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Lean Aircraft Initiative Implementation Workshop: Implementing Cross-Functional Teams in an IPPD Environment

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Part I: Introduction and Executive Summary

There is an emerging consensus in the Aerospace sector around the importance of Integrated Product and Process Development (IPPD). This is a rejection of the old model, where different engineering disciplines and different functional groups each focused only on their own part in the development, manufacture and deployment of new products. Instead, nearly every new program is now established around a set of Integrated Product Teams (IPTs). These teams may include people involved in concurrent activities or they may involve representatives of upstream and downstream activities. Either way, the integrated team structure enables critical forms of coordination by the people doing the work – not just senior leaders.

While there is little debate on the "what" (IPTs in an IPPD context), there remains quite a bit of confusion and debate on the "how." How should IPTs be set up? How should they be trained? How should the efforts of multiple IPTs be coordinated? How should performance be assessed? It is these and other issues that were of interest to the LAI's Implementation Team and the broader membership of the consortium.

In order to learn more about the experience to date, 14 teams from across the Lean Aerospace Consortium were brought together. Each team featured a mix of 3-5 organizational representatives, including senior line managers, IPT leaders from engineering and manufacturing operations, managers responsible for organizational change, and others. The broad goals of the session included both providing a constructive learning experience for the participants <u>and</u> generating insights that might be of value to the larger consortium.

The strength of a workshop such as this lies in the diversity of the participants. Not only were there people from a mix of functions and disciplines, but the participating organizations included customers and suppliers, direct competitors, and even newly merged partners. As well, the group spanned quite a few organizational levels. It is a tribute to the participants and the overall LAI consortium the differences did not become a barrier to dialogue. Instead, participants were able to appreciate and build on the different perspectives.

At the outset, it is important to note that many aspects of work in the Aerospace sector have historically involved teams, such as project teams or flight crews. The concept of eliminating waste, which is a core lean principle, has focused a spotlight on a broad range of additional ways that teams can be used. Simply put, there are cost, time, and quality savings that are only possible when interdependent activities are addressed in an integrated way. Further, operating with integrated teams hold promise of an improved work experience for people at all levels. We hope that this report will help close the gap between complicated daily realities (which too often fall sort of the vision) and the gains that we know are possible.

Key Findings:

There are five overall lessons that emerge from the workshop experience. Each has the characteristic of being what might be termed "deceptively simple." The points may seem obvious, but attending to these points in the implementation of IPTs is enormously challenging.

The first finding from the workshop emerged unexpectedly from the diversity of case presentations. After each presentation there were comments from others saying that the presentation was helpful, but of course that wasn't the only kind of IPT. From these comments emerged a clear recognition that there is not one best model for a team-based operations. While this may seem obvious, the reality is that the government as a customer and most firms as suppliers or OEMs (original equipment manufacturers) all must work hard to not emphasize a "one size fits all" approach to IPTs.

The second finding builds on the first. We found that IPPD contexts can vary with respect to at least five dimensions – customers, products, IPTs, suppliers and time. The first four dimensions vary with respect to scale (many customers versus few, for example) and the amount of innovation/adaptation required (for example, incremental product changes versus products that have never existed before). Time can be bounded (in a one-time project context), periodic (in a program with distinct phases) or continuous (in an ongoing manufacturing operation). During the workshop we assembled these elements into a matrix that proved a useful framework for charting the range of IPT activity in context.

Taken together, the first two findings point away from any single implementation "cook book" since there are different types of IPTs and a range of contexts. This sets the stage for the third finding, which is that the implementation of IPTs in an IPPD context is not a one-time event. Throughout the workshop we explored how the implementation challenges change in different phases of a program. This points to an implementation strategy that emphasizes an ongoing process of learning and adjustment. For example, the ideal team composition and the appropriate metrics may shift dramatically as an IPT moves from development to production.

A fourth finding involves the linkage between the IPT structure and the application of lean principles. Simply put, the case studies vividly illustrated that lean principles such as variance reduction, design for manufacture, or supplier integration depend on integrated teams for implementation. It is not that such teams represent a better approach – it is that key objectives can not be accomplished without a formal structure that enables interdependent parties to work together on a regular, ongoing basis. In this respect, it is clear that integrated product teams are here to stay for any organization that seeks to advance lean principles.

Finally, implementing these increasingly indispensable teams requires fundamental changes in the flow of information, authority, rewards and other enabling systems in organizations. Again, this is a deceptively simple finding. It is one thing to say, for example, that teams should have regular feedback on cost, quality and schedule performance. It is quite another thing to generate regular team-level data in a format that is understandable, with support for the team to interpret and apply the data to drive continuous improvement. Implementation of a recommendation such as this requires fundamental cultural changes among line managers and in support functions (such as finance, quality, etc.).

A Metaphor:

In order to fully understand the complex challenge of implementing IPTs in an IPPD context, consider the following simple metaphor (which was incorporated into the presentation of workshop findings at the LAI Executive Board):

> You have a workshop at home where you do home improvement projects. Over the years, you have developed a particular way of organizing a home project, which includes the way you have laid out your tools on your workbench, the way you buy materials, the way you schedule the work, and other parts of a project. This process doesn't always

complete projects on time and projects do sometimes go over budget, but in the end you have generally done what you have said you would go.

Now someone comes along and says they have a better way of organizing home projects. They say that this new system involves laying out your tools in a new way, changing the way you buy materials, and making some adjustments in the way home improvement projects fit into the mix of other family activities.

You will probably find it disruptive to organize your tools in a new way. You will also find that important adjustments are needed if you buy materials in a new way. Yet, these changes will seam minor in comparison to adjustment in the expectations and agreements with other family members.

What is the point? In the implementation of any new team-based system, there is a mix of "tangible" changes in the way work is laid out and other aspects of the operation. There are also a range of more "intangible" changes in the web of social relations. Implementation involves attention to both the tangible and intangible aspects of a new work system. Often, it is the intangibles, such as teamwork, learning, prevention, integration, and other principles that are the most challenge.

Design Overview:

The design of the workshop centered on three case study presentations, combined with small group working sessions on five themes, a keynote address and an industry presentation from outside the aerospace sector. The highlights of the design were as follows:

Day One

- Morning case study: Rockwell Avionics and Communications
- Afternoon case study: Northrop Grumman -- GATS/GAM
- Five breakout groups meeting in morning and afternoon
- Keynote lunch speaker -- Anne Donnellon, F.W. Olin Graduate School of Management, Babson College

Day Two

- Morning case study: F-22 (Lockeed Martin and Boeing)
- Analysis of the diversity of IPPD elements
- Featured industry presentation -- David Roggenkamp, Ford Motor Company
- Afternoon recommendations from breakout groups

One important feature of the design emerged in response to the fact that all three cases featured Integrated Product Teams in an IPPD context, but all were very different.   Midway through the workshop, dialogue among members of the Implementation Team and lead presenters led to a redesign of the program for the part of Day Two. The additional part of the design involved having each of the nine tables where people were sitting assume that it was a newly formed IPT. Three of the tables were to be operating in a context similar to Rockwell Collins, three in a context similar to Northrup Grumman, and three in a context similar to the F-22. Each was to identify its priorities in that context, which would be presented to the lead managers from the sites themselves. Based on the presentations and the feedback, we set up a simulation where the data from each of the three different contexts could be compared. The results, which are included in this report highlighted both similarities and differences across the settings.

Part II: Expectations

At the outset of the workshop, participants listed their expectations for the two days. These comments represented the goals and objectives of a diverse and skilled group of practitioners. Their expectations, which were in addition to the specific activities listed on the agenda, were as follows:

- Identify new ideas on rewards and incentives
- How to keep functional support involved and fresh – especially when people return from an IPT
- How to enhance information flow
- "How To" vs "What is"
- Tie communications to diffuse learnings
- Team composition and integration of various cultures (e.g. merged companies)
- Integration across teams
- Definition of IPPDs within and across companies
- Get to "nuts and bolts" of implementation
- How to cope with moving along the product life cycle
- Attributes of mature teams – what is success?
- Validate linkage between the LEM and lessons learned

As these comments suggest, participants came into the workshop with a desire to focus on the "how to" aspect of implementing IPTs in an IPPD context. The were interested in practical, yet complex challenges, including information flow, cross team integration, merged cultures, and dynamics across the product life cycle.

