

A SYSTEMS-BASED APPROACH TO THE DESIGN, MANAGEMENT AND INTEGRATION OF ENTERPRISE-LEVEL CHANGE IN DEFENSE SHIPBUILDING

by

Andrew S. Bond

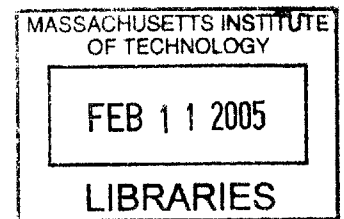
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Abstract

Continually declining Navy surface combatant acquisitions, the war on terror, shifting Congressional priorities and a consolidated shipbuilding industrial base are forcing fundamental changes in the defense shipbuilding market. Shipbuilding in the United States is a mature industry that requires an experienced workforce and a predictable workload to design and construct an extremely complex product. However, naval planning and Congressional appropriations are volatile and discontinuous processes governed by a broad array of exogenous forces. Substantial changes will be required at Bath Iron Works (BIW) to enable the company to more nimbly and flexibly support the U.S. Navy customer as the environment continues to change and new threats emerge.

There is no one, integrated, approach for implementing enterprise-level change from conception through implementation. Large-scale change must be tailored to the requirements of the individual organization and executed in a manner that is acceptable to the prevailing culture, even if the culture itself is an objective of the change. Successfully changing the processes and culture of an enterprise takes time, significant planning, technical and business acumen and must employ elements of organizational behavior and processes, project management, and system design, to name a few. BIW's change effort, known internally as BIW 2011, will be a substantial, complex endeavor requiring a rigorous, systematic approach to design, integration and planning before any implementation begins. This thesis explores the exogenous and endogenous elements affecting BIW and applies the principles of change management and systems-thinking to design an integrated, systematic plan for approaching enterprise-level change.

Thesis Advisor: Janice A. Klein

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Acronyms

BIW – Bath Iron Works Corporation, A General Dynamics Company

BMDA – Bath Marine Draftsmen’s Association, UAW Local 3999

CMM – Capability Maturity Model

DDG or DDG 51 – Arleigh Burke Class of Guided Missile Destroyer

DD(X) – Next Generation Surface Combatant

DoD – Department of Defense

CG or CG 47 – Ticonderoga Class of Guided Missile Cruisers

EDP – Engineering Development Program

EQP – Equivalent People

EVMS – Earned Value Management System

FFG or FFG 7 – Oliver Hazard Perry Class of Guided Missile Frigates

FLS – Front Line Supervisor

GD – General Dynamics

HPWO – High Performance Work Organization

IAM – International Association of Machinists and Aerospace Workers

IGA - Independent Guards’ Association

LAI - Lean Aerospace Initiative.

LCS – Littoral Combat Ship

LLTF – Land Level Transfer Facility

LS6 - Local S6 of the International Association of Machinists and Aerospace Workers

LS7 - Local S7 of the International Association of Machinists and Aerospace Workers

MRP – Materials Requirement Planning

NASSCO - National Steel and Shipbuilding Company, A General Dynamics Company

NC – Numerically Controlled

NGSS – Northrop Grumman Ship Systems

OJT – On the Job Training

OSD – Office of the Secretary of Defense

OSHA – Occupational Safety and Health Administration

PDM – Product Data Manager

QTTP – Quality Through Training Program

RACI – Roles and Responsibilities Chart

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Problem Description and Thesis Motivation

Introduction

Continually declining Navy surface combatant acquisitions, the war on terror, shifting Congressional priorities and a consolidated ownership structure of the shipbuilding industrial base are forcing fundamental changes in defense shipbuilding. Shipbuilding is a mature industry providing an extremely complex product with production durations of several years for each ship. The construction of each ship requires a broad array of industry-specific expertise spanning the gambit from engineers and naval architects to shipfitters and welders. An additional complicating factor is the coordination and management of various change initiatives and continuous improvement programs across the enterprise as well as the extensive exterior supplier network while striving to maintain a predictable workload and associated workforce continuity. In sharp contrast to the required workload stability within the multi-year design and construction process is the volatile and discontinuous nature of Naval force structure planning and the annual Congressional budget cycle, which are governed by a broad array of exogenous forces. These asynchronous cycle dynamics require careful boundary management to minimize the effect of external perturbations on the internal system.

This thesis strives to develop an enterprise-level framework for managing and implementing change that is appropriate to an operating environment characterized by the exogenous and endogenous variables affecting Bath Iron Works (BIW), a builder of surface combatants, ships such as destroyers, cruisers and frigates, for the U.S. Navy. Ambitious, enterprise-level change, such as this, will ultimately require changes in almost all areas and levels of the company as the system is realigned and adapts to the new goals. The complexity of the situation requires a structured systems approach to change that incorporates traditional elements of good change management. This change framework is developed in five chapters, which are briefly described in the following sections.

Industry Overview

The entire defense industry has undergone radical changes both in composition and function in the post-Cold War world and continues to transform as the new requirements for the war on terror, humanitarian missions and joint operations, to name a few, evolve. Defense shipbuilding has followed a similar trend, as the industry has gone from twenty first-tier, major construction shipyards in 1965 to six defense shipyards today.

As the industry has evolved, naval acquisition policies and philosophies have evolved as well. Naval acquisition budgets have declined steadily over the past decade. This has translated into fewer orders for new ships, fewer new design contracts and an insatiable desire by the customer for greater performance and a wider range of capabilities with no increase in cost. This trend shows no sign of reversing itself in the future, and, if anything, it will worsen before leveling off. However, the mission and political imperatives that drive the composition of the fleet and available funding continue to be dynamic and unstable targets from year to year, which induce continuing instability and uncertainty within the industry.

The design and construction cycle of a surface combatant is measured in years, with design ranging between ten and twelve years and construction averaging four years. Said another way, from the time a ship starts concept design until the first ship of the class enters the fleet can be upwards of fifteen years. The quickly changing external environment coupled with the extended internal cycle times requires careful, long-term planning. Making bad programmatic decisions can cost a lot of money, take a long time to change, and, in the worst case, can close businesses. Shipbuilding in the United States is a very traditional, mature industry that must transform itself if it is going to survive these increasingly dynamic external cycles. Success in the future will require organizations that are more flexible and responsive to variations in the environment.

Bath Iron Works Overview

Bath Iron Works, located in Bath, Maine, delivered its first ship to the United States Navy in 1893 and has continued that proud tradition to this day. BIW is currently the lead designer and builder for the DDG 51, Arleigh Burke Class of destroyers, which will be

the largest post-World War II class of U.S. Navy ships when construction completes in 2010. BIW is also an active participant with Northrop Grumman Ship Systems in the design of DD(X), the next generation of surface combatant. BIW is also developing one of two competing designs for the Littoral Combat Ship (LCS), a smaller, faster craft adapted for the changing threat environment.

BIW inaugurated a new world-class construction facility in 2001 after a \$300 million investment, which has revolutionized the ship construction process at BIW. The new facility and associated new processes and methodologies are beginning to pay dividends, but the transition has not been seamless or without its growing pains. BIW's hourly paid production workforce is entirely unionized, as are parts of the design and clerical staffs. BIW labor-management relations have been strained for the last several decades; improving this situation will be critical to ensuring future success. An analysis of the organizational structures and cultural traditions at BIW forms the foundation for approaching enterprise-level change.

Additionally, the elements of the ship construction process and the interrelations of these elements are presented as a process flow to introduce the reader to shipbuilding vernacular and the processes germane to enterprise-level change. This process flow establishes the terminology and elements used throughout the later portions of the document.

Change Overview

Numerous change identification, implementation and management theories exist, all with varying levels of credibility and intellectual rigor. This section will examine the frameworks and theories of some of the field's leading experts and describe those chosen for application at BIW. Choosing culturally compatible change initiatives and tactics are fundamental to successful change. Similarly, developing change agents of varying expertise at all hierarchical levels within the organization is also critical to sustaining and successfully implementing change beyond the initial kick-off. Finally, this section describes a process for temporally-defining the details of change and decomposes change

initiatives into ten areas of equally important focus that will become the structure for the section entitled *Organizing and Implementing Change*.

