



Interoperability and System of Systems

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Air France Flight 447

June 1, 2009



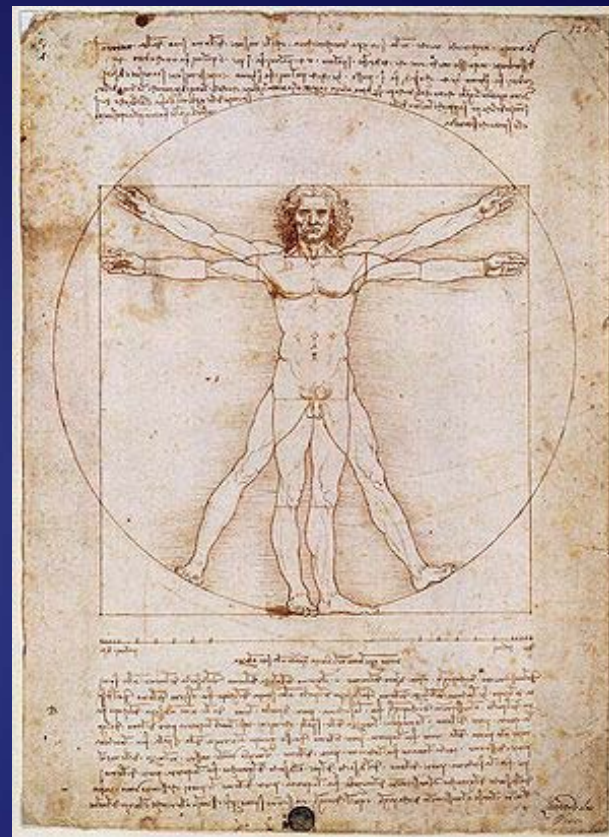
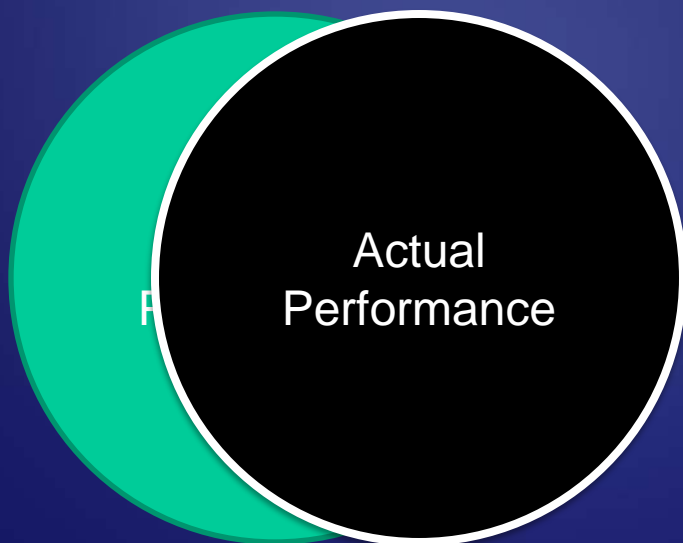
- Human judgments, of course, are never made in a vacuum. **Pilots are part of a complex system that can either increase or reduce the probability that they will make a mistake.** After this accident, the million-dollar question is whether training, instrumentation, and cockpit procedures can be modified all around the world so that no one will ever make this mistake again—or whether the inclusion of the human element will always entail the possibility of a catastrophic outcome. After all, the men who crashed AF447 were three highly trained pilots flying for one of the most prestigious fleets in the world. If they could fly a perfectly good plane into the ocean, then what airline could plausibly say, "Our pilots would never do that"?