Part III: Case Summaries

Case Study I: Rockwell Avionics and Communications

Presenters: Wayne Flory, John Koomar, Randy Buck, Bob Brus, Don Stulken

Overview:
-- IPPD/IPT process focusing on 1) reducing variation in manufacturing, 2) transferring of accountability from design to manufacturing and 3) design robustness/readiness assessment measurement tool

Rockwell's presentation addressed the implementation of company-wide process improvements intended to align engineering and manufacturing activities across all teams. Based on the desire to better utilize human resource potential in the organization, their IPPD initiative focused on institutionalizing a change process through strong leadership commitment, developing a change process structure, and training and educating employees. The workshop presentation concentrated on three areas – key product characteristics, IPPD to IPT accountability transfer, and design robustness/readiness assessment – that provide a challenge to all industry teams looking to achieve best practices in IPT implementation.

The core of Rockwell's attempts lay with the desire to compete more effectively within the government procurement system by decreasing their time to market. One means to achieve this is through variation reduction, so that new product programs can be ready for production earlier. Rockwell's solution to this challenge began with their adaptation of Boeing's Advanced Quality System (a variation of the ISO-9000 standard for the measuring and analysis of statistical variation). Their efforts focused on the production side of the life-cycle chain, involving the manufacturing organization up-front in telling engineering where process improvements could aid the design effort.

The concept of key product characteristics (KPCs), defined as "those characteristics of the design which most influence the fit, performance, supportability, and life-cycle cost," was used to determine the design limits and appropriate production processes for the product requirements. A risk rating system was developed to judge the probability of occurrence, detectability, and resulting severity for various manufacturing problems, using a worksheet-style system to combine quantitative and qualitative assessments. Unlike past attempts introduce risk analysis, the worksheet method “resonated” with the engineering department, since it represented a systematic way to analyze the criteria. As was noted with all of the improvement initiatives, gaining acceptance from all facets of the organization was one of the keys to their successful implementation. Since the worksheet could be updated as the design evolved, as well as used by suppliers to improve the quality of incoming materials and subassemblies, the team was able to develop a tool that could be used to verify the existence and relative magnitude of manufacturing problems across the facility, and in turn used for feedback and learning. Other important aspects of the KPC implementation effort included the designation of functional area champions and the choice of design engineers with experience in manufacturing to lead the pilot project.

Confusion resulting from the lack of clearly defined roles and responsibilities for the different phases of the product development life-cycle led Rockwell to implement their second initiative, an IPPD to IPT accountability transfer process. A cross-functional team was tasked with developing a complete “roles and responsibilities” matrix that would govern the new transition process. The new system defined the milestones and signature requirements for the transition of cost responsibility between design and manufacturing, one of the crucial interfaces in the product development process. One particularly unique aspect of the Rockwell initiative was the provision that the manufacturing organization could arrange through the program office to contract for engineering support during the manufacturing phase. This linkage allowed for smoother transition of the technical elements without complicating the segregation of cost accounting between the two phases.

The final initiative presented by the Rockwell team was their design robustness/readiness assessment program. With some 75 new avionics products introduced over the past year, managers had noted that some “had an easy time” transitioning into production while others proceeded with more difficulty. In order to understand why such different experiences occurred, the company decided to examine the “producibility” issues affecting design robustness. The engineering and manufacturing organizations worked together to design a quantitative robustness ranking system that assessed both subjective and objective criteria such as impact of design change notices, the level of design complexity, and the results of production tests. The results of the analysis for existing products showed that the robustness score was inversely proportional to product cost, demonstrating one of the key elements of lean production – effort spent improving the producibility of a design pays off later in lowered manufacturing costs.

Rockwell now uses the ranking system for products in the design phase, such that weak areas in a product's score are used to trigger corrective action. For example, poor scores for the impact of design changes led to the management of changes in blocks in order to reduce the impact of frequent interruptions. Joint ownership of the robustness measure encouraged both the engineering and manufacturing groups to participate in the corrective action process, and the focused and quantitative nature of the ranking system meant that feedback was provided in an actionable format that increased the employees' focus on better first-time performance.

Rockwell's process improvement efforts were guided by a "merge left" philosophy, with the goal of moving best practices sooner into the product development cycle and applying them across all product lines. An overall product development process robustness scale was developed to judge the effectiveness of new initiatives in each phase, as well as to provide hand-off criteria between phases. The company was thereby able to create an objective tool for comparing product performance across phases (by using the same scale but different criteria for each phase as appropriate). Rockwell's success at implementing these initiatives was publicly acknowledged last year when their Cedar Rapids, Iowa plant was named one of *Industry Week*'s "Top Ten U.S. Manufacturing Facilities."

Key lessons learned from the implementation effort include the following points:

- Practices are a continuum without start and stop points.
- Accept variation reduction as a way to do business.
- Joint ownership of process by everyone is critical.
- Expect resistance; lead your way through it.
- Clearly defined roles and responsibilities are essential.
- Corrective action to feedback is critical.
- High robustness leads to lower costs when processes create accountability for results.

Questions from workshop participants:

How is the product development process organized?

Design activities are performed by the IPPD organization, which consists of between 200 and 300 people matrixed onto many product lines. The number of engineers per product depends on the design complexity (i.e., new product vs. enhancement) and where it is in the product development life cycle. The IPPD organization is co-located, with most product teams contained on a single floor or building wing. The IPPD organizational hierarchy consists of directors, managers, team leaders, and engineers (from top to bottom).

Manufacturing activities are performed in IPTs of 20 to 25 people each (not including touch labor). The teams live on the factory floor near their product lines so that the manufacturing engineers can interface with touch laborers and manufacturing support technicians. IPTs are led by team leaders.

Who performs cost estimation and/or tracking functions?

In the IPPD organization, engineers perform cost estimation when the develop bids for production contracts. In the IPTs, it is more of a mixed bag: sometimes there are IPT members capable of doing cost estimation and sometimes financial/logistics people are brought in.

What is the role of program managers?

Under the new triadic organization – IPPD, IPT, and PMO (program management office) – program managers have lost some control due to the increased empowerment of the engineering and manufacturing organizations. However Rockwell believes that the three-way system, while it may slow decision-making somewhat, results in more well thought-out decisions.

Case Study II: Northrop Grumman Corporation's GATS/GAM Program

Presenters: Margaret Calomino, Gerald Panek

Overview:
-- IPT implementation adding GPS aided targeting system for B-2A advanced technology bomber with a focus on Quick Reaction Capability (QRC) to streamline the program design approval and development process.

The team from Northrop Grumman presented their experiences with product development on the GPS Aided Targeting System/GPS Aided Munition (GATS/GAM) project, which provides the global positioning targeting and delivery system for the B-2A bomber. Their need to achieve both high performance and minimum cost led them to develop new processes to push the product development capabilities of the team beyond the usual managerial and programmatic boundaries, focusing on pioneering "quick reaction capability" (QRC). In doing so, they were able to exceed cost, schedule, and performance goals while creating a "fun" program effort.

The success of the GATS/GAM project started with the organization of the single IPT that performed both development and demonstration activities. By eliminating the intermediary management layer between the B-2 program manager and the GATS program manager, a single link was created between the program and the customer. This direct connection was a key factor in the control of "requirements creep," since all changes had to go through these two people. The program manager had authority to direct all project-related activities, including direct control of the budget and funding profile, and had direct access to upper level management at all times.

The GATS/GAM-dedicated IPT members were co-located in a single room, which facilitated the team emphasis on constant communication. Weekly two-hour IPT meeting brought together 50 to 60 people from all facets of the project, including suppliers and representatives from other parts of the B-2 program. The meetings were run according to a philosophy of "your problem is our problem," which helped to encourage both a problem-solving attitude and understanding of the "big picture." To this end, the IPT conference room was papered with program schedules, technical metrics, and operating plans that were updated weekly to track progress. A strong team focus was fostered throughout of the project, emphasized by a rewards/recognition program that included program patches, monetary awards, thank-you luncheons, and birthday celebrations at IPT meetings.

In addition to their organizational leanness, the GATS/GAM team developed a quick reaction capability in order to capitalize on existing B-2 program design and test data, minimize formal documentation, and limit logistics training. By making use of off-the-shelf hardware, a standard bomb body, and batteries already qualified on another Army program, the team was able to streamline the development process and eliminate the need to extensive qualification tests and simulations. Both the DPRO and the SPO encouraged the team to take advantage of "qualification by similarity" wherever they could and approved the team's plan to replace the software preliminary and critical design reviews with less formal design technical interchange meetings. In exchange, program documentation was stored in the IPT library for the customer to review as needed.

