Apr 27th, 12:00 PM

Luncheon Speaker on Foundations of Supply Chain Management for Space Applications

Michael C. Galluzzi
NASA-KSC

SPACE VISIONS CONGRESS 2007

FRIDAY LUNCHEON SPEAKER

"FOUNDATIONS OF SUPPLY CHAIN MANAGEMENT FOR SPACE APPLICATIONS"

MICHAEL C. GALLUZZI

Canaveral Council of Technical Societies

CCTS

NASA Biography

National Aeronautics and
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Kennedy Space Center, Florida 32899

Michael C. Galluzzi

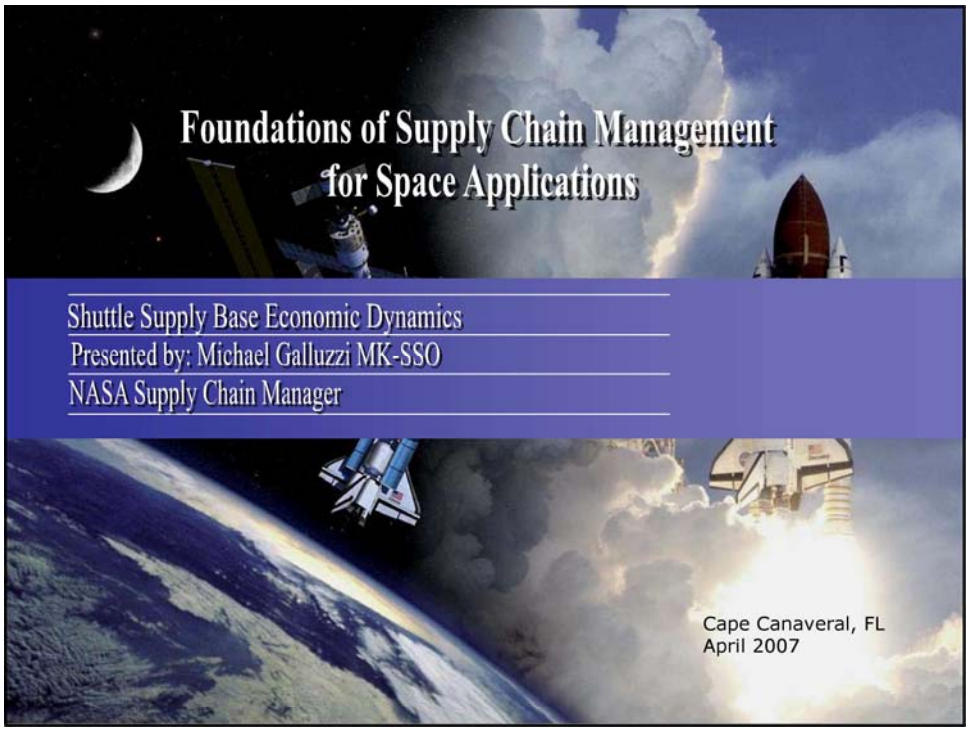
NASA experiences: *Supply Chain Management, SSP Transition & Retirement, Logistics Engineering, Simulation & Modeling, member of the NASA Historical Artifacts Committee and co-investigator of the Exploration Systems Architecture Study (ESAS)*

Mr. Galluzzi works in the NASA Space Shuttle Program Office (SSP), responsible for the Space Shuttle Program Supply Chain and cross-element impacts from diminishing supplier and product-line viability. He is also responsible for formulating the program strategy on Diminishing Manufacturing Sources and Material Shortages (DMSMS). It was these program level responsibilities that earned him the unique opportunity to be selected as a member of the KSC Exploration Systems Architecture Study (ESAS) where he was instrumental in refining the Launch Operations Cost Section and co-authored, Opportunities for Improvement in Supply Chain Management. In a complementing role, he is also a co-investigator of a NASA Exploration System Research & Technology (ESR&T) project titled; *"Earth-to-Orbit Supply Chain Modeling, Simulation & Analysis".*

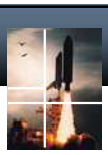
Prior to joining NASA, Mike was founder and CEO of a company based in Dublin, Ireland and a subsidiary office in the United States, where he designed an electronic marketplace for trading unused and obsolete ship hardware, which was managed by the company's DMSMS analysis tool set for the commercial Maritime Industry. Ultimately the trading exchange and solution mix exposed alternative disposition and DMSMS mitigation options to support aging ship systems design and to dispose of obsolete ship hardware. Customers included major ship management companies, ship owners and manufacturers located in 15 countries primarily located in the United States, Europe and Asia.