Building the Case for Change

Rarely has creating real change been successful without building a simple, compelling case for it that establishes a sense of urgency within the organization. This section will build the case for change at BIW by analytically evaluating the external and internal environments affecting the business. The external influences are drawn from the *Industry Overview* section and analyzed for their effect on BIW. The internal influences include facilities and process change requirements, but focus largely on the workforce by assessing core competencies and issues related to cultural and organizational change in a union-dominated environment. The section concludes with an assessment of the organization's readiness for change.

Organizing and Implementing Change

This section decomposes successful change into the following ten elements:

- Common Theme and Shared Vision
- Symbols and Signals
- Guidance, Structure and Process
- Education, Training and Action Tools
- Champions and Sponsors
- Quick Wins and Local Innovations
- Communications and Best Practice Exchange
- Policy, Procedures and System Alignment
- Measures, Milestones and Feedback
- Rewards and Recognition

Within each section the current situation at BIW is discussed as are specific plans for implementation of change. The totality of this section represents a recommended, top-level plan for systematic enterprise-level change at BIW, including organizational structures for implementation. Significant work at the lower-levels of detail, which are beyond the scope of this document, is still required for successful implementation.

Industry Overview

The U.S. defense industry, the principal market sector for General Dynamics (GD), BIW's parent company, has changed dramatically over the past twenty years as has BIW's primary customer, the U.S. Navy. Therefore, before addressing a specific change strategy for Bath Iron Works, one must understand the industry in which BIW operates and its primary customer as well as how the variables exogenous to BIW influence how BIW conducts business internally. This section will describe the evolution of the defense industry over the past twenty years, the effects of industry consolidation on the operation of BIW, the main competitors within the shipbuilding industry, the defense shipbuilding industry's business model and the major programs of interest to BIW.

Defense Industry

Consolidation

Through a series of mergers and acquisitions, divestitures and closures, the landscape of the American defense industry has changed dramatically over the past twenty years. These complex, overlapping changes, which began before the end of the Cold War, have led to an industry with five major competitors as seen in Figure 1. Driven by the need to cut costs to maintain market share combined with shrinking defense acquisitions, industry consolidation has not simply merged the myriad small defense contractors into five large ones; it has resulted in the closure of numerous factories and the loss of tens of thousands of industrial and manufacturing jobs. Specifically, within the U.S. defense shipbuilding industry an estimated 20,000 jobs have been eliminated since 1993 as the industry has contracted.¹ This loss of jobs has resulted in a degradation of critical, defense-related skills and has left the industry, in all sectors, with a workforce that, for the most part, will be eligible to retire within the next several years.

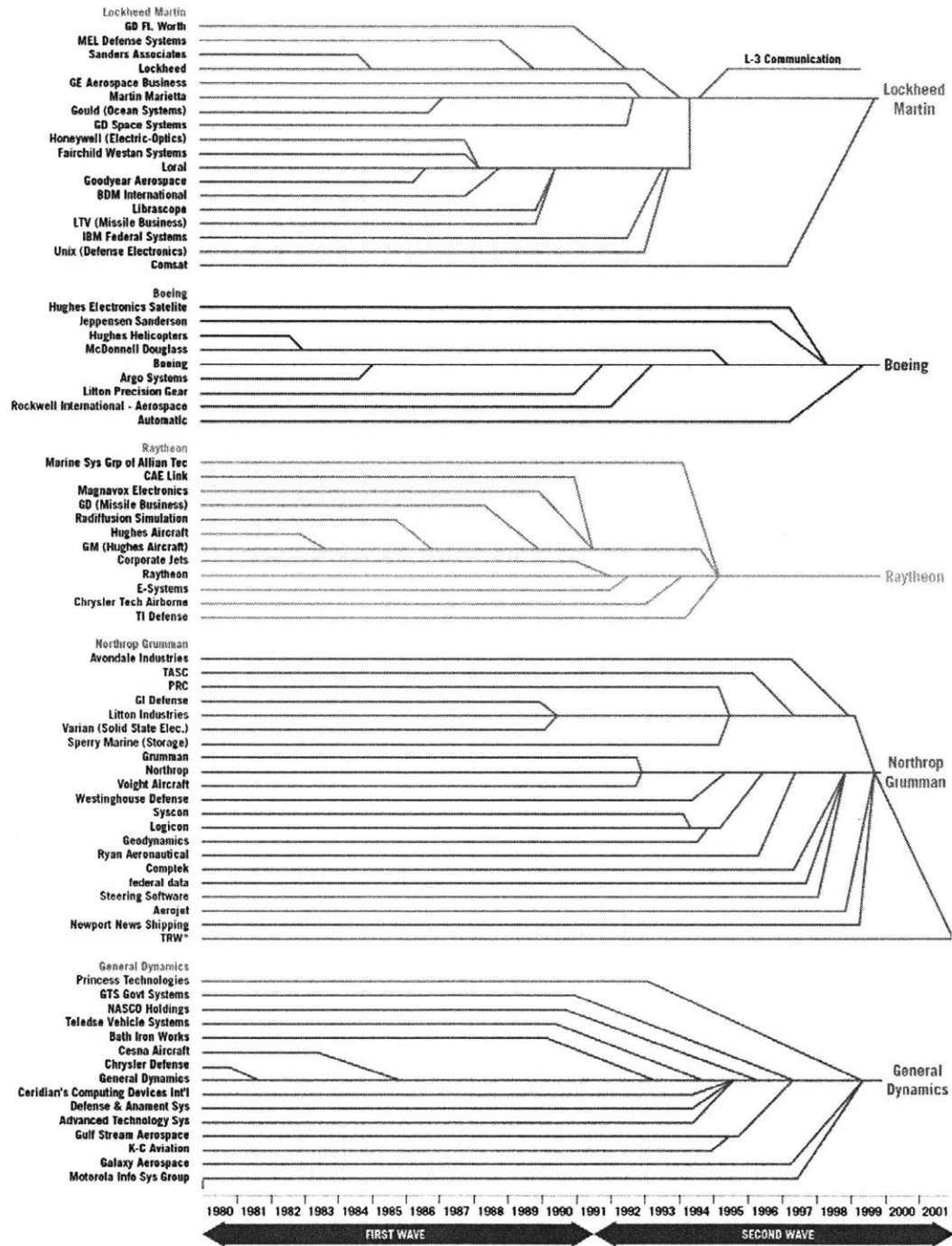


Figure 1: 20 Years of Defense Industry Consolidation²

Defense Shipbuilding

Historical Context

Shipbuilding in the United States has changed radically over the last three decades. In 1965, the United States had twenty first-tier, major construction shipyards building both commercial and military ships; however, today that number has been reduced to six major shipyards owned by two corporations, General Dynamics and Northrop Grumman, focusing almost exclusively on military construction. (See Figure 2.) The market forces and economic factors driving the consolidation within the shipbuilding industry do not lie solely with shrinking defense budgets but can also be attributed to intensifying international competition, foreign subsidies and the elimination of domestic subsidies. History shows that once a shipyard closes it never reopens successfully and those unique skills are lost. *Appendix A – Defense Shipbuilders: 1965 - 2004* contains additional industry consolidation data.





	1965	1975	1985	2004
Total First-Tier Shipyards	20	11	10	6
Aircraft Carriers 	1	1	1	1
Submarines 	7	3	2	2
Surface Combatants 	11	6	4	2
Amphibious Warfare, Auxiliaries & Commercial 	11	6	5	3

Figure 2: First-Tier Shipyard Trends

“Big Six” Overview

Today, the major construction shipyards in the United States are collectively known as the “Big Six”, and, as stated previously, General Dynamics and Northrop Grumman each own half of them. Figure 3 shows the geographic distribution of the six major shipyards

and the following sections provide an overview of each shipyard to better define the competitive landscape in which Bath Iron Works operates.