Other unique elements of the GATS/GAM program included a streamlined procurement process in which managers had ample signature authority to make decisions regarding the many off-the-shelf parts in the system. This eliminated multi-tier reviews and contributed to the entrepreneurial style of the project. The team was also able to save time in engineering and manufacturing development by bringing back retired team members as technical consultants instead of training new personnel. Having design decision authority resident within the IPT also allowed for the rapid approval of design changes and avoided the more cumbersome procedures of the baseline B-2 program. Not everyone in the organization approved of the QRC approach, however, and the team was not able to implement the initiative in all areas. For example, some managers viewed the team's efforts as "shortcutting" established program and division procedures, and the team was unable circumvent the B-2 program change board process. Likewise, some subcontractors decided that the process put them too much at risk and instead chose to conduct "business as usual." Nonetheless, the GATS/GAM project came in under budget and schedule and was able to achieve a 100 percent hit rate in their demonstration tests, showing that the teams' attempts to achieve high performance within a quick response environment were successful.

Key lessons learned on the program include the following points:

- Maintain constant communication at all times.
- Don’t second-guess technical experts.
- Vigorously resist requirements creep.
- Gain customer agreement with program management approach and technical goals.
- Have design decision authority resident within the IPT.
- Streamline procurement practices.
- Use rewards and recognitions to build team spirit and to give IPT members “bragging rights.”

Questions from workshop participants:

How were monetary awards paid for? Will the incentive program continue within the company?

The company’s general reward fund was used to pay for team rewards. These awards were considered more of a reward than an incentive, since team members didn’t know that they might be eligible to receive them ahead of time. Top management supports the way the GATS/GAM project ran its reward/recognition program and intends to continue similar programs.

Did the project leader have to rely on functional managers in order to acquire personnel resources?

Most of the time, the project leader was able to request team members by name. In the rare occasions when a random assignment was made from a functional area, she had the opportunity to replace them if they didn’t work out. Most new people were trained on-the-job.

How will the GATS/GAM experience affect operations in the rest of the Northrop Grumman B-2 division?

There is no formal mechanism in place to apply the GATS/GAM approach to other projects, but the project leader did put together a white paper on the team’s experience that was distributed through the B-2 program. All in all, the QRC initiative could have been unique occurrence at Northrop Grumman, since management is not deliberately choosing to use this approach on future programs at this point.

Case Study III: F-22 Program

Presenters: Gen. Mike Mushala (System Program Office), Tom Burbage (Lockheed Martin), John Ogg (System Program Office), Tom Sarama (Lockheed Martin), Bob Barnes (Boeing)

Overview:

-- System Program Office (SPO) -- Background on the F-22 Air Dominance Fighter Program, including mission, requirements, contract structure, and how the Air Force SPO has been structured to manage an industry IPT/IPPD approach.

-- Program Overview -- Program-level IPPD experiences with a focus on the use of Analysis and Integration (A&I) teams to achieve major systems integration. Integrated Product Team successes and difficulties will be highlighted.

-- Boeing Defense and Space Group -- Lessons from integrated team leadership assignments across multiple phases of the product development process

-- Lockheed Martin Aeronautical Systems Sector -- Integrating the F-22 structure (forward, mid, aft fuselage and wings) using common graphical design systems and common design/manufacturing methodologies among multiple, widely dispersed partners. Major changes in aircraft design and manufacturing practices such as the elimination of master tooling and mockup will be discussed.

The F-22 presentation provided a nice counterpoint to the GATS/GAM project by describing the challenges associated with a very different type of product development: one with over a hundred IPTs and an extremely complex technical agenda. Lockheed Martin, Boeing, and the Air Force System Program Office (SPO) participated in the discussion, presenting their impressions of the recently-concluded engineering and manufacturing development (EMD) effort and their hopes for an easy transition into the production phase of the program. With a first-ever contractual requirement to use IPPD, the F-22 provides an interesting look at the effectiveness of customer-contractor organizational structuring and the use of systems engineering techniques for interface integration.

The F-22 team began the EMD phase forced to deal with the problem of having essentially three prime contractors (two Lockheed Martin companies and Boeing), none of whom was used to acting in a subcontractor role. Considerable effort was required to construct a team mentality among three organizations with conflicting cultures, independent accounting systems, and differing design philosophies. The solution was to put in place a management system devoted to the IPPD concept, emphasizing the following goals:

- Create multi-discipline teams with responsibility, authority, and accountability,
- Stimulate and reward innovative thinking,
- Promote “Doing the Right Things” over “Doing Things Right,” and
- Challenge rather than accept “old or traditional Rules.”

In order to support this system, the F-22 SPO changed its organizational structure from a functional orientation to a product one, such that the division of labor was organized around the physical components of the aircraft (airframe, engines, etc.) instead of its technical elements (propulsion, aerodynamics, etc.). The contractors’ organizations were designed to mirror the SPO arrangement, so that each person associated with the program had a counterpart to communicate with. This promoted the timely sharing of information and faster response to problems, eliminating some of the bureaucracy formerly associated with large military development projects. At each tier of the organization, analysis and integration (A&I) teams were created to make decisions on requirements and monitor their flow across product components. These teams were responsible for both vertical and horizontal integration and formed the major systems engineering communication path for the program.

In addition to organizational changes, the F-22 program concentrated on improving the product development process. The approach focused on considering the life cycle of the weapons system from the start, incorporating issues from manufacturing, operations, and support into the design phase. In order to do this in the complex F-22 environment (dozens of teams organized into five tiers at three geographic sites across three time zones), the program developed an elaborate infrastructure of common databases, tools, and procedures that were followed at all levels of the program. These systems engineering activities included the following initiatives:

- A design handbook defined policies on such manufacturing issues as assembly sequences, the use of shims, and fasteners installation specifications. Design criteria, such as those for low observability and electromagnetic influence, were also standardized. Common databases were constructed for materials allowables, internal loads, environmental criteria, loft, internal structural arrangements, and subsystem configurations.

- Interface control drawings were used to document and track all relevant information across the major subsystem joints (e.g., vertical tail to aft fuselage). This up-front agreement on detail design data (such as loads, tolerances, tooling, and surface finish) for each of the thousands of physical interfaces between each major joint allowed separate teams to proceed simultaneously.
- Software data was shared in real-time via a distributed network between contractors. This included such tools and methodologies as 3-D electronic design tools (CATIA), 3-D electronic mock-up (COMOK), finite element modeling, and computer aided theodolites.
- Standard parts were defined for commodity items like connectors, fasteners, and couplings.

Both the contractor and government presenters expressed their strong conviction that there was no way they could have finished the F-22 EMD phase without an integrated approach. Benefits realized from the IPPD implementation thus far include 80 percent of F-22 units passing all qualification testing for hardware safety of flight without redesign or manufacturing changes (compared to 10 percent on previous programs) and the successful installation of the first prototype wing ship-set within 12 hours of its being received from Boeing.

Key lessons learned on the program include the following points:

- IPT philosophy takes leadership commitment from the top.
- Need to constantly work on improving team communication/integration: the “I” in IPT stands for integrated, not independent.
- Training to function as a team is paramount.
- IPT managers must have authority over personnel and budget resources.
- An integrated network of communications/software tools is mandatory.
- Set team goals and objectives, and then track them!
- IPT leadership should become a mainstream discipline/function and a viable management career path.

Questions from workshop participants:

Was there a "master plan" for the F-22 program?

The program has been mostly "event-driven," such that major reviews are required between phases in order for the development effort to proceed. These reviews are done jointly by the program office, the customer, and the engineers. Milestones are tied to the work breakdown structure.