System of Systems



- Understanding the characteristics of a system is important for V&V of that system
- IT systems have scary features
 - Morphing requirements
 - Emergent behavior
 - Software is never final



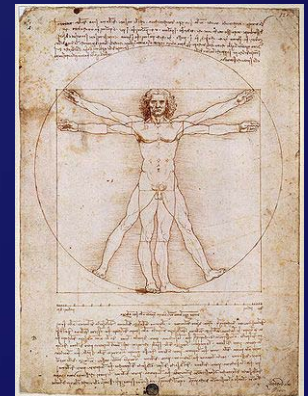


What is data fusion



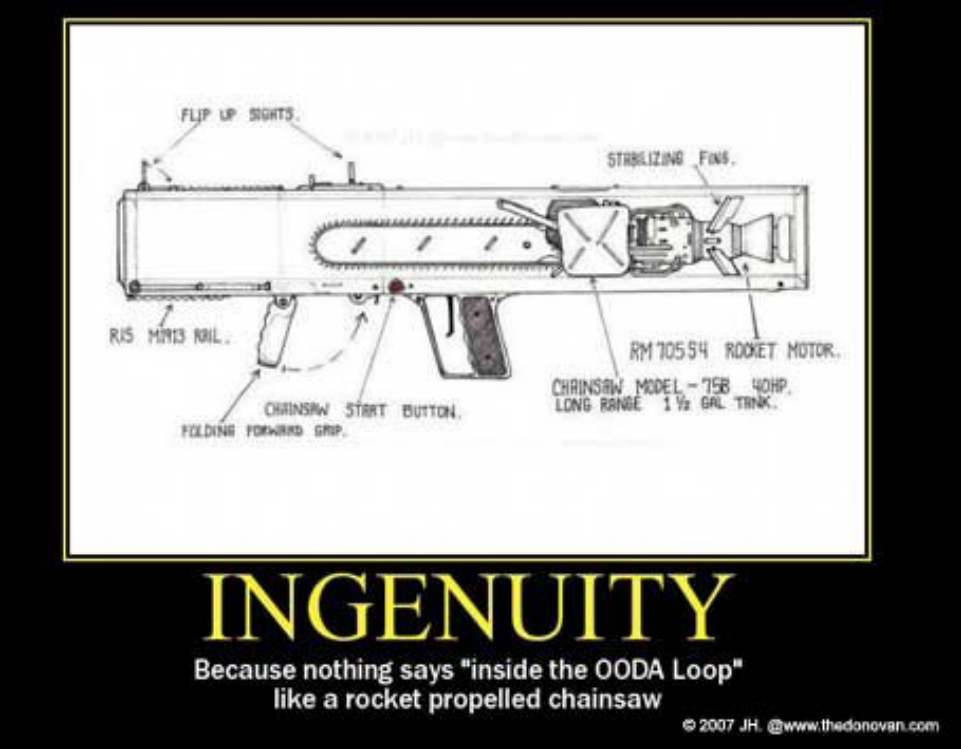
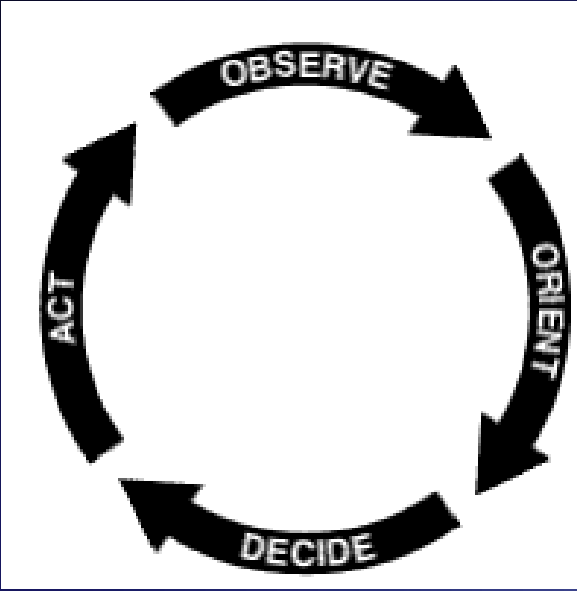
Data fusion - the use of techniques that combine data from multiple sources and gather that information into discrete, actionable items in order to achieve inferences, which will be more efficient and narrowly tailored than if they were achieved by means of disparate sources.

