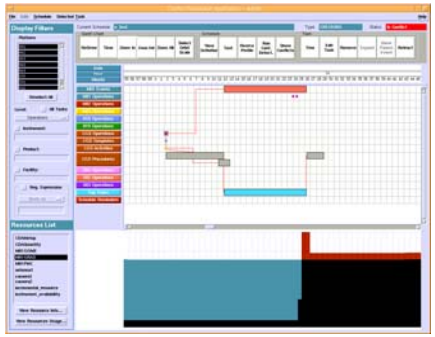
OUR MISSION: Provide our customers with systems fulfilling the desired combination of features, cost and deployment schedule

INNOVATION IN THE PRODUCTS OFFERED

- For a private company providing systems for the ground segment of space missions, innovation in the products offered is **essential for its survival**
- Enormous pressure from the market: If you do not innovate, someone else will and you will soon be obsolete
- Great difficulty to determine which **new technologies** available are here to stay or will soon be abandoned
- Not easy to distinguish a trendy but short-lived ‘buzz word’ from a powerful **new paradigm**







INNOVATION IN HOW THE PRODUCTS ARE DEVELOPED AND DEPLOYED

- A lot of the innovation in industry happens '**behind the scenes**', impacting:
  - How new products are developed
  - How they are deployed, customized and tested to supply turn-key systems for specific missions
- Impacts **tools, methods, quality system**
- This part is key to
  - Remain competitive
  - Increase the reliability of the systems provided
  - Accommodate aggressive schedules, more and more typical

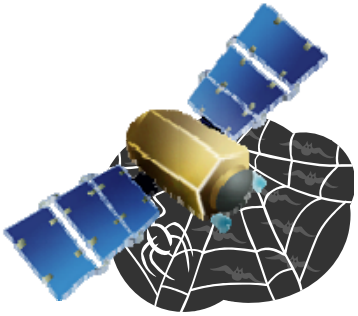
TECHNOLOGY INNOVATION

DIFFICULTIES DEPLOYING NEW TECHNOLOGIES IN GROUND SYSTEMS

INNOVATING SOLUTIONS

INNOVATION DIFFICULTIES

- This is a **risky business**. A problem can have a huge impact on the mission.
  - Nobody wants to be the first operator that uses a new product or a new technology:
- Ground Systems not always the best environment for the development of new technologies. Usually, only **proven technologies** are applied.



- Investment decisions made by operators usually do not take into account **total cost of ownership** throughout the mission
- The number of potential deployments of a new technology is small (small customer base). **Return on investment** for supplier may be small (or negative).

- Large **variability of requirements** across missions.

TECHNOLOGY INNOVATION

GMV'S INNOVATION STRATEGY FOR GROUND SYSTEMS

INNOVATING SOLUTIONS

INNOVATION PILLARS (1)

- **Internal actions**
  - Maintain technical excellence in core activities
  - Tight control on costs to remain competitive. Innovation vs price
  - Reduce response time to market
  - Channel innovation through product lines
  - Dynamic definition of product roadmaps
  - Exploit synergies and technological exchange among different business units within our organization