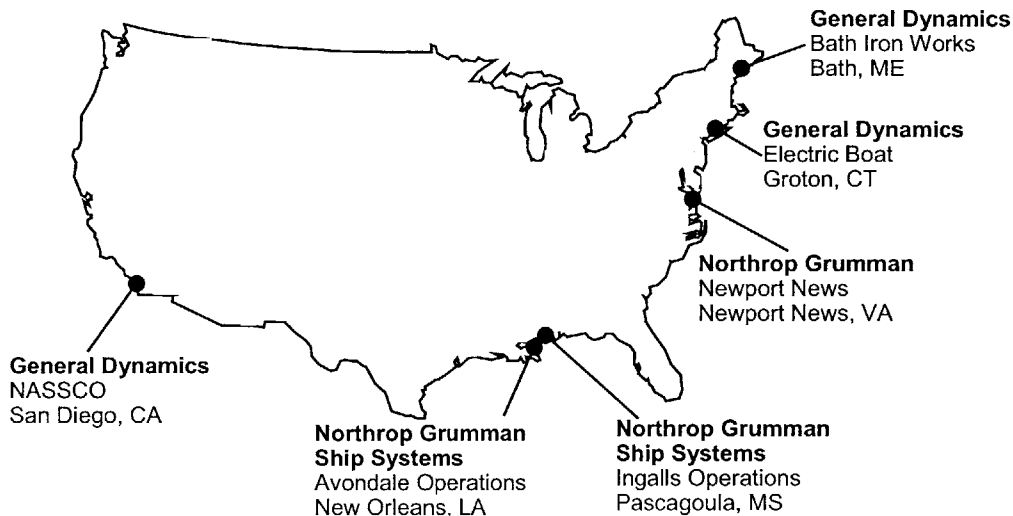


Figure 3: The “Big Six” Shipyards

General Dynamics Marine Systems

General Dynamics Marine Systems is comprised of Bath Iron Works, Electric Boat and the National Steel and Shipbuilding Company (NASSCO). NASSCO was the last member to join GD Marine Systems with its acquisition in 1998. Since that time, the three shipyards have increasingly cooperated in design and engineering efforts, but operate as largely autonomous business units. To date, there has been no sharing of manufacturing work among the three shipyards. GD Marine Systems 2003 sales were \$4.3 billion.³

Bath Iron Works

Bath Iron Works, located on the Kennebec River in Bath, Maine, has been in operation as an entity since 1826. BIW delivered its first ship in 1890 making it the oldest of the major private U.S. shipbuilders. General Dynamics purchased BIW in September 1995. BIW specializes in the design and construction of surface combatants for the U.S. Navy and currently produces DDG 51 Class destroyers. BIW is also a participant in the design of DD(X), the next generation of surface combatant, with Northrop Grumman. More detailed information about BIW is found in the *Bath Iron Works Overview* section.

Electric Boat

Electric Boat is the premier provider of submarines to the U.S. Navy, and is located three miles downriver from the U.S. Navy submarine base in New London, Connecticut, homeport of sixteen of the twenty-seven submarines in the Atlantic Fleet. Electric Boat operates two major facilities, located in Groton, Connecticut, and Quonset Point, Rhode Island. Quonset Point is a fabrication and unit assembly facility while unit joining, outfitting and testing are performed in Groton. Electric Boat is currently constructing the USS Jimmy Carter, a Seawolf Class submarine, and the new Virginia class of attack submarines in conjunction with Northrop Grumman Newport News. Electric Boat does not build surface combatants and is not a direct competitor to BIW.

National Steel and Shipbuilding Company (NASSCO)

NASSCO occupies 140 acres just south of downtown San Diego, California, and is in close proximity the homeport of the majority of the Pacific Fleet. NASSCO primarily constructs large naval auxiliaries, specialized cargo ships and large commercial ships, primarily tankers, and performs U.S. Navy and commercial overhaul and repair work. NASSCO does not build surface combatants and is not a direct competitor to BIW.

Northrop Grumman Ship Systems

Northrop Grumman Ship Systems (NGSS) had 2003 sales of \$2.9 billion and employs over 17,500 people at two major shipyards located in Mississippi and Louisiana. Their principal customers are the United States Navy and Coast Guard.⁴ Northrop Grumman's third shipyard, Newport News, operates as its own entity and is not part of Ship Systems.

NGSS, Ingalls Operations (Ingalls)

Ingalls is located at the mouth of the Pascagoula River in Pascagoula, Mississippi, occupying approximately 800 acres. Ingalls builds ships on a land level facility, similar to the process employed by BIW, has one floating dry dock and is in the midst of a major facility upgrade. Currently, Ingalls is building DDG 51 Arleigh Burke Class destroyers, LHD 1 Tarawa Class large-deck amphibious assault ships, LPD 17 San Antonio Class amphibious assault ships, and national security cutters for the U.S. Coast Guard. Ingalls is BIW's primary competition and is the only other producer of surface combatants for

the U.S. Navy. Ingalls is also the prime contractor for the design and construction of DD(X), the next generation of destroyer, which will begin construction toward the end of this decade.

NGSS, Avondale Operations (Avondale)

Avondale is located on the Mississippi River about twelve miles North of New Orleans, Louisiana. Avondale occupies approximately 265 acres, has recently completed a major facility upgrade and is in the midst of another major upgrade. Avondale also builds on a land level facility and has a floating dry dock. Avondale is the primary building yard for the LPD 17 Class of amphibious assault ships and is completing construction on the Conoco Philips' Polar Class tankers. Ingalls and Avondale are separated by approximately one hundred miles by land and have the ability to share work and personnel between the two facilities.

Northrop Grumman Newport News

Northrop Grumman Newport News is located on the James River in the Hampton Roads / Tidewater area of Virginia. Newport News is only five miles from Norfolk Naval Station, the major East Coast homeport of Atlantic Fleet. Newport News occupies 550 acres along two miles of riverfront and has more capacity than any other shipyard in the nation. Newport News reported 2003 sales of \$2.5 billion and is the only shipyard in the United States that builds aircraft carriers, as well as sharing construction of submarines with Electric Boat.⁵ Newport News also performs repair and overhaul work of various U.S. Navy and commercial ships. Northrop Grumman Newport News is not a direct competitor to Bath Iron Works in surface combatant design and construction.

Naval Acquisition

Fleet Trends

The U.S. Navy fleet currently numbers 289 ships*, which is the smallest fleet since the United States' 1917 entry into World War I. Additionally, for the past twelve years the Navy has ordered only six ships per year, on average, which is the lowest procurement rate since 1932.⁶ Figure 4 shows the U.S. Navy fleet size over time and the corresponding effect of the fleet size reductions on the shipbuilding industrial base as presented in the *Defense Shipbuilding* section. Current budget projections do not indicate that these adverse trends are likely change in the near future.

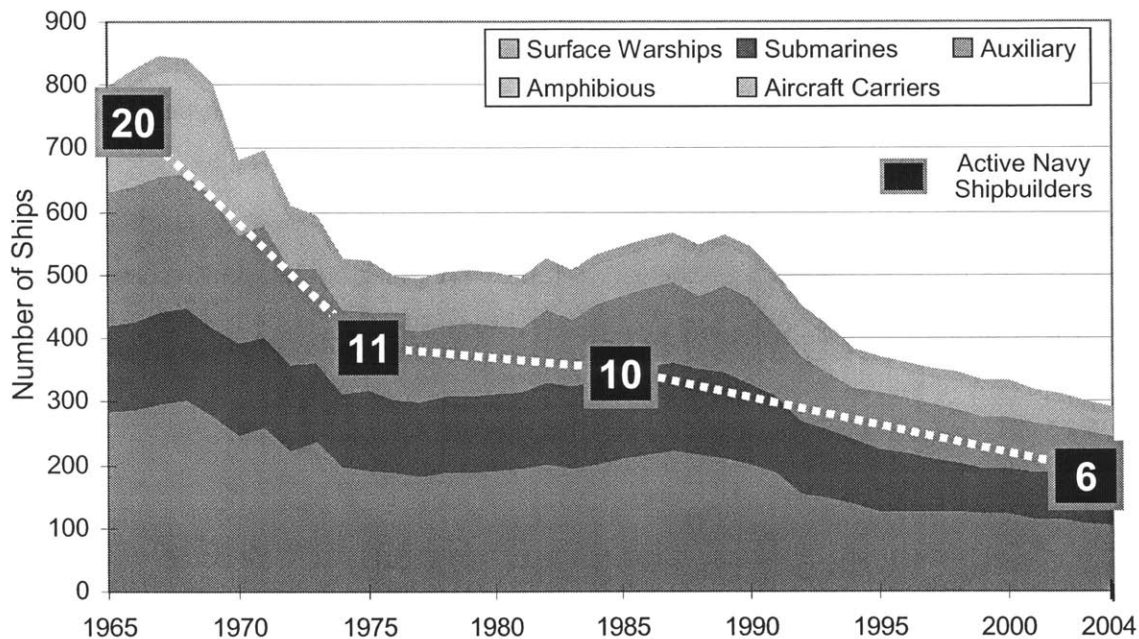


Figure 4: U.S. Navy Fleet Size and Industrial Base Consolidation (1965-2004)⁷

Navy Surface Combatant Programs

This section will provide basic descriptions of the DDG 51, DD(X) and LCS Programs, the Navy's currently active three surface combatant programs. BIW's involvement in

* Actual fleet size statistics vary by source due to differences in counting method, date of count, etc., but the exact number is not as important as the magnitude of ships or the overall fleet trends.

each of these programs and the Program's specific impact on BIW are discussed in the *Major Programs* portion of the *Bath Iron Works Overview* section.