The expectation is that fused data is more informative and synthetic than the original inputs





Data Fusion and the OODA Loop

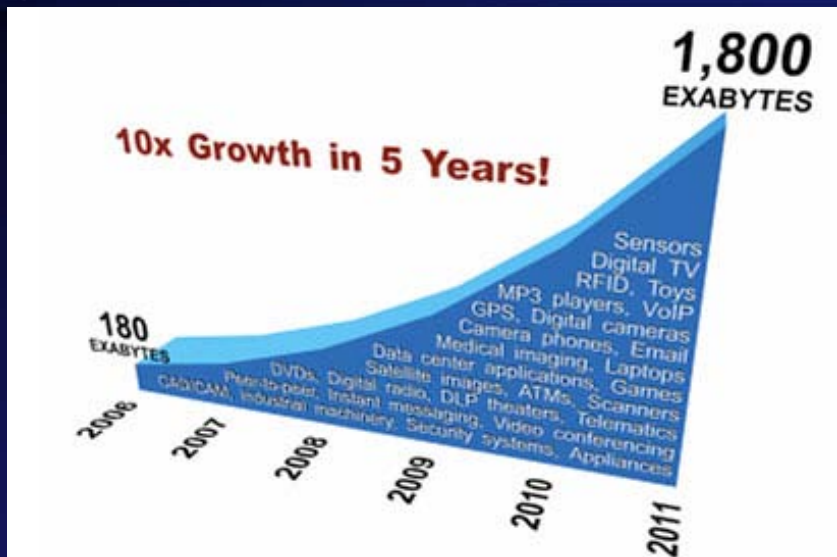


• OODA Foundations

- *Fingerspitzengefühl* – “fingertip feel,” or a “leader’s instinctive and intuitive sense of what’s going on”
- “Speed is the more important element of the cycle – whoever can go through the cycle the fastest will prevail”



OODA in Practice



- Given
 - ✓ The exponential rate of digital information growth...
 - ✓ Speed is of the essence



Who better to fuse and process the data?



Sensor to Shooter



- In the cockpit

4" 4"



- Elsewhere in the AOR...in 1080 Hi-Def!





How to Present Data



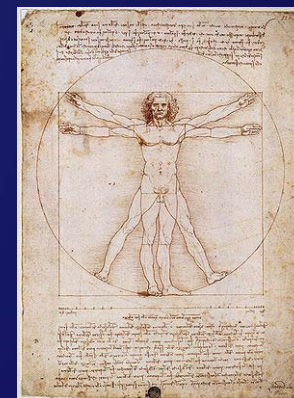


Data Presentation Is Integral To Everything We Do...because



- **Our Reliance on Platform IT**

- The malware on the Spanair computer has been identified as a type of Trojan horse. "Any computer that is connected to a network is vulnerable to a malware infection," O. Sami Saydjari, president of Cyber Defense Agency, told *TechNewsDaily*. "Standards have not been set to protect critical infrastructure."



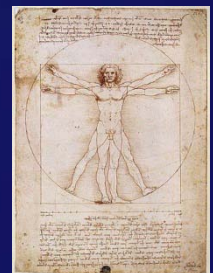


How to test...current challenges



- **Integrated Strategic Planning and Analysis Network (ISPAN)**
 - Decision engine
 - Collaboration tool
- **Joint Space Operations Center (JSpOC) Mission System (JMS)**
 - Sensor fusion engine
 - Data collection & collation
 - “Test and tell us what it will do” (I ♥ my program!)

**Tail is to dog as cart is to horse
As test results are to capability need**





Summary



- The value in test is its potential to reduce bad decisions
- Computers have to complement not replace human judgment
- Relationships are key to savings and success
- In the highly connected, fiscally constrained world, no agency of the U.S. Government can afford to go it alone



It's a complex world...and getting more so.