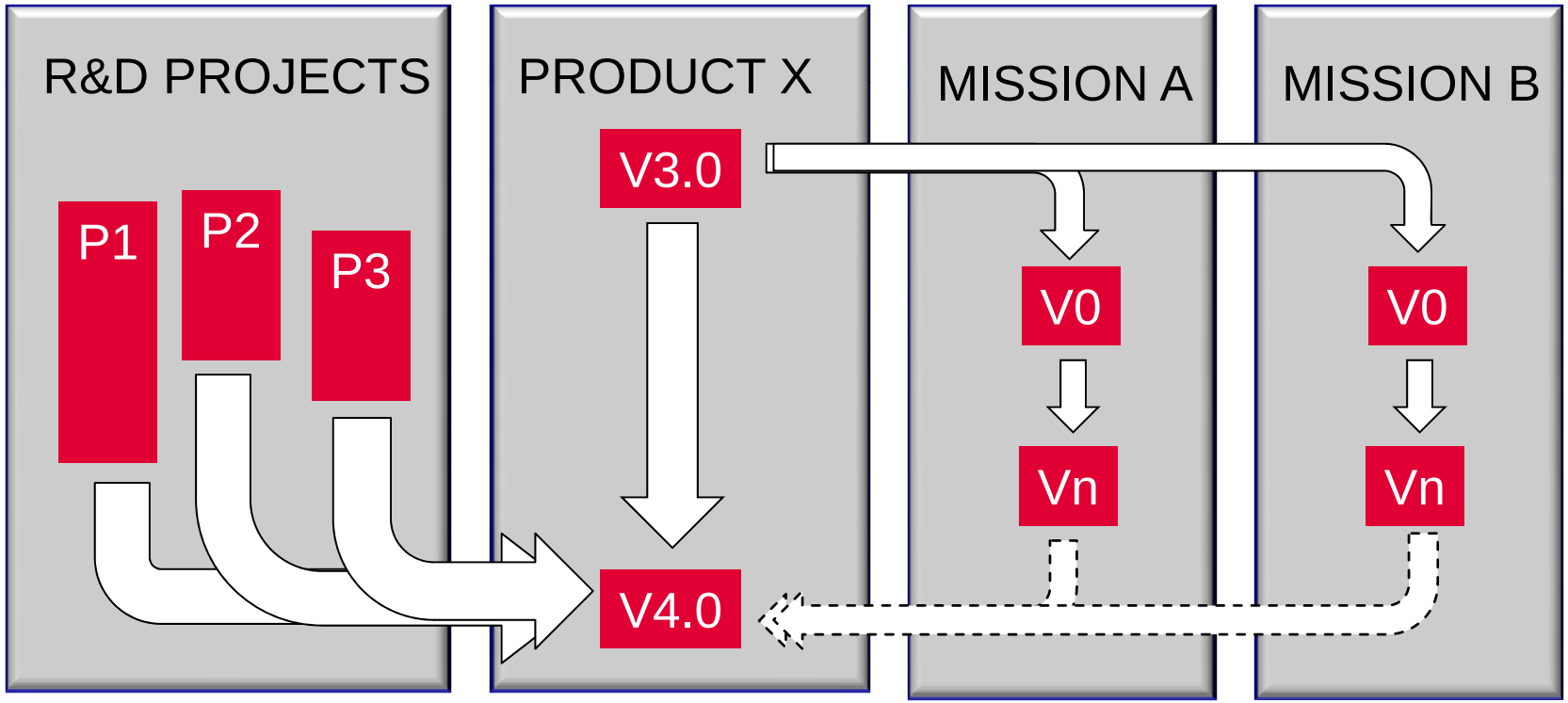
- **Funding**
  - Reinvest revenue: 12% goes back to research & development
  - Promote active cooperation with institutions and research centers

INNOVATION PILLARS (2)

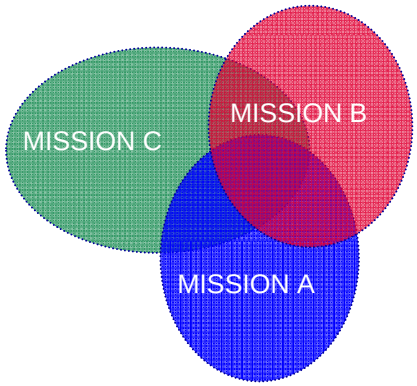
- **Relationship with market:**
  - Aim for a wide and global customer base
  - Continuous benchmarking with respect to products from competitors and custom systems developed for specific missions
  - Participation in conferences and workshops
  - Promote long-term agreements with customers (frame contracts) for continuous cooperation
  - Feedback from customers to understand their needs, issues and wishes for future versions
- Active participation in groups defining future **standards** (e.g. CCSDS)
- Active participation in **institutional initiatives**, e.g.
  - NASA Goddard's GMSEC
  - ESA's EGOS