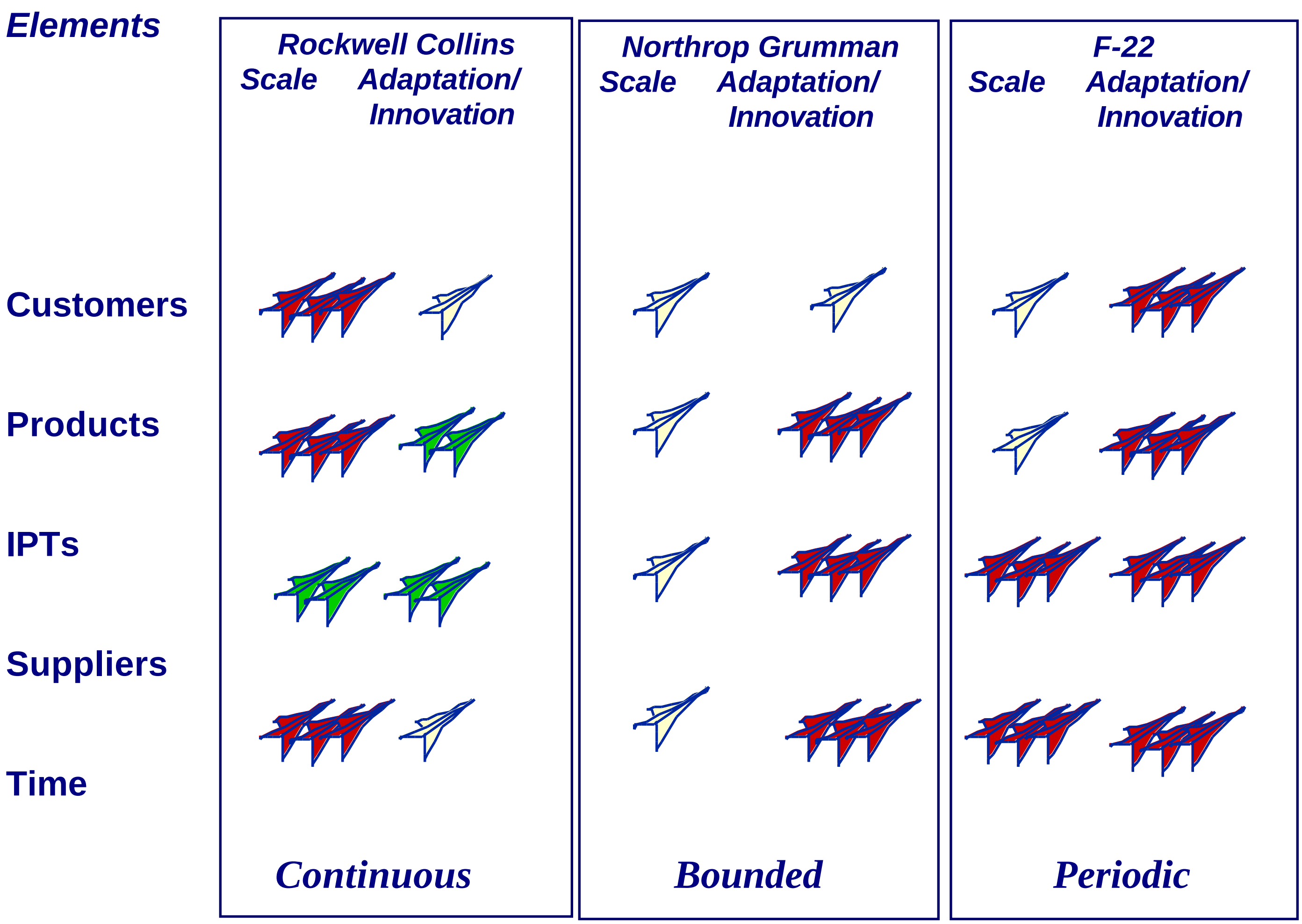
How was the cost of common tools and databases shared among contractors?

Each of the three major contractor site created their own budget for system and infrastructure development and was responsible for their own implementation. Data was organized according to the IPT organizational structure, and costs were product-based (e.g., the wing IPT manager at Boeing was responsible for the cost of designing and building the wing, including the cost of supporting their portion of the common database). In the case of smaller subcontractors, Lockheed Martin has loaned them CATIA tools and trained their personnel so they can participate in the common database.

Part IV: Emergent Framework for Classifying IPPD Context

An unexpected, but important outcome of the session involved the development of a common framework to classify IPTs. This framework is presented in the following chart, where the three case studies are classified. As the chart suggests, the cases vary both in scale and in the degree of adaptation and innovation required. It is this range of activity that points away from any one best model for an IPT.

Classification of the Cases



First four elements vary along two dimensions:

Scale -- *(1=few, 2=moderate, 3=many)*

Adaptation/Innovation Required -- *(1=little, 2=moderate, 3=extensive)*

Dimensions of time:

Bounded, Periodic, and Continuous

It is important to emphasize that this classification is a preliminary analysis, conductive with input from a small number of organizational representatives in a compressed time period. As such, it should be treated as illustrative, not definative. While the classification by scale is relatively straight forward, the classification on the required levels of adaptation and innovation involve judgement calls that are less easily quantifiable. Even though this is a broad brush classification, it still has potential value in providing a first order identification of the type of IPPD context in which an IPT is expected to operate. In this way, it could be an aid for self-assessment during present state analysis as well as a set of boundary parameters for future visioning and strategic planning. In an effort to test the utility of the framework, we conducted a special simulation, which is described below.

Insights from IPT Launch Analysis

As an initial test of the utility of this framework, participants in the workshop were assigned to one of the three different IPT contexts – as represented by the three cases. That is, three of the tables in the meeting room were asked to consider themselves newly formed IPTs operating in a context similar to the Rockwell-Collins case; three tables were asked to operate in a context comparable to the Northrop Grumman case; and three tables were asked to assume they were part of a program similar to the F-22 case. Each table then was asked to identify its most important concerns and priorities as a newly formed IPT in its given context. The tables reported out to the senior managers from each of the three cases and were given feedback on their reports.

Across the nine tables, there were a number of comments and recommendations that were similar (regardless of the context). These included the following priority concerns:

Common to all IPTs

A. Specify product requirements (features, timing, links to other products)

B. Establish mechanisms for communication and coordination

C. Clarify resources (budget, training, facilities, software platform, senior champion)

D. Ensure leadership

E. Need to re-align organizational culture

While none of these concerns are particularly surprising, the commonality across all of these simulated IPTs suggests than any implementation of a team-based structure should include systematic attention to each. There were also important contrasts across the settings, including the following:

Distinctions among IPTs

A. Variation in tolerance for requirements creep and expected changes in other products – with little tolerance in a settings such as the Northrup Grumman GATS/GAM IPT in contrast with an expectation of changes in a large program such as the F-22.

B. Variation in importance of horizontal and vertical coordination of activities – again a function of scale and time frame.

C. Contrast between co-location and electronic coordination – partly a function of scale, but also a degree of variation even with different IPPD contexts

D. Contrast between leader as "coordinator" and leader as "champion" – with more of an emphasis on the champion role in program that has more of a "skunk works" quality

E. With scale, culture challenge is larger, but lower risk of being marginalized

These different forms of variation point to a mix of contrasting challenges and priorities depending on the IPPD context – with key differences driven by scale and time frame.

Specific Issues Raised by Simulated IPTs in a Context such as the F-22:

Classification of this IPPD context:

	Scale	***Required Innovation***
Customers	Few	High
Products	Few	High
IPTs	Many	High
Suppliers	Many	High
Time: Bounded		

The specific three priorities for IPTs working in such a context were as follows:

Group 1:
- Communication strategy (customer/supplier – modes, means, norms)
- Define charter (requirements, environment, budget constraints, priorities, skills, operating guidelines, SOW definition, vertical/horizontal integration)
- Tool set for work to be performance

Group 2:
- Integrated schedule (budget and resources)
- Definition of IPT mission (including cost, suppliers, etc.)

- Define charter – similar to group 1

Group 3:

- Shared vision for all stakeholders
- Seamless information flow (data bases, common tools, etc.)
- Process to horizontally integrate across all teams

Feedback by F-22 organizational leaders:

Communication strategy is critical
The role of suppliers is critical
The role of IPT around technology insertion is critical
Seamless information flow is critical
Important implications of shifting priorities as moving from EMD to production to sustainment

Specific Issues Raised by Simulated IPTs in a Context such as Rockwell Collins:

Classification of this IPPD context:

	Scale	***Required Innovation***
Customers	Many	Low
Products	Many	Moderate
IPTs	Moderate	Moderate
Suppliers	Many	Low

Time: Continuous

The specific three priorities for IPTs working in such a context were as follows:

Group 1:

- Understand IPT goals/commitments (cost, schedule, etc.)
- Establish effective involvement in infrastructure (tools and processes)
- Communicate and align within and among IPTs

Group 2:

- A&I (analysis and integration) team at high level
- Flow up of multiple products
- Build development capability with production focus IPT

Group 3:

- Supplier management
- Process capability/process control
- Data management

Feedback by Rockwell Collins organizational leader:

First step is true co-location
Experts can be on call, but are not needed full time
High levels of coordination are required across programs
Focus on product improvement and affordability

Specific Issues Raised by Simulated IPTs in a Context such as GATS/GAM:

Classification of this IPPD context:

	Scale	***Required Innovation***
Customers	Many	Low
Products	Many	Moderate
IPTs	Moderate	Moderate
Suppliers	Many	Low

Time: Bounded

The specific three priorities for IPTs working in such a context were as follows:

Group 1:
- Pick right person to lead team
- Clear focus on customer and requirements – no creep
- Solid execution plan (cost, schedule and resources)