DDG 51 Arleigh Burke Class, Guided-Missile Destroyers⁸

Named for the Navy's most famous destroyer squadron combat commander and three-time Chief of Naval Operations, the USS Arleigh Burke was commissioned July 4, 1991. The DDG 51 multi-mission guided missile destroyer operates in support of carrier battle groups, surface action groups, amphibious groups and replenishment groups, providing a complete array of anti-submarine (ASW), anti-air (AAW) and anti-surface (SuW) capabilities. The ship's combat capabilities center around the Aegis combat system, the SPY-1D, multi-function, phased-array radar and the Mk-41 Vertical Launch System, which has expanded the role of the destroyer in strike warfare. Designed for combat survivability, the ship incorporates all-steel construction, multiple system redundancies and, like most modern U.S. surface combatants, DDG 51 utilizes gas turbine propulsion. The combination of the Aegis combat system, the Vertical Launch System, an advanced anti-submarine warfare system, two embarked SH-60 LAMPS III helicopters, advanced anti-aircraft missiles and Tomahawk ASM/LAM (anti-ship and land-attack missiles), the Burke Class is the most powerful surface combatant ever put to sea. The Burke Class will be the U.S. Navy's largest class of ships since World War II when the 62nd ship is delivered by BIW in late 2010. (See Figure 5 and Figure 6.)

Principal Ship Characteristics - Flight IIA[†]:

- Length Over All: 510 feet (156 meters)
- Beam-Waterline: 59 feet (18 meters)
- Displacement-Full Load: 9,217 tons (9,365 metric tons)
- Power Plant: Four General Electric LM 2500-30 gas turbines; two shafts; two CPPs (Controllable Pitch Propellers); 100,000 total shaft horsepower.
- Speed: in excess of 30 knots
- Crew: 380 Total (32 Officers; 27 Chief Petty Officers; 321 crew)
- SPY-1D Phased Array Radar and Aegis Combat System (Lockheed Martin)
- Aircraft: Two embarked SH-60 LAMPS III helicopters (ASW operations)

[†] The first ships of the class were Flight I, but the ship has undergone two subsequent major upgrades. The current ships under construction are all Flight IIA ships.

- Armament: Two Mk 41 Vertical Launcher System (VLS) launchers with Standard, Vertical Launch ASROC & Tomahawk ASM/LAM missiles; 5"/54 Mk-45 gun; two CIWS; six Mk-46 torpedoes

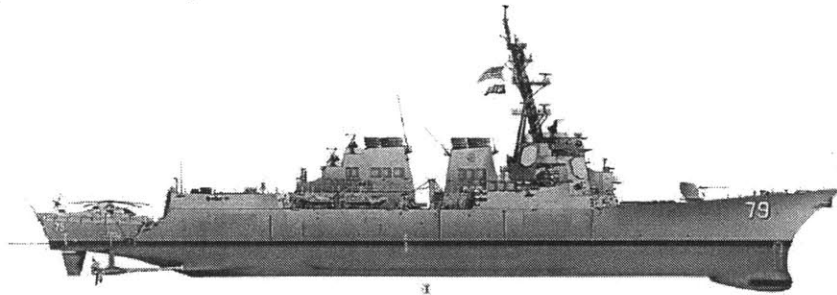


Figure 5: First Flight IIA Ship: USS OSCAR AUSTIN DDG 79



Figure 6: BIW's Most Recently Delivered Ship: NITZE DDG 94

DD(X) Future Surface Combatant⁹

The DD(X), illustrated in Figure 7, is intended to be the first new class of warships in the U.S. Navy's revolutionary vision for 21st Century surface combatant design. A changing global political landscape, coupled with budget and manpower realities, demands revolutionary changes in Naval Surface Combatants; the DD(X) will take these concepts from vision to reality over the next decade. The ship will be designed as a multi-mission destroyer to provide independent forward presence and deterrence or will be able to operate as an integral part of a Joint or Multi-national naval task force. Primary mission emphasis on Land Attack, Maritime Dominance and Joint Interoperability will enable DD(X) to control the littoral (near-shore) battlespace and deliver more ordnance on target over a broader range of military objectives than any surface combatant ever put to sea.

Key program features include:

- Achieving maritime dominance goals with a focus on littoral capability
- Extending DD(X) technology/systems developments to other ships of U.S. Navy Fleet
- Enabling capable and affordable future U.S. Navy force levels
- Driving fundamental U.S. Navy doctrine changes

The DD(X) design introduces a wide range of new technologies that will generate tangible breakthroughs in performance and affordability. Advances such as electric drive/integrated power systems, ship control and damage control automation, a totally integrated, ship-wide command and control system, and low-observable topside designs are potentially applicable to other shipbuilding programs.

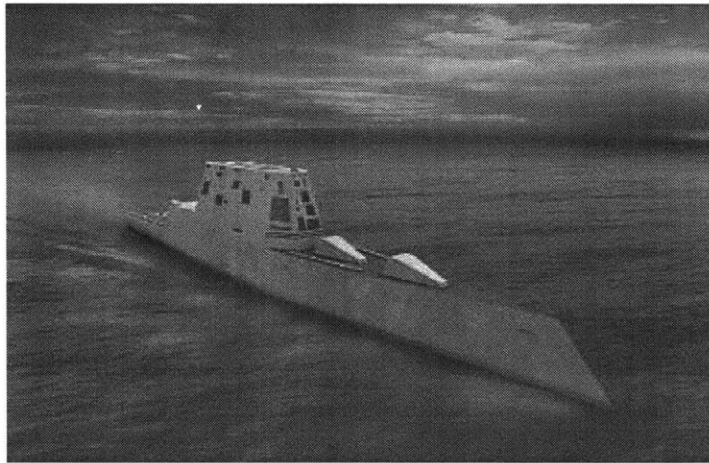


Figure 7: Conceptual View of the DD(X) Future Surface Combatant

Littoral Combat Ship (LCS)¹⁰

The Littoral Combat Ship is a key element of the Navy's plan to address asymmetric threats. Intended to operate in coastal areas of the globe, the ship will be fast, highly maneuverable and geared to supporting mine detection/elimination, anti-submarine warfare and surface warfare, particularly against small surface craft.

In May 2004, the Navy awarded contracts to General Dynamics and Lockheed Martin to continue development and complete detail design of their ship concepts. These contracts also contain provisions for construction of prototypes of each of these new high-speed surface ships. The Navy ultimately contemplates a fleet of 30 to 60 LCS.

The General Dynamics approach features an innovative trimaran hull (three-hulled ship) that enables the ship to reach sustainable speeds of nearly 50 knots and ranges as far as 10,000 nautical miles with unmatched interior volume and payload. The ship is designed to allow a crew of fewer than 40 sailors to fully operate, maintain and defend it. (See Figure 8.)

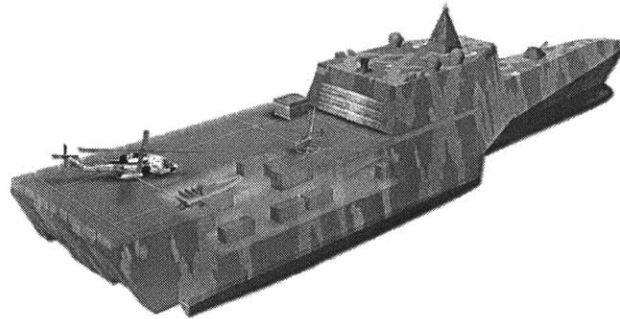


Figure 8: Conceptual View of the GD LCS

Business Model

Naval acquisition does not follow a typical market-driven commercial business model. Design and construction of naval ships is an expensive, lengthy, low-volume business with few competitors vying for a prime contract position for an ever-decreasing number of new programs. The U.S. Navy customer has far more direct input and control at all stages of design and construction than in a standard commercial enterprise. Additionally, not only is naval acquisition directly driven by world political and security conditions but is also an inherently political process since the Navy falls within the Executive Branch yet is funded by the Legislative Branch. Figure 9 illustrates the surface combatant business model in which BIW operates. The business model for other types of ships is similar, but the involved shipbuilders and situational dynamics are different.