He also worked for a short while at Aspect Development located in Mountain View, California (later acquired by i2 Technologies for $6.3B) where his title was the Aerospace and Defense Industry National Product Lifecycle Management (PLM) Account Manager developing new business opportunities for the Aspect PLM and Supply Chain Management software applications. Prior to the Aspect/i2 Merger, Aspect acquired TACTech, Inc. where Mike was Director of Sales and Marketing for the company's microelectronic obsolescence management and stochastic projection software. In just under the 4 years he was there, he obtained over 40% of TACTech sales which ultimately lead to a NASDAQ Initial Public Offering of the company. In obtaining this level of success, he presented to nearly 200 Military Defense Contractors, high level corporate executives, congressional staff and high ranking military personnel representing the United States, Canada, France, United Kingdom, Switzerland, Sweden, Australia and Italy.

In the late 80's early 90's Mike started his career as a Logistics Engineer at Rockwell International Space Systems Division supporting the Environmental Control Life Support System on all Orbiters and was an investigator for the Director of Logistics working Independent Research and Development (IR&D) on several studies, which included: DMSMS, Supply Chain Management, Just-In-Time Inventory Management and Statistical Process Control Metrics for Management. He also worked Site Support as a Shuttle Coordinator of Payload Integration, Flight Crew Systems and Mission Kit Hardware.

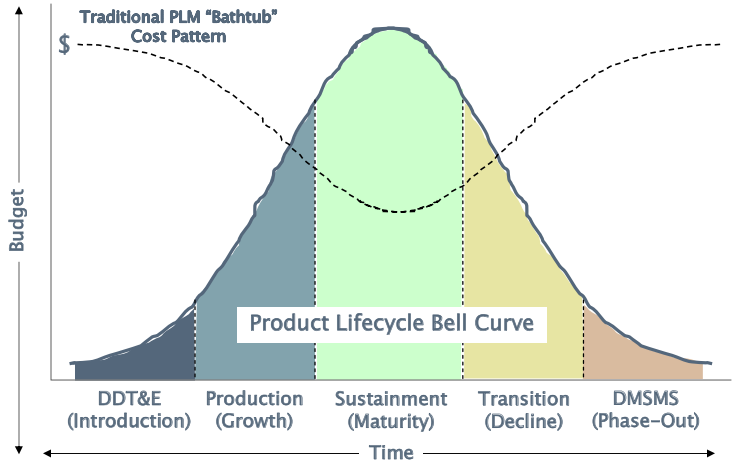


Cross Element Impact Analysis Activity



- MK-SSO Performing cross-element analysis of Shuttle Diminishing Manufacturing Sources and Material Shortage (DMSMS)
- Apply stochastic or discrete event methods to extract supplier data patterns, multi-attribute influence relationships and create a supplier risk assessment.
  - Analyze DMSMS Cause and Effect impacts on SSP Project Offices and Program as supplier or product line terminations occur
  - Understand geographic and congressional district impacts to supplier terminations
- Periodic follow-on to review previously terminated/closed suppliers to assess gap risk for Cx first need date.
- Consider PPB&E as terminations influence DMSMS mitigation costs and Program budget

Product Lifecycle to Cost Trend Analysis



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Supplier Management System

Developed by the Jet Propulsion Laboratory

Customer to the Shuttle Program Office (MK-SSO)

MK-SSO/OSMA collaboration Goal:

To improve Program-wide Critical Recurring OEM Termination Influences and Assurance efforts while leveraging existing resources by investing and supporting in up-front initiatives

Termination Influences on Quality, Reliability, Supportability

- The NASA industrial base has a direct and significant relationship to the quality of the final product delivered, the reliability of which is a factor from diminished potential aerospace market growth.
  - Contract terminations introduce reliability and quality issues inversely proportional to the quantities being supplied and suppliers supporting the Shuttle Program.
  - The quality that can be expected diminishes rapidly where quantities are few.
  - Acute awareness at the supplier sub tier level is important as their primary revenue source is diminished as prime supplier contracts are terminated, thus impacting sub tier level quality.
- An operations architecture that allows for identification of cross element cost impacts will help the Shuttle Program Office, specifically MK-SSO, manage loss of supplier impacts due to the shrinking economic gains and diminishing marginal returns as prime supplier contracts are terminated by the project elements

Supplier Management System

What product/value does this analysis provide?

- **Determine cross-element analysis of SSP and Cx DMSMS Tier 1 impacts.**
- **Apply the SMS stochastic methods to extract cross-element Tier 2 supplier data patterns, supplier data relationships**
  - *Analyze DMSMS Cause and Effect impacts on SSP Project Offices and Program as supplier or product line terminations occur*
  - *Understand geographic and congressional district impacts to supplier terminations*
  - *SSP Program Office needs an active interface to obtain accurate and timely supplier data.*
- **The SSP enterprise relationships and material exchanges are complicated and visibility would be invaluable at the Program level**
- **Review supplier retention and/or close-out recommendations prior to implementation from a cross-element perspective**

Benchmark Measures for Determining DMSMS

Operational Quality/Reliability
Quality Performance

Core Capability
Product technology,
Market Competitiveness,
Critical Skills

Financial Health and Liquidity
Earnings Before Interest and Tax (EBIT)
Annual Gross and Price Earnings Ratio

Business Operations and Processes
Sub-Tier Management
Industry and Product line Diversity
Government to Commercial mix

Of the four benchmark measures, it is product quality that usually gives the first indications of unusual economic stresses on a supplier, which in the end will result in diminished product-line availability, supplier liquidity or critical skills loss

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Challenges – Small Manufacturers

Tier 3 (Suppliers Supplier)- Reluctant to pursue Aerospace business due to…

- Excessive bidding costs
- Unfamiliarity with the acquisition process
- Little experience with specifications
- Incomplete understanding of the magnitude of this business opportunity

Technically proficient but challenged by…

- Market erosion due to offshore, low-cost competition
- OEM cost pressure
- Limited Computer Aided Drafting/Computer Aided Manufacturing and Standard for the Exchange of Product Model Data experience
- Aging workforce (lack of knowledge, management, and succession planning)

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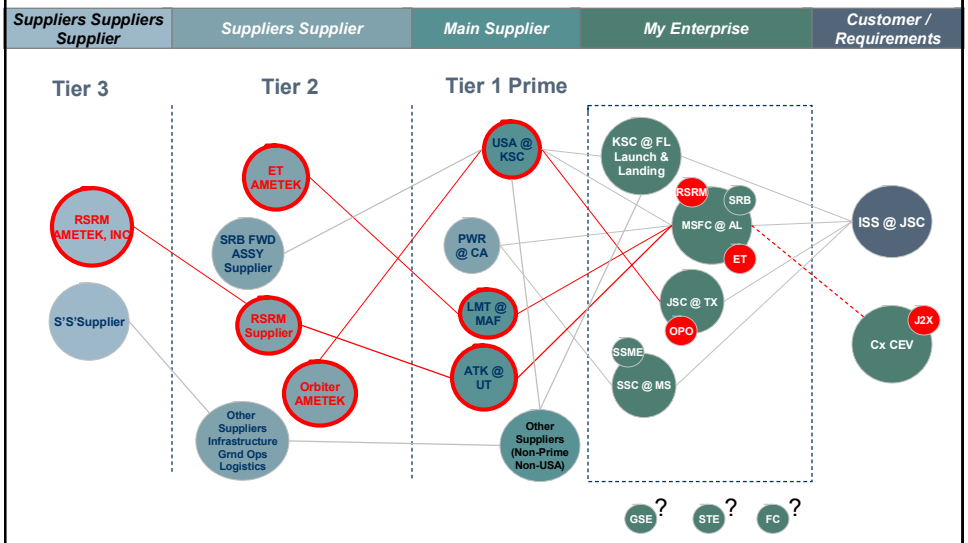
The Supply Chain as a Relationship Network of Enterprises