Group 2:
- Establish team roles and responsibilities (scope, budget, etc.)
- Staffing of entire program
- Communications and metrics

Group 3:
- Mission statement (champion identified, empowerment, buy-in (horizontal and vertical), focus – meet the requirements and only the requirements)
- Requirements (IPT) (Budget, cost target, schedule, quality level/product)
- Technical risks and challenges (determining team composition – experts where needed, supplier base review for cuts)

Feedback by GATS/GAM organizational leader:

First goal – define resources and tools
Second goal – establish schedule, requirements and budget
Third goal – technical performance measures (no creep)

Additional Notes from General Discussion:

- Common elements across IPTS:

- Scoping the task
    - Right people/right skills
    - Communications
    - Fit into the bigger system – even though big picture is different in each case
    - Horizontal and vertical integration

- Match organization/style to program(s) characteristics/phase
    - Contingency theory
    - No one formula

- In time bound/phased program, integrated schedule is key – contributes to challenge of getting senior management commitments

- Desire for clear, unambiguous, stable requirements – but not a reality
    - Design in ability to deal with expected/anticipated change
    - Change breeds need for communication
    - Proper team organization, training and empowerment within team builds ownership

- Hard work to build in lean (cost improvements) in IPTs
    - Sense of urgency (market, environment, factors, multiple players, program cancelation)
    - Build into culture

- Overlooked function role in process stability

- Remaining issue: Rewards, incentives and motivation

Part V: Keynote Address

Managing the Challenges of Cross-Boundary Teams

Prof. Anne Donnellon,
F.W. Olin Graduate School of Management,
Babson College

During her luncheon address, Professor Donnellon reviewed four major challenges facing cross-boundary teams and then explored keys to managing each of these challenges. The following text lists the challenges and management comments as they were numbered on her slides. The bullet points represent selected notes taken during the presentation.

Challenges

1. The environment that creates the need for teams is often inhospitable to team work.
   Examples:
   - rapid product change
   - increasing customer demands
   - sponsorship by senior management (which can result in interjection of their own agendas, micro-management, and requirements for lengthy reports that become the team's main "product")

2. Teams are expected to produce revolutionary change but are rarely seen as revolutionary themselves.
   - Younger professionals assigned to teams are good technically but not able to recognize convergences and divergencies across functions.

3. The more integrated the team becomes, the less differentiated the team members become.
   - issues: development of technical proficiency; motivation (the skills and power that used to be valued have shifted)
   - focus is on applying knowledge, not refreshing or improving it

4. Structuring team work is critical but threatening to the team process.
   - Some structure and encouragement is necessary, but teams need autonomy to create a good process.

Managing the Challenges (very top-level, since "there are no silver bullets")

1. Leadership specifies ends, not means.
   - transparency in the organization: whole company knows and understands strategic goals

- management sets product parameters (i.e., for revenue) but doesn't constrain resources up-front - lets team present scenarios for investment and pay-off

2. Training and coaching are critical.
    - team members need team skills such as training in managing conflicts and communicating in different languages
    - coaching allows team to learn over entire lifetime
    - focus is not just on near term problem-solving but is intended to build up capability over the team's life and over team members' career life

3. Evaluating and rewarding teams requires complex tradeoffs of many variables.
    - reward teams not individual team members (creates less tension for individual)
    - let teams set their own goals in consultation with management and let teams allocate rewards

4. Adapt career paths to new strategic and work requirements.

Examples:

- more frequent performance evaluations
- rotate people through functional departments
- sabbaticals for technical skill development
- create technical consultant role for advanced individual contributors (i.e., functional managers)
- add a ladder of team responsibility to managerial and technical ladders
- create career counselors with bigger picture of corporate and industry needs

Part VI: Focus Group Recommendations

Five focus groups were established each with a group of approximately one dozen of the seminar participants. People were able to self-select the topics and each group followed a relatively standard agenda that included defining their topic, outlining a future vision, identifying current reality, and highlighting improvement recommendations. The groups focused on the following topics:

- Rewards and incentives
- Leadership and integration
- Performance measurement
- Functional roles and career development
- Dynamics across product and team lifecycles

Recommendations on Rewards and Incentives

Rewards should be team based

- Financial Rewards
  - Tangible Benefits ($)
    - Cash Awards
  - Career Path
    - Educational Opportunities
    - Promotion - Career enhancing assignments
    - Separate IPT career path
- Non-Financial
  - Recognition -- medals, letters of appreciation, etc.
- Consider underlying assumptions about motivation

Recommendations on Leadership and Integration

Within an organization**:**

Senior executive management must advocate and enable the IPT philosophy

Use industry-wide definitions as a baseline
IPT definition
Role of IPT

Develop robust company-wide process for selecting, developing, and maintaining IPT leadership

Industry-wide:

Develop a "Capability Maturity Model" which delineates the characteristics of an

Recognize and support people when they are executing and acting like an IPT

Recommendations on Performance Measurement

Set clear enterprise "big picture" metrics and synchronize at every level

New programs can then look upward to corporate metrics and flow downward

Anticipate feedback and adjustment in both directions

Fewest possible measures

Driven by product and program requirements

Shift with phases of implementation

Early on, focus on the right management system (including metrics feedback)

Over time, focus increasingly on outcomes

Requires a fundamental culture shift in finance, other functions

From downward control to both control and support

Recommendations on Functional Roles and Career Development

Balance specialists and generalists

Clearly define roles/responsiblities of functional groups

Identify skill needs and share responsibility for training

Functional groups: Assure a pool of specialists
IPTs: Mentoring, coaching, and OJT

Clear staffing process -- motivate/maintain expertise within IPT environment

Career planning opportunities

Rotation, technical sabbaticals, promotions (within and across functions),
Functional leads selected from both functions and IPTs
Shared training -- organization and individual

Career development/path for IPT leaders

Senior management recognition of IPT leadership as a discipline
Compensation and defined skill sets at each tier

Dynamics Across Product and Team Life Cycles

Top level recognition that you don't have the right team in place for tomorrow

No static solutions

Team composition/development strategy wired to product life cycle

IPPD/IPT valid process
Requires change strategy

Recognize there are some things IPTs cannot impact (such as overhead, capacity utilization, etc.)

Part VII: Industry Presentation

Product Development Process Leadership at Ford Motor Company

David Roggenkamp,
Ford Product Development Systems

David Roggenkamp provided an overview of the current initiative at Ford to build into product development a system comparable to the Ford Production System in manufacturing. Here are highlights from his presentation:

Ford Product Development System (FPDS)

Linked to Ford Production System (FPS) and systems for "order to delivery" and "after sales service"

Three places to take time out of the development process -- focus on the first two

1) Defining the product, 2) Design and Analytical Verification, and 3) Development, Tooling and Launch

Themes of: People, process and technology

Systems engineering, Product development factory, Reusability, Voice of the customer, Job #1-like commitment, Teamwork

Results

Individual Programs: Time-to-market (25-45%), Warranty (25-30%), Resources (30-40%), Investment (25-30%)

Total System: More new programs, Improved cash flow, more employee pride

Part VIII: Appendix – Flip Chart Notes From Focus Groups

As was noted earlier, five focus groups were established during the Workshop. Each integrated lessons from the case studies and the experiences of group members relative to a key theme. The five themes were as follows (with the lead facilitator indicated in parentheses):

- *Rewards and incentives – Mike Bell*
- *Leadership and integration – Greg Manuel*
- *Performance measurement – Joel Cutcher-Gershenfeld*
- *Functional roles and career development – Jan Klein*
- *Dynamics across product and team lifecycles – Mike Packer*

While selected highlights from the focus groups are featured in the report, this appendix presents the full text of the notes from these sessions. Many important ideas and themes surfaced during the discussions and it is hoped that the charts will prompt further ideas and applications across the Lean Aerospace consortium.

Note that the format and of the different reports varies, reflecting flexibility that was given to each group to adjust their analysis to match important themes or lessons that were emerging from their efforts.