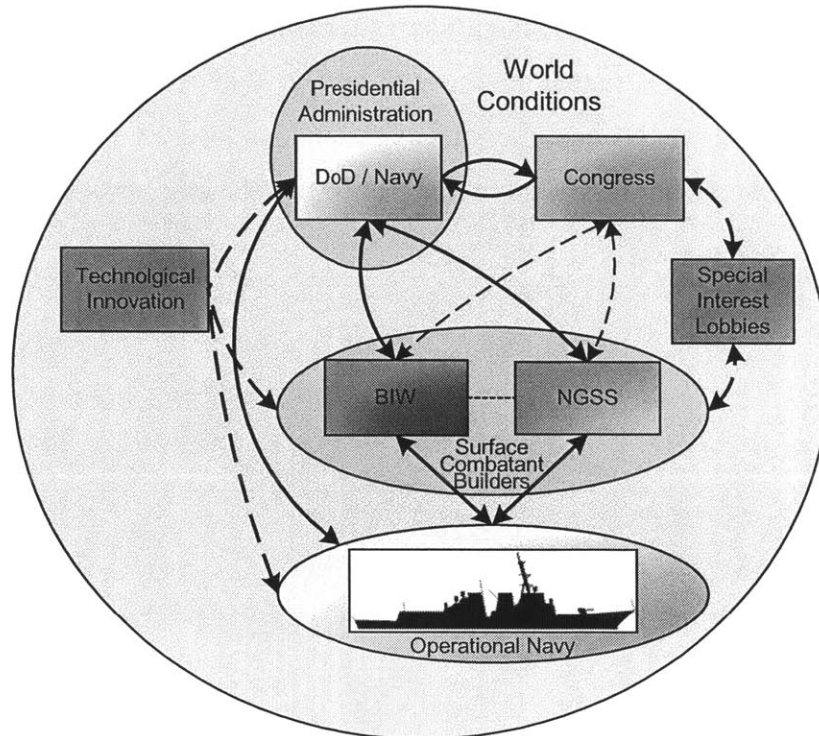


Figure 9: Surface Combatant Business Model

World geopolitical conditions fundamentally drive U.S. Naval acquisition planning. The Department of Defense (DoD) and the Navy develop operational strategies and procurement requirements to address both national defense policies and threats while being constrained to operate within the President’s agenda and Congress’ budgetary authority. The President submits the Navy’s budget as part of the entire Government’s budget for consideration and authorization by the Congress. Additionally, Congress provides operational oversight of the armed services. Assuming Congressional authorization, the acquisition branch of the Navy contracts the design and construction of ships with private industry. Industry constructs the ships and delivers them to the Operational Navy, which is a different customer than the acquisition arm of the Navy. The Operational Navy must also provide for lifecycle service and support once the ships have been delivered to the fleet. The dotted lines in Figure 9 indicate the informal, yet important, relationships among the major participants. Technological innovation enters the system at several points, both supporting design and construction processes and exerting significant influence on the equipment aboard the ships. Given the extended military ship design and construction cycle, technological innovation is often responsible

for driving significant amounts of change once the ship has entered the construction cycle, which can become a major source of disruption.

Special interest lobbies are also shown on the business model because they are often able to exert significant influence over the behavior of Congress and industry. For example, national labor unions are special interest constituencies concerned with the impact of defense appropriations on their members and they wield substantial lobbying budgets in an effort to influence decisions on Capital Hill that are favorable to their membership. Similarly, on a local level, labor unions are able to influence how a company is structured and interacts with its workforce. Since, Maine is not a Right-to-Work state, all of BIW's blue collar employees must join a union as a condition of employment, and consequently, relations with the union strongly influence the way BIW conducts business.[‡]

In the wake of industry-wide consolidation and sharply reduced U.S. Navy procurement budgets, surface combatants are the only U.S. Navy ships that are currently procured through a modified system of competition. Although not depicted in Figure 9, this fact significantly affects industry dynamics. All other ship types, including aircraft carriers, amphibious assault ships and submarines, are sole source contracts. Shrinking naval procurement and the diminishing number of shipyards has forced this shift in acquisition and incentive structure. However, BIW is the only one of the major shipyards without a sole source program, which causes BIW's cost structure and business model to be different than its competitors.

Finally, it is essential to understand the relative rates of the appropriations, design and construction cycles in order to assess the overall naval acquisition cycle. The appropriations and authorization process occurs annually and even seemingly stable programs are subject to the admixture of changing world conditions, political influence, Navy priorities, naval personnel rotations, presidential administrations and Congressional elections. Conversely, the design and construction cycle of a surface combatant is measured in years, with design ranging between ten and twelve years and lead ship

[‡] BIW's organizational structure and unions are further described in the *Bath Iron Works Overview* section.

construction averaging four years. Said another way, from the time a ship starts concept design until the first ship of the class enters the fleet can be upwards of fifteen years. The quickly changing external geopolitical environment coupled with the extended internal cycle times requires careful long-term planning. Making bad programmatic decisions can have severe consequences for both Government and industry including increased costs and overruns, extended and delayed schedules, and, in the worst case, closed businesses or canceled programs.

When contemplating internal changes to BIW it is important to first understand BIW's external environment and associated influences. The defense industry and the U.S. Navy customer are complex systems that are undergoing fundamental changes that will significantly impact BIW's future. The totality of the defense industry historical context, the competitive landscape within the "Big Six" shipyards, U.S. Navy fleet trends, current Navy surface combatant programs and the surface combatant business model provides the external environment in which BIW operates.

Bath Iron Works Overview

*Historical Overview*¹¹

The Bath Iron Works shipyard, located on the Kennebec River in Bath, Maine, is the namesake of a foundry established in 1826. Brevet General Thomas W. Hyde, U.S. Army (Ret) took over the foundry operation in 1865, following service with the 20th Maine Regiment during the Civil War. Nearly two decades later, he incorporated his diversified marine business interests as Bath Iron Works, Limited in 1884, before expanding into shipbuilding with the acquisition of the Goss Marine Iron Works in 1888. The first vessel delivered by BIW was a coastal passenger ship named *Cottage City* built for the Maine Steamship Co. Since the completion of Hull #1 in 1890, BIW has been awarded more than 425 shipbuilding contracts, including 245 military ships (mostly destroyers and frigates for the U.S. Navy) and over 160 private yachts and commercial vessels.

In terms of modern U.S. Navy surface combatant construction programs, the Lead Ship construction contract for the FFG 7 Oliver Hazard Perry Class of guided missile frigates was awarded to BIW in 1973 and 24 of these surface combatants were delivered over the next 15 years. In 1982, the Navy selected BIW as second-source shipbuilder for the CG 47 Ticonderoga Class of AEGIS guided missile cruisers. The company went on to win contracts for eight of these warships, delivering the last one in 1993. In 1985 BIW won the competition for detail design and construction of DDG 51. USS Arleigh Burke, the Lead Ship for the Navy's newest, most capable class of AEGIS guided missile destroyers. BIW has delivered the Lead Ship and 22 Follow Ships. Eleven additional DDGs are under contract, with delivery of the last BIW-built DDG 51 scheduled for the fourth quarter of 2010. BIW is also actively involved in the design of the DD(X) and LCS classes of ships. The BIW list of merchant ships includes containerships, oil-products carriers, roll-on/roll-off ships, private yachts and fishing vessels; however, the shipyard has not had a commercial ship in its backlog since 1984. (See Figure 10.) BIW became a wholly-owned subsidiary of General Dynamics in September 1995.