R&D, PRODUCT LINES AND MISSIONS

- Evolution of technology is **gradual** and is managed within the product line, in line with the long-term **"road map"**
- Many enhancements come from **internal R&D efforts**
- Deployments for different **missions** provide customer feedback and new SW components, some of them are fed back to products



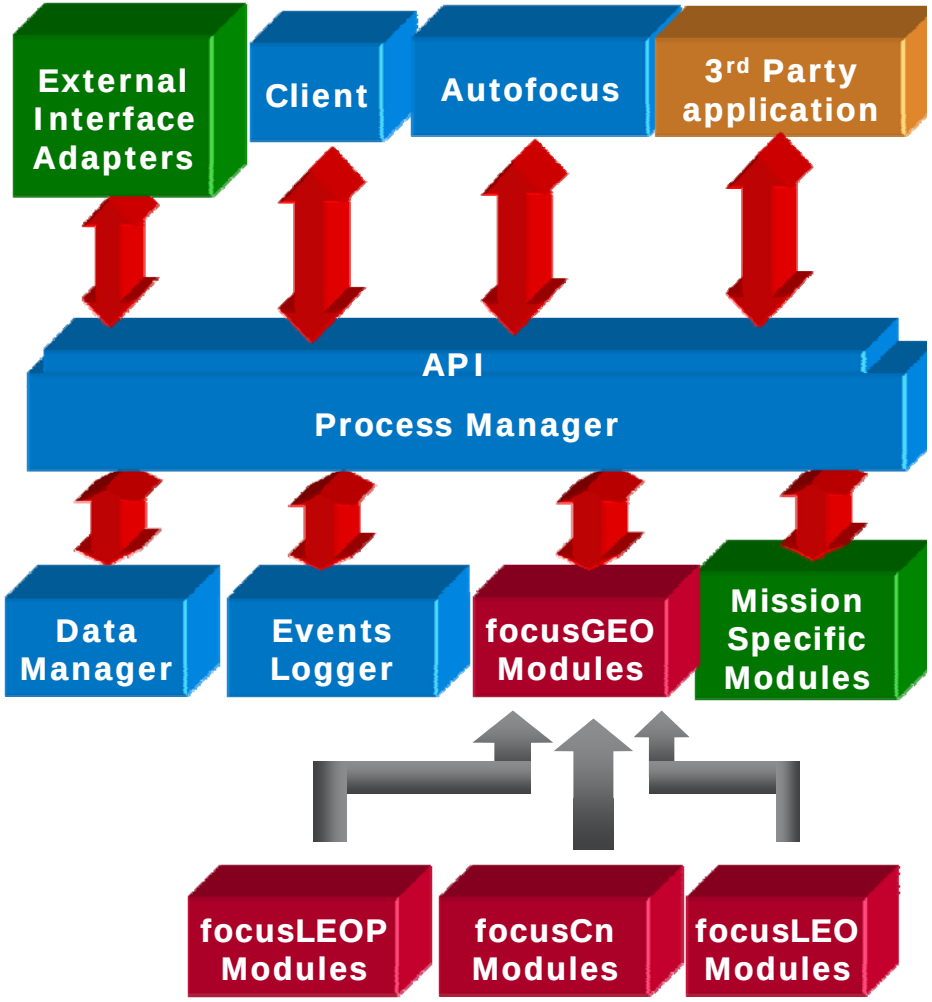
FRAMEWORK STRATEGY



The wide variability of the requirements in different space missions has led GMV to avoid a rigid product-based strategy

Instead we have used a **framework** strategy for each product line:

- **Reference architecture** (scalable)
- Suite of **configurable components**, some optional
- Open architecture, powerful **API**
- This approach **reduces risk and cost** in the development of new systems



INCORPORATING EXTERNAL TECHNOLOGY

GMV has successfully incorporated **technology from other parties** in some of its product lines. Some examples:

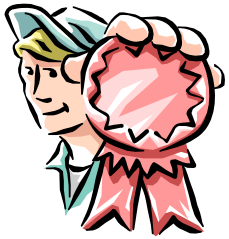
- esa
  - **Flight dynamics:** PEPSOC, NAPEOS within ***focusSuite***
  - **Satellite Control Systems:** SCOS-2000 within ***hifly***
- NASA
  - Messaging: **GMSEC**
- **Open source**: Multiple examples:
  - MySQL
  - Eclipse RCP
  - Jboss DROOLS