REWARDS & INCENTIVES

Analysis of Case Study I: Rockwell Avionics and Communications

Implications:

- Do we need financial incentives - can we afford?
- Do incentives need to be broken into Team/Individual?
- A symmetry of rewards & incentives
- Removing disincentives & adding incentives
- Incentive design to attain desired result
- Reward balance between team to team & individuals
- Timing of rewards
    - People who created improvements or failures may have moved on
- Who determines rewards & incentives?
    - Values

Core Elements:

1. Alignment - linking of performance measures throughout the process
2. Financial rewards are not the only form of incentive & rewards
3. Buy-in/Ownership
4. Motivate better performance (individual & team performance)
5. Helps to drive change in functional organizations
6. Customer Satisfaction
7. Competitive Advantage

Alignment:

Going Well

- Not much is going well
    - Organizations are hesitant to change systems (don't know what to change to)
- Establishing top level goals & linking them to performance of the various organization levels (to salaried workforce)
- Nucor Steel
    - Doing some good things

Not Going Well

- Contractual relationship between government & contractors to grow IPPDS/IPT's
- A lot of large organizations involved with varying reward processes
- Equity issues

- Too much focus on financial
- Union workforce lacks incentive/motivation to play

Financial Rewards not only form of Incentive & Rewards:

Going Well

- Non-financial in the form of individual career growth
- On the spot awards can be decided at IPT leader level
- Cash awards within a week
- Tickets to ball game
  - Decided by product team leader

Not Going Well

- Not timely or balanced (not inclusive of all appropriate people)
- Not well defined
- Peer recognition
- Not enough variety or opportunities
- Alternative reward process and cycle times
  - Need lowest level decision capability
- Not getting input from teams

Analysis of Case Study II: Northrop Grumman GATS/GAM

Implications:

- What were dollar amounts available for the teams?
  - Avg - Member
  - Tap - one week to get award
    - Takes strong Program Manager to get share of award

- No specific incentives/rewards identified for this IPT
  - Award fee for coming in low
- Members felt great sense of accomplishment for team performance
  - Incentive was a successful program
- Career improvements considered rewards
- B players considered higher because of association
- Most incentives were non-financial
- Visible achievements throughout organization are criteria
- Align behavior with organizational goals

Disconnects & Root Causes:

- Focus on dollars causes paralysis

- Don’t know how to pay for it
  - Not part of culture; corporate has to determine
  - Incentive Formula
- Fear of failure - incentive formula
- Equity issue
  - People rotation/timing issues
- Fairness
  - Inability to assess individual contribution objectively
- Union Issues
  - Can make $800 on a good program vs O/T on a bad program
- Insights into Root Causes:
  - Need to develop business case to do incentive program
  - Win/Win for all stakeholders
- Money has to be tied directly to desired performance
- Success requires buy-in at P&L decision point

Analysis of Case Study III: F-22 Team

Structure:

- Aim(s)
- Recommendations - improvement options - components
- Issues/Concerns/Considerations
  - What is system for tangible benefits
  - Problems w/employee or individual of the month (split teams apart)
  - Timeliness – do monthly/quarterly vs. annual
  - Fairness
    - Clear performance targets at team level
  - Difficult to leap from negative to large success in a single leap
    - Do CPI (neutralize the negative then improve)
  - Plan early in process
  - Need corporate buy-in
  - Roll down of award fee
  - Ask the teams what they value
  - Pilots

Recommendations:

Team Based

- Rewards
  - Financial
- Tangible Benefits ($)
  - Cash Awards
- Career Path

    - Educational Opportunities
    - Promotion - Career enhancing assignments
    - Separate IPT career path

Non-Financial

- Recognition
    - Medals
    - Letters of appreciation, etc.

LEADERSHIP AND INTEGRATION

Leadership and Integration Aim Elements:

1. Setting Team Vision
2. Interface to other elements of Program
3. Ultimate ownership of product
4. Ensuring all members have common goals
5. Ensuring balance of input by all team members
6. Recognize and removal all barriers
7. Establish Team boundaries
8. Coach, Facilitator, Motivator
9. Ensuring correct functional representation
10. Ensuring roles and responsibilities are understood within and between teams
11. Execute established processes

Aim Statement:

The goal of Quality Leadership and Integration in an IPT environment is to assure that the Team's vision is accomplished by clearly identifying roles and responsibilities and integrating all activities, both horizontally and vertically, while meeting established cost, schedule and quality measures.

Team Vision Disconnects:

- No champion/lack of support
- Instantaneous/unrealistic results
- Lack of transfer of vision to specific team goals and objectives

Integration Disconnects:

- Lack of integration between team goals and functional goals
- Focused IPT success at the expense of the enterprise
    - Stove- piped IPTs

Role and Responsibility Disconnects:

Team Composition

- Team looking for best technical person in each specialty, yet really needs generalists

- Directed Team size by upper management, i.e., small size more generalists
large size more specialists
- Availability of key skills to support team

Continuity of Team Leadership

- Turnovers
    - Career path
    - Up or out
    - Downsizing
    - Commercial competition for personnel

Quality Leadership Disconnects:

- Lack of Qualified Leadership
    - Inadequate Training
    - Inadequate Experience

- Leaders chosen for wrong reason(s)
    - "Specialist" success not a good criterion

Integration:

Establish a structured integration of IPTs vertically and laterally for all tiers.

Leadership/Integration Issues to Present to Top Management:

1. Senior Executive Management must advocate and enable the IPT philosophy by using the established industry wide definitions as a baseline.

2. Create and communicate a dynamic definition of the IPT role and of IPT leadership.

3. Develop a robust company wide process for developing, maintaining and selecting IPT leadership.

4. Develop formal career progression format for IPT leaders.

5. Develop formal IPT Leader (Member) Training Program.

Industry Wide:

Develop a “Capability Maturity Model” which delineates the characteristics of an IPT (are you executing and acting like an “IPT”)

Analysis of Rockwell Collins

1. Who has ultimate leadership, ownership, accountability
    - Need clearly defined roles and responsibilities including a charter
2. Who is responsible for Integration
    - Responsible for Integration B/T IPT and IPPD within all PMO (day-to-day is IPT/IPPD)
3. Who selects IPT leader
    - Senior leadership

Aim/Goal of Leadership

The aim or goal of leadership when it comes to IPT is:
1. Setting vision of team
2. Interface to other elements of program
3. Ultimate Ownership of Product
4. Ensuring all members have common goal
5. Ensuring balance of input of all members...appropriate voice by all
6. Recognize and remove all barriers
7. Establish boundaries for team
8. Coach, facilitator, motivator
9. Ensuring correct representation
10. Ensuring roles and responsibilities are understood within and between teams
11. Ensure timely, quality decision and ensure right level of decision is made

Disconnects

- Availability of key skills to support team
    - Losing both “young” sponges and key skills (core competences) with experienced individuals
    - Less and less availability of Team leaders due to career progression
- Continuity of Team Leadership
    - Both within company and government
    - Turnover within government creates disruption within program
    - Goal of government leadership as a result might not be the goal of team (i.e.____ promotion spat)

Team Vision Disconnect

- Lack of Team Vision for Team

- Lack of knowledge of Company/Team vision
- Lack of buy-in of the vision by Team or Team Members
- Believes in IPT concept or not
- No champion for the Team
- Lack of, or use of, the characteristics of IPT and IPPD.
    - Labeling everybody/organization a Team
    - Assignment without empowerment

Additional Note

1. Leadership Roles and Responsibilities within the Team, Between Teams, and above and below; Roles and Responsibilities for Team members (10 & 8), 9, 7, 4, 2
2. Executing Team Vision (1&3), 7,5,4,11,12

Implications/Observations from GATS/GAM Program

- Empowerment of Team Leader and Team from Program and Division management.
- Bringing in outside "consultant"/technical expert to assist Team
- Clear goals from the beginning; Only three (3) distinct/specific goals
- Focus Team vs IPT vs "Skunkworks"
- Decisions made at the appropriate level?
- Fieldable/prototype philosophy helped execute program
- Project oriented vs Process
- Rice bowls are damaged → probably reduces success of other programs
- The fact that Team reported to PM prevented the permeation of change, PI.
- Acquisition Reform prior to acquisition reform.

<u>Quality Leadership Disconnects</u>

- Lack of qualified leadership and opportunity/career path
- People chose for the wrong reason (good technically)
- Manager to Team Leader - "shotgun approach"
- Training Programs not integrated
- Grooming leaders along functional lines
- Need formal job title
- Lack of senior management champions for IPT

<u>No Title (Buckets)</u>

- Team Vision
- Roles and Responsibilities
- Integration
- Quality Leadership

<u>The Goal of Quality Leadership</u>

The goal of quality leadership and integration in an IPT environment is to assure that the Team's vision is accomplished by clearly identifying roles and responsibilities and integrating all activities, both horizontally and vertically while meeting established cost, schedule and quality measures.

Roles and Responsibilities

Team requires/wants the best technical person, but at the same time needs a generalist to execute.

- Tech expert carries an ego
- Lack of other perspectives within Team members
- Challenged to migrate technical experts to more of a generalist at the same time maintaining Core competence. “Don’t need one of everybody.”