Case Example: Ametek, Inc.



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CSSS Cross Element Impact Status

MK CSSS list includes all functional unit LND (Production, Repair, Sustainment)

	A	B	C	D	E	F	G	H	I	J	K
1	Supplier	CAGE code or street,city address	Item(s)	Project	SCA						
2	Identify: Supplier for items (parts/materials) or provider of services for which there is no direct or immediate replacement available.	Identify specific supplier site where product is produced	Identify: Materials, Parts, Services	Identify: Project Element	LND as identified in SCA DB	Baseline LND PRODUCTION (Mar 2007)	Revised LND PRODUCTION	Days remaining to LND	Contract Value Source: (SAS)	Program Days Without Functional Production Capability	Baseline LND Replace & Repair (Mar 2007)
138	The Boeing Company - Div C3 Networks	94756	AMEC, EMEC	Orbiter	11/1/2012			2,039		(720.00)	12/1/2008
139	Universal Propulsion Company (UPCo)	17610	Emerg. Egress Slide, Thruster Assy., Window Prvo Devices	Orbiter		12/1/2007		242		1,065.00	12/1/2008
140	UTC Fuel Cells (was International Fuel Cells)	1F2J4	Fuel Cells	Orbiter	10/15/2010	4/30/2006		(338)		1,646.00	12/1/2008
141	Vacco Industries (was Eaton)	1PVC5	Filters, Valves, Regulators, Disconnects	Orbiter	10/15/2010			1,291		16.00	12/1/2008
142	Wyle Labs	09097	Connectors	Orbiter		12/1/2008		608		699.00	
143	Wintec LLC	05CK7	Filters	Orbiter/ GSE	9/30/2008	9/30/2008		546		761.00	12/1/2009
144	Arrowhead	70628	Flex Ducts	P/L Integration	10/15/2010	12/1/2006		(483)		1,795.00	
145	Cox	96985	Line Heaters	P/L Integration		7/30/2009		849		458.00	
146	3M	PO Box 2000M Springfield, MO	Witness pad adhesives	RSRM		7/30/2009		849		458.00	
147	Accurate Energetic Systems				11/1/2005	5/30/2008		423		884.00	
148	Aceto Corporation	3K700	MAPO (Inhibitor Curative)	RSRM	4/1/2008					942.00	
149	Albany International Techniweave	7Y446	Carbon fiber rope (nozzle)	RSRM/Orb		12/1/2008		608		699.00	
150	ALCOA Specialty Metals	01404	Aluminum Powder	RSRM	10/1/2008	12/1/2008		608		699.00	
151	American Pacific Corp (AMPAC) (Wecco)	1VA84	Ammonium Perchlorate	RSRM	10/1/2008	12/1/2008		608		699.00	
152	American Sythetic Rubber Comp (ASRC)	3A950	HB Polymer	RSRM	10/1/2008	7/30/2009		849		458.00	
153	Babcock			RSRM	2/1/2006	withheld		(406)		1,733.00	
154	Borden Chemical	64049	Phenolic resin (nozzle)	RSRM		7/30/2008		484		822.00	
155	Cytec Engineered Material	1KT46	Glass, Carbon, Silica Cloth	RSRM	8/1/2008	7/30/2008		484		822.00	
156	Cytec Engineered Material	1KT46	Glass, Carbon, Silica Cloth	RSRM		12/1/2008		608		699.00	