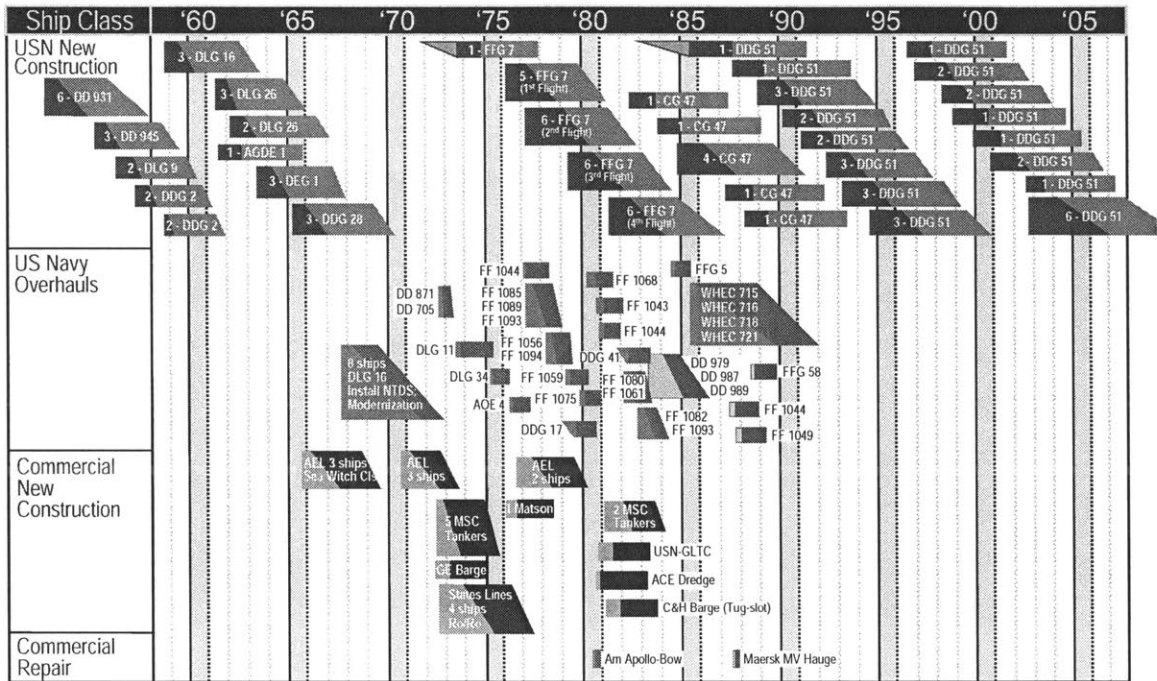


Figure 10: BIW Shipbuilding and Repair Programs 1955-2010

Major Programs

This section will describe BIW’s participation in three ongoing surface combatant development and construction programs introduced in the *Navy Surface Combatant Programs* portion of the *Naval Acquisition* section. These programs currently are, and will be, the Navy’s premier surface combatant construction programs over the next decade and BIW’s best prospects for future U.S. Navy work.

DDG 51

BIW is the lead designer and builder for the DDG 51, Arleigh Burke Class of destroyers, which have been BIW’s mainstay construction work since 1987. To date, BIW has delivered 24 of these ships to the U.S. Navy and will build a total of 34 of the 62 ship class by the time construction completes in late 2010. BIW not only builds the DDG 51 Class ships, but is also the class design agent and provides support for the ships currently operating in the U.S. Navy fleet. Essentially, BIW provides “cradle to grave” support to the Navy for the Arleigh Burke Class of destroyers. Much of BIW’s current manufacturing workforce has only worked on this class of ship given its extended class

size, and many of BIW's facilities and processes have been customized for its construction.

DD(X)

BIW is the follow shipbuilder on the NGSS-lead DD(X) design development and ship construction team. As such, BIW is actively involved with engineering and design of the lead ship and will build portions of the first ship for NGSS, which is anticipated to begin construction in late 2007. Additionally, BIW will build the second ship of the class in Bath, which should start fabrication in mid-2009 according to the current program schedule. There are typically several years of overlap as one class of ships completes construction and another begins since these periods of transition are typically rocky as initial design and construction issues are resolved. However, not only is there no overlap between the DDG 51 and DD(X) programs, but there is a multi-year gap even if the program remains on schedule. Unless the gap is eliminated it will lead to dramatic swings in BIW's anticipated workload during the period of transition. The DD(X) construction program is critical to BIW's long-term success, and any delay in the construction of BIW's first ship will have serious implications on BIW's future.

LCS

BIW is leading one of two industry teams developing two different designs for the LCS. In partnership with Austal, an Australian fast-ferry builder, a trimaran (three-hulled ship) concept is being developed by the BIW-led team with prototype construction to start in late 2005. Given Austal's expertise in aluminum construction, the first several ships of the class will be built at Austal USA's facility in Mobile, Alabama. Consequently, LCS is not a near-term construction opportunity for BIW and is largely a design development and program management program.

Facility and Process Description

BIW is principally located on 73 acres in the town of Bath, Maine, and is supported by offsite fabrication and warehousing facilities. The ship production process can be segregated into four major construction stages: fabrication, pre-outfit, land level transfer facility (LLTF) and ships completion. Figure 11 shows the physical arrangement of the

Structure and Outfit

Ships are fundamentally comprised of structure and outfit, which need to be defined to understand the stages of construction and the production workflow. Structure forms the ship's skeleton. As the structural elements progress through the various stages of construction, they grow into larger and larger assemblies such as, plates and shapes, foundations, panels and sub-assemblies, units, super units, and ultimately the ship. (See Figure 13.) Outfit is essentially everything that isn't structure, including the combat system, propulsion equipment, and the thousands of other operating components and distributive support systems (e.g., electricity, fuel, air and water). (See Figure 14.) Outfitting is performed concurrently with structural work at all stages of construction according to the type of outfit, logical installation point and its durability (e.g., Can it withstand the blast and paint process? Is it likely to be damaged by the installation of surrounding equipment?).

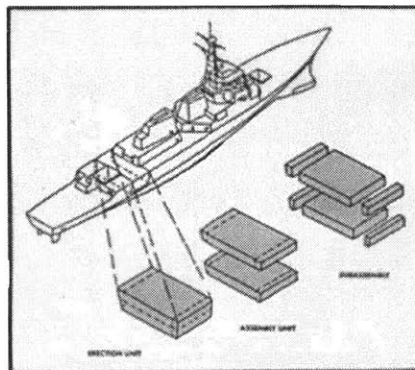


Figure 13: Structural Sub-Assemblies, Units and Super Unit Illustration

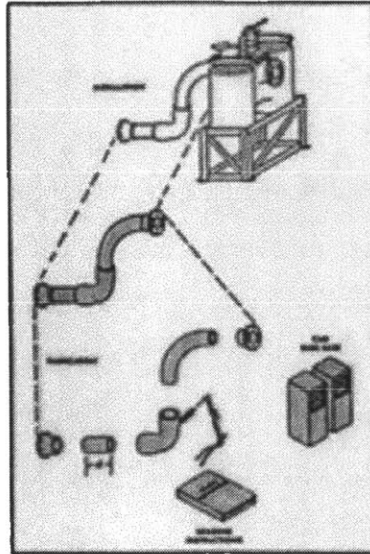


Figure 14: Outfit Piping Illustration

Stage 1: Fabrication

Virtually all raw materials used in ship construction begin the process in the fabrication area. BIW's fabrication facilities are located approximately three miles from the shipyard and are segregated into a structural steel fabrication facility (the Hardings Plant), a pipe/vent/hull-outfit fabrication facility (the East Brunswick Manufacturing Facility) and a Consolidated Warehouse. At the Hardings Plant, steel plates and shapes are cut by NC (numerically controlled) machines and begin to form the ship's structure. The structural assemblies are limited in size and weight to what can be transported over public roads to the main shipyard. Most structural fabrication supports the next stage of construction, Pre-Outfit.

Surface combatants are very complex ships with a tremendous amount of outfitting throughout the construction process. Outfitting encompasses all the equipment and support systems required aboard the ship. Outfit fabrication, such as pipe, vent, electrical and sheet metal, is performed across the street from the Hardings Plant at the East Brunswick Manufacturing Facility. After the raw materials have been fabricated into subsystem components, they are packaged to create an installation kit with associated purchased materials, such as pumps, valves and machinery, and stored in the adjacent warehouse for installation at the appropriate stage of construction in the shipyard.