Integration

- Focused (sub) IPT success at the expense of the system
- Lack of Integration B/T Team goals and function goals.

Leadership/Integration

Implementation issues you would want presented to corporate/executive management

- Train all senior executives in comprehensive IPT/IPPD Philosophy
- Develop formal career progression for IPT leader
- Formulate formal IPT Leader (member) training program

No Title

Understand the process and selection criteria of defining team member roles and responsibilities

Setting the vision for the team and the roles and responsibilities for team members

IPT and Role of IPT Leaders

1. Senior Executive management must advocate and enable the IPT philosophy by using the established industry-wide definitions as a baseline.

2. Create and communicate a dynamic definition of IPT and role of IPT leaders.

3. Develop a robust company-wide process for developing, maintaining and selecting IPT leadership.

INDUSTRY-WIDE

Develop a “Capability Maturity Model” which delineates the characteristics of an IPT (are you executing and acting like an “IPT”)

PERFORMANCE MEASUREMENT

Comments on Case Study I: Rockwell Collins

- Organizational discipline around processes and measures of outcomes is an indicator of team/process health
- Before and after an IPT it is hard to assess since teams go back a long way – teaming began in manufacturing
- Discussion of two comparable programs – one with variance reduction and one without – the one without had three redesigns and went $600,000 over budget
- The successful team did a risk matrix around cost and schedule – using these two metrics to drive the risk analysis
- Matrices are a key element of design robustness and integration – they drive new behavior
- Measurement of something that seems intangible – "robustness" was key and it required manufacturing to drive it
- Another key is manufacturing leading some design activity
- Budget hand-off negotiation is very important
- If you are resisting new processes you lose out on certain incentives – such as recognition

Elements of an Aim (with "multi-votes" in parentheses)

12 votes	Identify the need to make process improvements or to validate the process
9 votes	Integrated metrics to match integrated product and process development – which point toward dollars (cost) and time (schedule) as two key variables
7 votes	Tool to allow you to manage – metrics matched to the process being managed – issue of metrics across the product cycle
6 votes	Meaningful and common goals – effective feedback and learning mindset
4 votes	Metrics help prevent recurrence of problems and enable responsibility and accountability
4 votes	Enable rewards and incentives – issue of fairness, as well as importance
2 votes	The aim is consistency in any setting, but in the IPT context there are large non-rcurring expenses up front – so metrics allow comparisons across programs

2 votes	Given that the primary barriers are organizational and administrative, consistent metrics help to address these issues
1 vote	Signal of process innovation to be diffused more broadly
1 vote	Ability to satisfy customer requirements

Note overall importance of a long-term time horizon

Brainstorming on Reality Around Performance Measurement

- We all agree that IPPD is the right thing to do, but without metrics we can't address the skeptics
- Dominance of short-term metrics
- Not always walking the talk – only small pockets
- Systems don't allow us to measure what we need to measure (for example budgets, not cost improvements or observables rather than process)
- Some savings may take years to realize or see
- Pressure or resources make metrics critical – without metrics resources may not go where most needed
- Resources sometimes flow to those who are best at managing metrics
- Great resistance to any new metric and any flaw may discredit whole idea
- Hard to set consistent goals across teams – so performance against metrics may or may not be different, but would not be reflective of actual accomplishments
- Points to the need for an overarching or integrating IPT to address fairness, coordination, and consistency on metrics
- "Catch ball" program at one organization where teams "catch the ball" in hand-offs with metrics
- Baseline measures are critical – are you "fat" or "lean" to start? It is also difficult to get baseline measures
- Used more as a "hammer" in the negative, rather than as a tool for learning
- Irony with performance measures – that which is supposed to help becomes a barrier
- Goals shift over time – moving targets on cost, schedule, and requirements – and they always shift in the more difficult direction

Comments on Case Study II: GATS/GAM at Northrup Grumman

- They eliminated unnecessary performance measurables
- It required pushing on the system
- Resisted internal (within team) and external requirements creep
- Resisted analysis paralysis
- Communications was central

- Open organizational boundaries
- Big picture performance feedback
- QRC was key
- Size is a key aspect of the case – but there are still implications for big programs

Brainstorming on Disconnects

- Mearurables are supposed to support improvement and instead used as a "gotcha"
- Not measuring what is important
- Short-term reality versus long-term aim
- No base-line measures

Deep Dive on "Gotchas"

- Usually someone outside the team uses the metrics against the team
- May reveal a lack of integration of key stakeholders
- Response is to serve up the numbers, if that is what they want
- "Gaming the numbers"
- Shifts the focus to rationalizing and accepting
- Shuts down future reports on problems/risks
- Team becomes dysfunctional
- This is an issues generally, but the consequences are more severe in an IPT environment

Root Cause Analysis

- Need for teams to take responsibility (and be given authority) to manage external boundaries (example of vice-presidents having to stand by to door in a crowded GATS/GAM meeting)
- Ignoring external priorities and politics brings risks too
- Core tension between self sufficient/integrated nature of a team that is operating in a hierarchy
- Legitimate hierarchical concerns can drive what the team sees as a "gotcha"
- Core misunderstandings between a team and a hierarchy may be played out through the measurables
- Root cause issues of reporting relationships and information flow
- Discussion of the case of an avionics company where some programs looked good and others less so due to the metrics – which drove a major reconfiguring – a negotiated process between IPT leaders and staff – an example where the staff group did not "top down it"

FUNCTIONAL ROLES/CAREER DEVELOPMENT

Analysis of Rockwell Collins Case:

- The primary focus of IPPD is engineering and the primary focus of IPT is manufacturing but both have cross-functional/cross-boundary involvement.
- In IPPD, functional leads hire, fire, and determine raises with input from the program manager.
- In IPTs, the IPT leads (who are drawn from multiple disciplines) hire, fire, and determine raises, but the budget for raises is held by the functional groups.
- IPTs are staffed as a two-year cross boundary assignment (engineering, finance, etc.).
- Functional excellence groups maintain functional expertise within the IPTs.

Analysis of Northrup Grumman GATS/GAM Case

- The lack of diffusion may have been due to:
    - lack of another leader/“special personality”
    - functional resistance
    - unique situation (QCR)/“special project”
    - communication inward, but didn’t appear to build support outward (need to figure out right amount and content

Aim/Goal (number of votes):

- (6) Balance of generalists and specialists
    - recognition of both functional expertise and generalist/business/IPT activities and competencies
- (6) Ideal short-term business goal would be to have functional groups with no one in them, but you still have to motivate, maintain expertise and disciplines of functional experts
    - transfer of expertise from one IPT to another
    - transfer of lessons learned
    - balance of desires/resources across IPTs
- (6) Allow for career development into IPT leadership from all functions (including operations/manufacturing, not just engineering)
    - new career paths with new skill sets (business orientation/mini-program manager)

Issues (number of votes):

- (5) Little training for IPT leads (new skill set), just throw them in.
    - lack of career development paths

        - no training (who should train?)
- (5) Lack of consistent process for staffing of team members
        - who hires, assigns, fires
    - If major problem occurs (e.g., flight failure), tendency is for senior management and customer to revert back to functional mentality
    - Funding of career development/training if outside program or functional area
    - Lack of consistent process for selection of team leaders
    - Recognition by functionals for activities outside function
    - Lack of skilled people to do job
    - When teams are functioning and a new team is formed, so decides who is going on new team
        - formation and disbanding of teams
    - Accountability
    - Concern that specialists turn into generalists in IPTs and don't come back
        - brain drain on organization?