Significant investment needed to:

- Add support for certain types of missions (e.g. commercial GEOs)
- Add capabilities to make the products competitive in the global market
- Add support for new standards (e.g. XTCE, SLE)

OTHER ELEMENTS

- Two instrumental elements of the technology innovation process at GMV are:



- **Quality Management System**:
  - ISO9001 & CMMI Level 3 certified, moving towards CMMI Level 5.
  - Essential to guarantee correct development process, stability of the products, repeatability, continuous improvement

- **Knowledge Management System:**
  - Technology map
  - Internal consulting
  - Corporate intranet
  - Powerful tools for project management and information search
  - Aggressive training program
  - Active participation in conferences

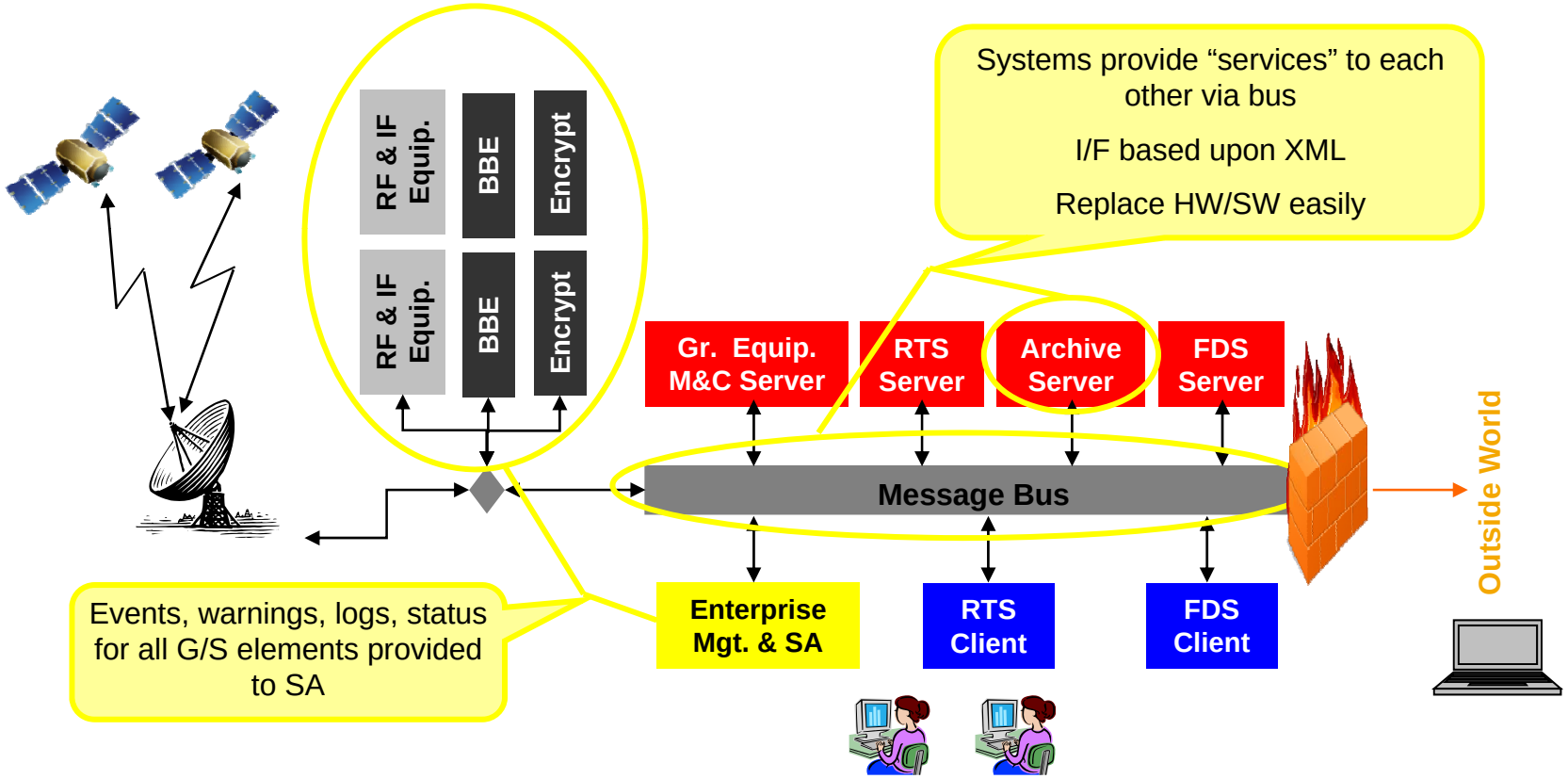
TECHNOLOGY INNOVATION

A FEW *HOT* TRENDS

INNOVATING SOLUTIONS

INNOVATION TRENDS (1): SOA

- Service Oriented Architecture (SOA)
  - "Services" are provided to and by the various sub-systems within the ground segment through a message bus using a standard Interface(I/F) protocol (several commercially available products)