Stage 2: Pre-Outfit

The ship starts to take shape during the Pre-Outfit I stage as successively larger units, or blocks of ship, are constructed using the structural elements fabricated at the Hardings Plant. The size of the units is governed by the physical limits of the facility, such as door openings and maximum allowable crane lift; capacity limits are further described in the *Facilities* section within *Building the Case for Change*. In principle, the larger the unit, the more efficient the construction process since, it is far easier (and therefore cheaper) to build ships in large, open, accessible sections within climate-controlled facilities than out in the elements once the ships has been erected on the LLTF and access to the interior spaces is more limited which confines and congests the workforce. Also, any outfit items that can withstand the blast and paint process, mainly piping and structural foundations, are installed during this stage of construction.

After completing the Pre-Outfit I process, the unit is blasted and painted before entering the Pre-Outfit II stage. Many of the ship's outfit items are installed in the Pre-Outfit II stage, including lighting, rotating equipment, engines, reduction gears, furniture, etc. Here again, it is far more efficient to install as much equipment as possible while in a climate-controlled environment where access for personnel and support services is relatively easy.

Stage 3: Land Level Transfer Facility (Unit Erection)

Prior to making the decision to invest over three hundred million dollars in a new, world-class land level transfer facility (LLTF) in 1998, BIW had been building ships on traditional inclined building ways for over one hundred years. Dedicated in 2001, the LLTF fundamentally changed the ship construction process at BIW enabling the company to effectively compete with other world-class shipyards. The LLTF is not subject to the size and weight constraints that had been present on the inclined building ways allowing launch completion levels to driven to greater than eighty percent. After completing Pre-Outfit II, the units are transported to the LLTF for unit erection, the process that will join the twenty-five separate units to create the final three-dimensional form of a DDG. Some of these units approach 600 tons in weight and many require a two-crane lift to move them into place.

As portions of the ship become structurally complete, outfitting activity continues with the final installation of more than 48 miles of pipe and 254 miles of cabling. The combat system is installed and tested on the LLTF and the ship's gas turbine-driven electrical generators are started for the first time. Unlike launching a ship on the inclined ways, the launch date on the LLTF is driven by facility scheduling requirements and not the maximum allowable launch weight.

Once the ship is ready to launch, the roughly 6,000-ton behemoth is literally picked-up using a series of computer-integrated electro-hydraulic trolleys and driven onto the floating dry dock positioned at the end of the LLTF building way. Over the next several weeks, the ship then receives its distinctive Navy gray topside paintjob and underwater hull coatings. Finally, the dry dock is re-floated and translated into the middle of the river using a massive chain-drive system and the internal tanks are flooded causing the dock to submerge, allowing the ship to float on its own for the first time. The ship is then towed to an outfitting pier for completion.

Stage 4: Ships Completion (Post-Launch)

At this point in construction, the ship is structurally complete with most distributive and weapons systems fully installed and partially tested. From the outside the ship is largely complete, however, the interior appears to be in disarray, which belies the fact that there is a relatively modest amount of construction work left to complete compared to the work already done. Most finishing work is left until this final stage so that it is not damaged by the construction process; the ship's most delicate and easily damaged equipment and furniture are installed and the interior spaces get their final coats of paint. Simultaneously, the myriad mechanical, electrical and combat systems are completing the final stages of rigorous test and certification processes. The final phase in the construction process is to take the ship to sea for the first time on trials.

Over a several day period during sea trials, every system on board the ship is operationally tested including: speed trials, general system tests, radar tracking, helicopter operations and gun and missile firings. Once the customer determines that the ship has met the specified performance, the Navy will officially take delivery of the ship.

The ship will remain at BIW for several more weeks as the crew moves aboard and last-minute jobs are finished. Finally, the completed ship will sail down the river for the last time as it heads for its homeport to be commissioned before joining the U.S. Navy fleet.

Process Flow

Description

The process of designing and constructing a ship is a complex, multi-layered and often non-linear system. The preceding sections have described BIW's programs, facilities and processes. Each of these elements is important and each presents a different view of the organization, but none presents an integrated view. This section will develop a more comprehensive view of the shipyard and shipbuilding as a complex system designed to produce a technologically sophisticated and highly complex product – a surface combatant. Additionally, the process flow introduces an analytically rigorous approach to understanding the dynamics of a highly-complex system that had traditionally been treated in a largely qualitative and non-analytic manner due to its complication and complexity. This common framework establishes terminology that will be repeated throughout this document as its many aspects are examined. Although tailored for the construction of a ship, most elements of the process flow are solution neutral and could be easily adapted to other design or manufacturing situations.

To gain insight and ensure a balanced and accurate representation, the author created the rudimentary process flow and then consulted stakeholders from all major areas of the shipyard including: Manufacturing, Planning, Engineering, Strategic Planning and Communications, Finance and Business Development. The interviews were conducted individually at various levels within each organization and included individual contributors, managers, directors and vice presidents. It quickly became clear that while the stakeholders understood and generally agreed with the overall structure of the diagram, there was significant disagreement and ambiguity regarding the details of the process flow due to the position and personal biases of each interviewee. These interviews enforced the importance of clear definition of the terms and the process flow's intended use. Consequently, a companion dictionary was created to eliminate ambiguity

and assure consistency of interpretation, which can be found in *Appendix B – Shipbuilding Process Flow Dictionary* if a deeper understanding is desired.

Process Flow Diagram

Figure 15 shows the most basic elements and functions of the shipbuilding process. Some of these elements map cleanly to BIW's organizational structure while other functions are shared among several divisions. The process representation focuses on physical construction of the product and the first-tier interactions. Secondary and supporting processes have been omitted for clarity. For example, the engineering and design work products are assumed as inputs to planning, which drive construction, but there are additional flows contained within engineering and design to produce those products. The solid lines in the diagram represent physical or material interactions between elements while dotted lines represent informational or process flows between elements.