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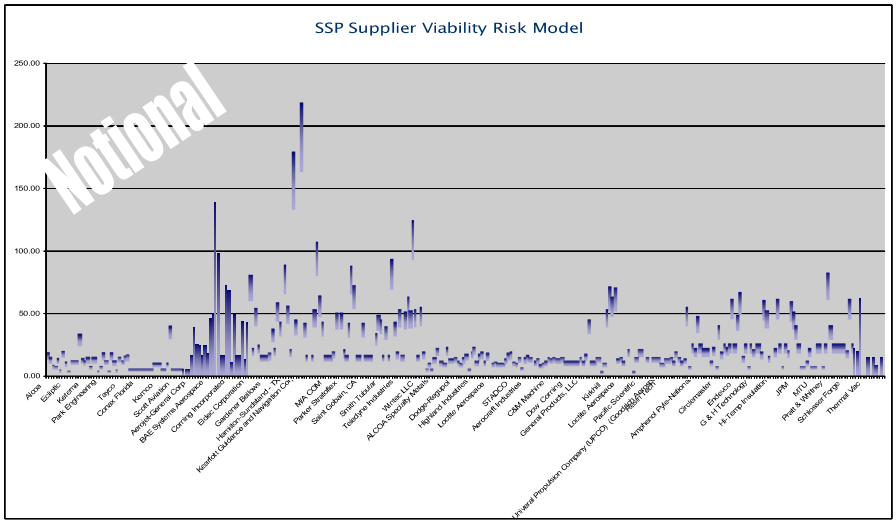
CSSS Cross Element Impact Status



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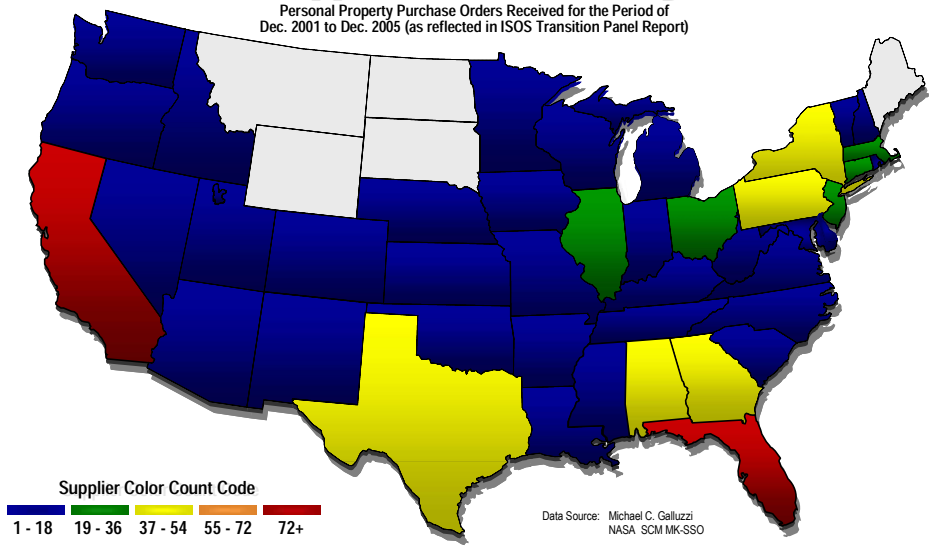
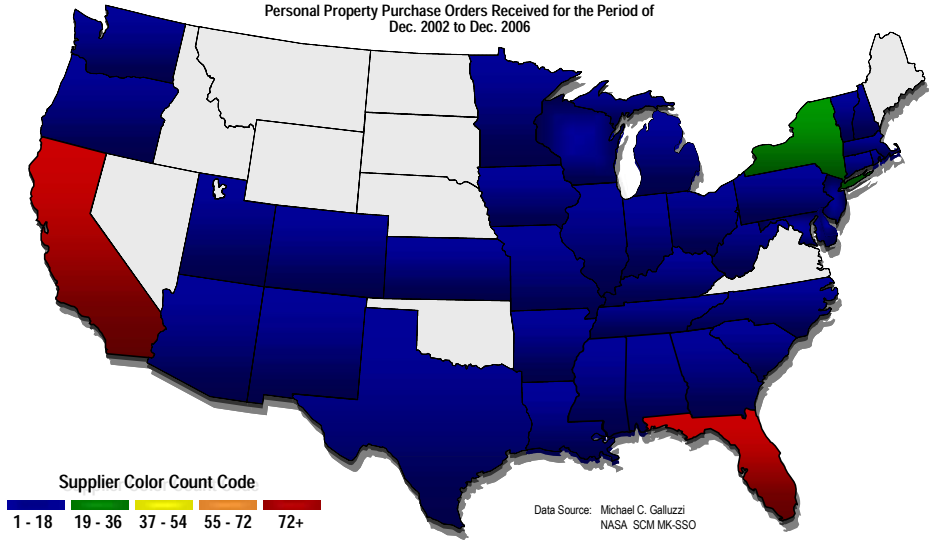
Space Shuttle Program
Active Supplier Distribution by State