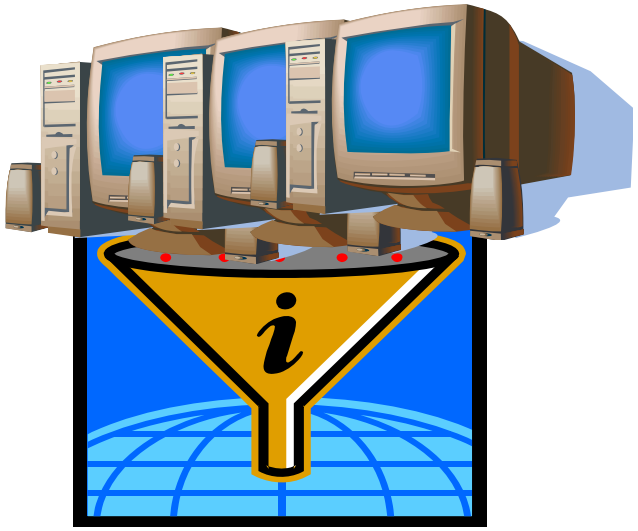


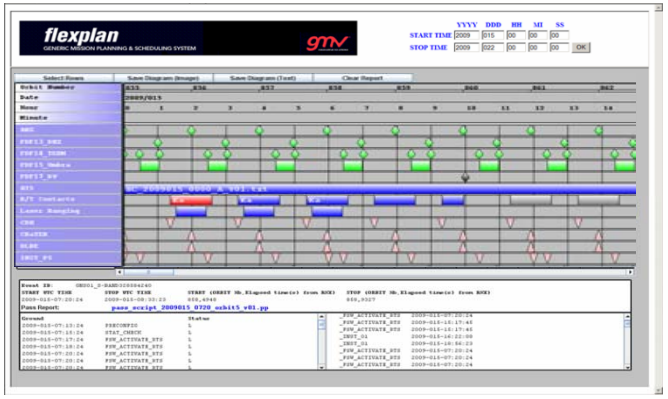
LEGEND

BBE = Baseband Equipment
FDS = Flight Dynamics System
G/S = Ground System
IF = Intermediate Frequency
RF = Radio Frequency
RTS = Real Time System
SA = Situational Awareness
XML = Extensible Markup Language

INNOVATION TRENDS (2): OTHERS

- **Virtualization**
  - Servers are virtualized and can be deployed on the same hardware
  - Reduces HW costs and vendor dependence, allows higher redundancy
  - Some costs in performance, hard to configure, not fully operational
- **XTCE**: Standard for TM/TC Satellite Database
  - Standard is available but its adoption is slow
  - Not used by most satellite manufacturers yet
- Increased **remote access** from any kind of device. Access vs security.
- Increased **automation**: Has been a trend for several decades, but still lots of room for improvements





Thank you

Gonzalo Garcia

VP of Operations, GMV USA

INNOVATING SOLUTIONS