Examples of ways to address balance issue with respect to career paths:

- Mix of both specialists and generalists on IPTs
- Generalists with a systems perspective typically assigned to IPT (but not co-located)/specialists are members of 2-3 IPTs and still in functional areas
- Place new people into functional groups first, then into IPTs
- Three career paths: technical management, technical experts, & program management (including IPTs)
- Hire into both functional groups & IPTs, but if IPTs, assign mentor who helps new hire to understand functional processes.
- Select functional heads with cross-functional expertise
- Functional managers are IPT leads, i.e., were two hats

Disconnects:

Staffing of team members -

- Functional department not really aware of what people's current assignments are relative to team activities – differences in perceived time spent on specific functional tasks
- Members assigned to do certain job, job gets done and then gets assigned to do something else – often assign by someone without right expertise
- Lack of sufficient people leads to second or third choice rather than optimal skills
- Lack of good supply/demand information
- Lack of communications between IPT and functional groups
    - too busy
    - don't think they need to know
    - don't want to spend 10 hours to get 5 hours of team member's time
    - flexibility within teams vs. functional network

    - differences in perceptions between IPT and functionals re: appropriate utilization of team member's skills/time (influenced by size of organization)
- Multiple decision process of marrying individuals to IPTs vs. one person making decisions
- Underground railroad which knows more than "official" decision makers (leads talking to one another)
    - information faster through "friends"
    - band-aid to current systems
    - undermines career paths (perception of insiders vs. outsiders)
    - knee-jerk reaction – hold people/keep best folks
- Team has information but unwilling to share for fear of losing people
    - not looking at big picture
    - human nature
- When functionals hold budget, breeds specialists/when IPTs hold budget, breeds generalists

Role of functionals:

- Put new technology in bag
- Coach & provide resources for IPTs
    - disciplines
    - training
    - common tools & processes
- Help in development career paths
- IPTs should nurture functionals and functional groups should mature IPTs
- Varying definitions of functional roles
    - need clear definition within each organization
    - shifting roles/responsibilities but need to be clearly defined both internal & external

IPT leadership career development & training issues:

- resources and time to train
- turnover of people (training only at formation)
- motivation of right people into career path

Implementation recommendations:

1. Balance specialists & generalists
    - clearly define roles/responsibilities of functional groups recognizing shifts
    - identify skill needs
    - shared responsibility for training
        - functionals: assure pool of specialists
        - IPTs: mentoring/coaching/OJT
    - staffing process

2. Motivate/maintain expertise within IPT environment
    - career planning/opportunities
        - rotation
        - technical sabbaticals
        - promotions (within & across functions)
        - functional leads selected from both functionals and IPTs
    - shared training – organization and individual
    - assure pool of specialists
3. Career development/path for IPT leaders
    - senior management recognition that IPT leadership is a new discipline
        - need to identify new skill set at each tier
    - recognize IPT leaders formally, compensate appropriately
    - tie skill set to clear career development path (including within and across functional groups and IPTs)

DYNAMICS ACROSS PRODUCT AND TEAM LIFECYCLE

- Team composition strategy over time - <u>no static solutions</u>

  - skills
  - focus & structure

- IPPD philosophy implemented through IPTs is a more effective "operational" paradigm, but . . . The larger management structure needs optimization to really gain the benefits . . . IPPD/IPT may serve as the change agent

Disconnects & root causes:

- High impact environmental changes
- Unrealistic expectations given resource constraints
- High risk program - risk averse environment
- Success "<u>despite</u>" vice "<u>because of</u>" senior management help

Dynamics across product and team lifecycle(day 1 summary transparencies)

Knee-jerks

- Paul principle
- Steering committees
- Grey beards
- Inchstones
- "another set of eyes"
- More metrics
- More people, horsepower

Rockwell Collins case study reactions (day 1 - flip chart 1)

- Supplier involvement up front during requirements definition
  - transfer thru commodity teams
- Up-front "customer" involvement - stabilize requirements, aid new process/tech insertion
- Organization structure

IPPD ⟷ IPT

- Continuance of team(s)
- Some rotation IPT to IPPD
- Common membership product specific
  - new - more common
  - mature (repackage) - less common

- IPPD teams - more cross-functional

- IPT - production focus

- Program office common

  - accountable (overall) - lead initiatives to ensure quality, processes are not sub-optimized long-term - e.g., warranty liability
  - budget management to achieve

Dynamics of product and team lifecycle (day 1 - flip chart 3)

<u>Aim:</u>

Senior IPT - move from reporting hierarchy to cross-team integration

- is there a need for senior IPT (analysis & integration)?

- push analysis & integration down lower

- lower level PTs force analysis & integration
  - Tabling top risk issues
  - Accountable for closure plans

Dynamics of product and team lifecycle (day 1 - flip chart 4)

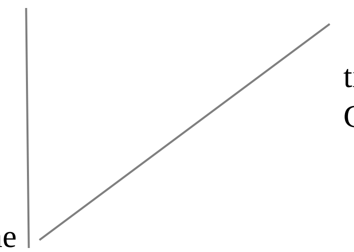
- Have to get over "shooting the messenger"

  → cultural issue

  - periodic workshops (IPPD) process to update members, refine process
  - excessive lower tier IPTs
    - -- too much decomposition ?
  - differentiate IPTs, short-term teams, functional teams
    - -- catalog to manage proliferation
  - "over meeting-ed"
  - common tools (engineering, s/w, etc.)
    - -- dominant to personal communication (e-mail)

- fundamental communication
    -- use individual focal points responsible for dissemination - both ways

- **Change of organizational structure as function of product phase**



IPT serves as forcing/acceleration function to address

Summary aim -- with alignment/disconnects (day 1 - flip chart 6)

1. Organization structure
    - change as function of product phase (how do you transition?)
    - analysis and integration function
    - overuse of “teams”
    - leadership, communication, participation

2. Common tools for information flow
    - engineering
    - analysis

3. Basic communication
    - upward, downward, across
    - team level - personal comm.
    - acceptance of action

4. Periodic education and refinement of team processes
    - “spring cleaning” is essential

Dynamics of product and team lifecycle (day 1 - flip chart 7)

Key elements	Alignment	Disconnects
Organizational structure	Leadership Participation Upfront customer & supplier involved Clear roles & resp	Incomplete integration in Large organization Membership continuity “team” proliferation Cultural accept and change

	A&i function Change-sunset/transition	change rate No. Emp Time (log-log) Unwanted help/second guessing
<u>Communication</u>	Common tools - engrg and analysis Up, down & across Accept actions Personal communication	Unclear respons. “team” proliferation
<u>Continuous improvement</u>	Catalogue & refresh (spring cleaning) IPPD process education - · Periodic · Refinement Lessons learned/reuse	Rewards/incentive Teams outlive usefulness Recognize sunset/transition

Case study (gats/gam) reactions (day 1 - flip chart 8)

- short life cycle impact enabler?
    - clear progress allowed “out of the box”
      To continue
    - incremental successes/celebrations
- size (scope) factor?
    - small
    - very focused on few clear goals along the way --- top to bottom
- better use of lessons learned --- re-use
- successful <u>sunset</u>
- finite product volume factor
- “inverted pyramid” org model
    - open working level communication
    - all decisions funneled - p.m.
        - protect against reqt’s creep

Key disconnects (day 1 - flip chart 9)

1. Incompatible environment for team work
- limited empowerment
- senior management lack of first-hand “teaming” experience (fundamental root cause)

Bandaids	Root cause
Steering committee	High risk programs in risk averse environment
Need independent eyes	External drivers, e.g. program restructure
Micro-manage (inch stones)	Unrealistic expectations given resource cor
More metrics	Training shortage - skill & amount
More people, teams, horsepower (more directors)	Teams may be wrong for work
Fire the coach	Functional separatists “limited authority”

Dynamics across product and team lifecycles (day 2 - flip chart 1)

- Conscious skill targeting, development and deployment
- Continuity of overarching goals
  - alignment/evolution of supporting objectives responsive to program phases
- Fundamentally, you do not have the team in place for the next phase of the program – there are “no static solutions”
- Define team focus & structure as related to product/program lifecycle

Dynamics across product and team lifecycles (day 2 - flip chart 2)

- How do we lean down management and infrastructure to reduce burden on value-added labor?
- Commit to team continuity
  Focus on enable & support vice oversight and management of teams
    Rapid change
    Right decisions
    Accountability
- Don’t dabble as teams change;
  do dabble if they don’t change
- Functional team roles are tool to enable efficient team operation and change

Top level recognition Key implementation elements (day 2 - flip chart 3)

· That you don't have the right team in place for tomorrow – no static solutions

· Team composition/development strategy wired to product lifecycle

- IPPD/IPT valid process --
    - requires change
    - requires change strategy

Recognize there are some things IPTs cannot impact – overhead, capacity utilization, etc.

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Recommended reading:

- Meyer, Christopher, “How the Right Measures Help Teams Excel,” *Harvard Business Review*, Volume 72, Number 3, May/June 1994.

Abstract:

Not only do traditional performance-measurement systems fail to support today's faster and flatter multifunctional teams, they also undermine them. Traditional measures do not help a multifunctional team monitor the activities or capabilities that enable it to perform a given process. The purpose of a performance-measurement system should be to help a team, rather than top managers, gauge its progress. A truly empowered team must play the lead role in designing its own measurement system. The team must create new measures to track its value-delivery process and should adopt only a handful of measures. Senior managers play an important role in helping teams develop performance measures by dictating strategic goals, ensuring that each team understands how it fits into those goals, and training a team to devise its own measures. But managers must never make the mistake of thinking that they know what is best for them. If they do, they will have rendered their empowered teams powerless.