Personal Property Purchase Orders Received for the Period of
Dec. 2001 to Dec. 2005 (as reflected in ISOS Transition Panel Report)



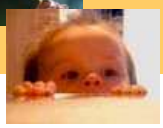
Space Shuttle Program
Active Supplier Distribution by State

Personal Property Purchase Orders Received for the Period of
Dec. 2002 to Dec. 2006



Conclusion

- No one project can be responsible for maintaining the industrial base for the entire program – No one Program can maintain IB for the entire Agency
  - Assess what level of supplier base is critical for development.
  - Establish critical single source supplier list.
  - Develop strategy to encourage supplier integration and collaborative demand planning.
- Understand gap risk and product lifecycle management as a strategy for enhancing supportability.
  - Evaluate all programs life cycle maturity.
  - Use new program development and timing to eliminate program retention breaks.
  - Map development program's vendor list to existing program vendors
- The influence relationships even at a macro-level of an entire operation such as the Shuttle Program, are a rich tapestry of an inter-connected thread of influences. These influences must be wrapped together, within frameworks that seek to present simple but powerful relationships about a complex system and its phase of the system lifecycle.



Enabling Supply Chain Management
A *Fresh* Start for the Agency

- We have a ***unique opportunity*** to develop a standardized and integrated Supply Chain as a result of and in support of, "The Vision for Space Exploration"
  - Optimize program life cycle development and performance
  - Start NOW if we want to influence future programs
- We can ***effectively transition*** from one program to the next while minimizing:
  - New program start-up costs
  - Disruption in the industrial base and supply chain
  - Gaps in current and future program transition

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A Fresh Start within reach

- We can ***create an agency supply chain***, sustain a major operational infrastructure, and measurable performance
  - Supplier stability forecasting and health / viability
  - Simulation Based Acquisition
  - Life cycle impacts (short, mid and long term)
  - Identify key competencies and shortfalls to support emerging technologies
  - Supply Chain Management Simulation
  - Minimize redundancies

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Closing Statement

The combination that has not been focused on before is the awareness of the NASA industrial base at the multiple layers of the supply chain, which includes cost by function, supply chain practices, techniques and of the inter-relationships among factors that stretch from product dependent factors, such as sub-tier supplier health and system design, to prime supplier and supply chain system dependent factors, offers a historical opportunity to dramatically improve the quality, cost and responsiveness for the Space Shuttle transition and retirement task ahead of us.

The Logistics community can shape and respond together, with changes in demand pressures while allowing for an integrated sustainment process without new congressional funding appropriations or departmental reorganization. What we are addressing is a representation and conscious effort to manage the many layers of Logistic and Quality activities from both the strategic and tactical approach. Success and efficiencies gained with this endeavor will require collaboration, planning, data migration and the spirit of cooperation. An awareness to product reliability, cost impacts, agile adaptation to changing economic pressures and improved quality will be the byproduct of this project as NASA comes to the end of the shuttle program and era in human space travel.