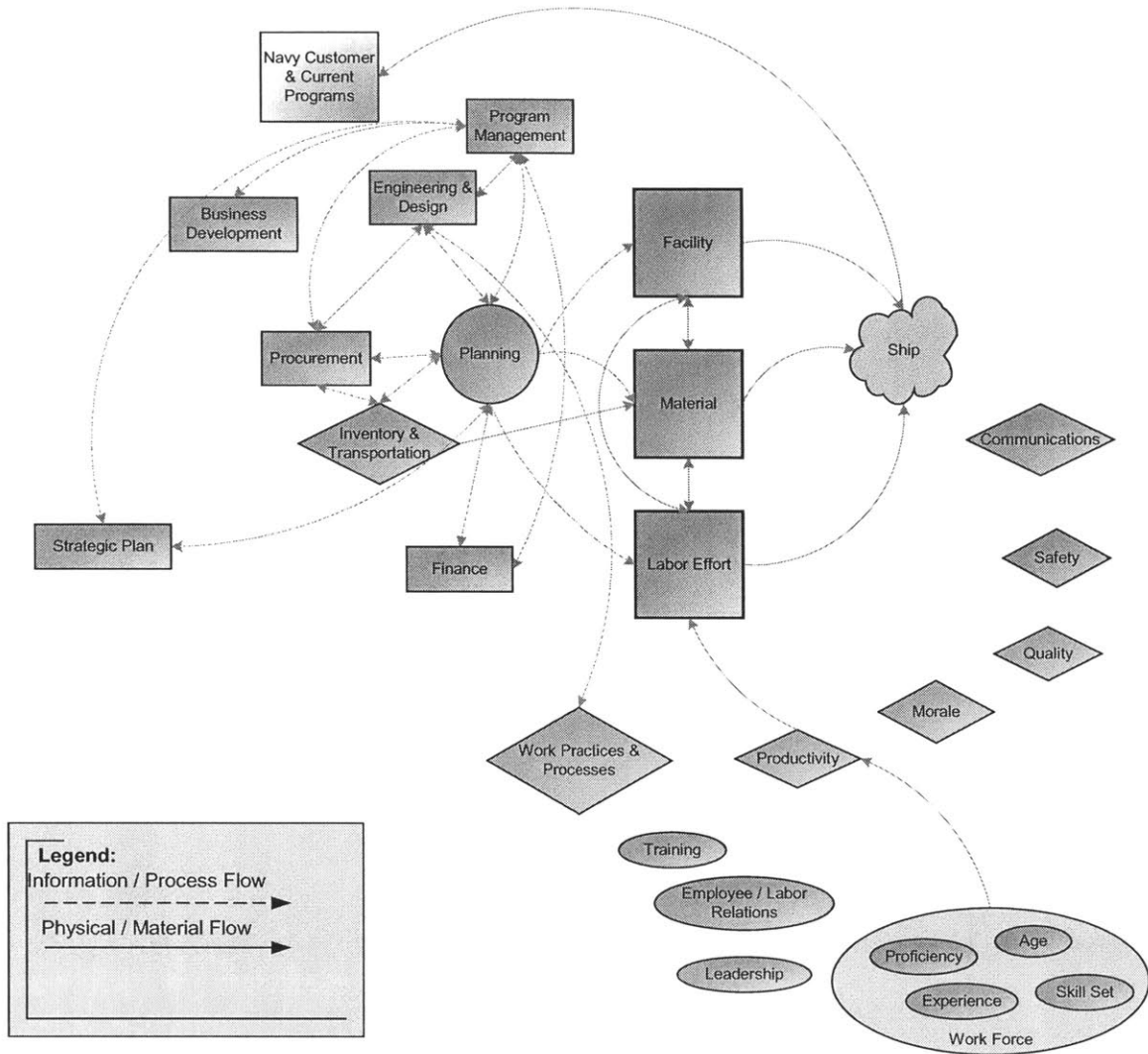


Figure 15: Core Shipbuilding Process

Figure 16 shows the complexity of the entire process by adding all of the first-tier interactions for all elements. Red lines associate to the core flow and black lines further define the system. Items external to BIW are yellow with the exception of the corporate owner, which is blue.

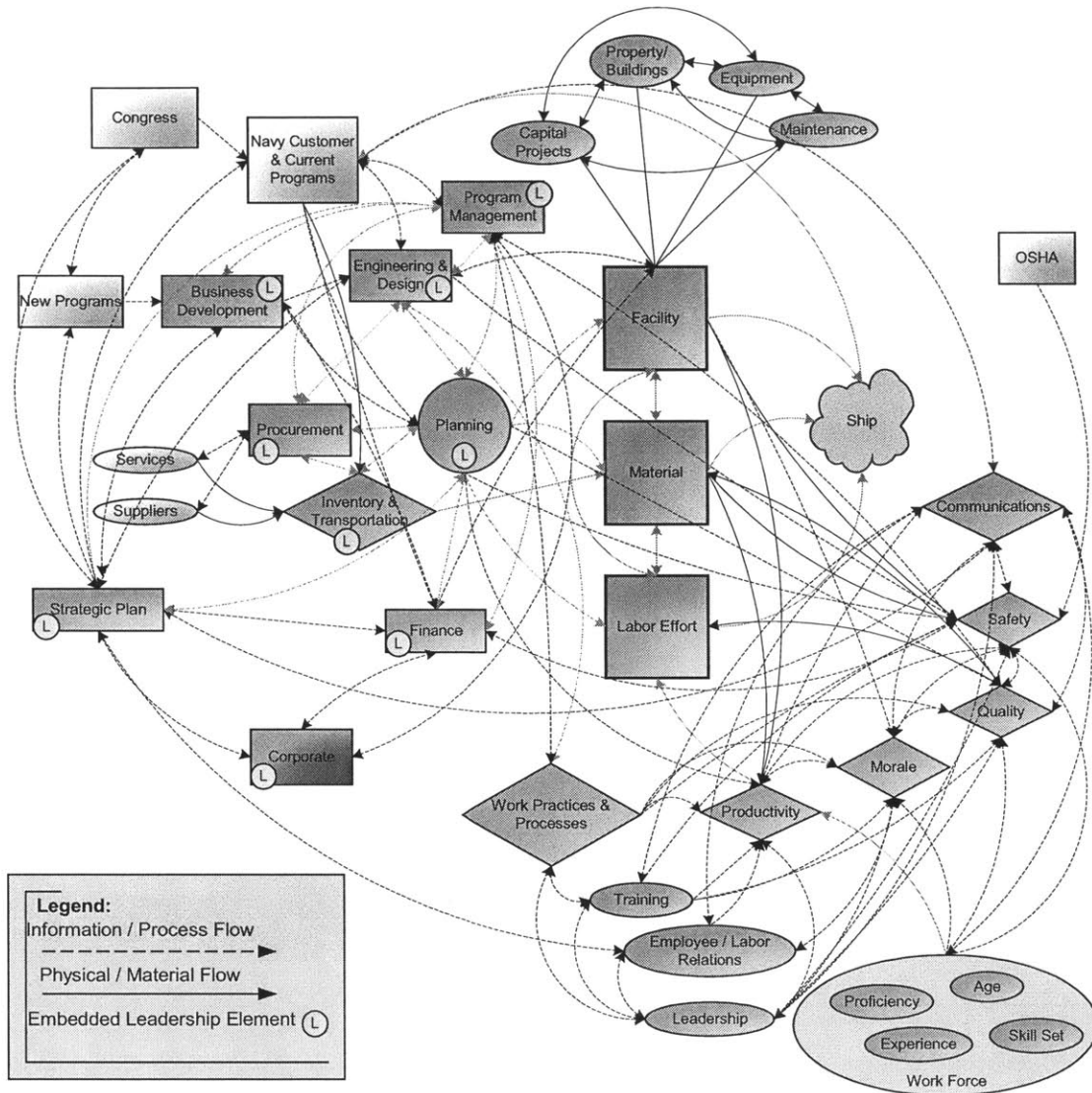


Figure 16: Complete Shipbuilding Process

A series of logically-decomposed flow diagrams, found in *Appendix C – Shipbuilding Process Flow Diagrams*, provide a systematic build-up of the overall process from the relatively-simple Figure 15 to the complex representation of Figure 16.

Workforce

Shipbuilding is a capital and labor intensive business, but the individual craftspeople are at the core. This industry demands a wide range of specialized skills ranging from naval architects and engineers required to design the ships to the craftspeople required to form steel into ship's structure to the delicate work of installing the combat systems. This broad range of shipbuilding-specific skills yields several significantly different workforce

constituencies with different needs and requirements. BIW has a strong union history that, at times, has been quite adversarial. The following sections will provide a high-level overview of the diverse workforce constituencies comprising BIW's 6,500 employees. More texture will be added to these groups in later sections.

Collective Bargaining Units

Four unions represent the majority of BIW's employees: Local S6 of the International Association of Machinists and Aerospace Workers (LS6), Local S7 of the International Association of Machinists and Aerospace Workers (LS7), the Bath Marine Draftsmen's Association, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) Local 3999, (BMDA) and the Independent Guards' Association (IGA).

Local S6

LS6 is the largest union with approximately 4,300 members, representing all of the manufacturing trades. The working relationship between LS6 and the company has been strained over the past decade and culminated in a fifty-five day strike in the fall of 2000 before a new labor contract was accepted. Following the strike, former U.S. Secretary of Labor Bill Utery was brought in to evaluate labor-management relations at BIW and make recommendations to improve the situation. The LS6 contract expired in May 2004 and a new four-year contract was ratified in timely manner by the members as a testament to the progress made in labor relations over the past four years. This is not to say that labor relations are ideal, but progress is continuing to be made.

Local S7

LS7 represents approximately two hundred fifty clerks and production trade planners. Relations between management and LS7 have traditionally been less contentious than those with LS6 and a three-year contract was readily passed in the spring of 2004. The large number of ships and the fairly stable design of the DDG 51 Class have decreased production planning requirements over time and has caused a significant contraction in union membership.

BMDA

BMDA represents the roughly six hundred members of BIW's detail design and drafting staff within the engineering division. A majority of this group of seasoned professionals is skilled in computer-aided design, maintain the three-dimensional models of the ship, produce construction drawings and provide deck plate[§] liaison support between manufacturing and engineering. This union has been severely affected by the shrinking numbers of new Navy ship design programs and has suffered significant layoffs over the past several years. However, the relationship with management and the salaried engineers has remained professional.

IGA

The fifty members of the IGA provide plant security, fire protection and EMS support to the shipyard. The role of this small union has increased significantly in the post-September 11th era with more stringent security and plant protection requirements.

Salaried

BIW's salaried population of approximately 1,400 employees is composed of a diverse array of professional skills, including managers from all divisions, front line supervisors, degreed engineers, master planners and analysts. The salaried population is not represented by any collective bargaining unit and relations with management vary by division. Salaried personnel in the planning, finance and human resources areas have been affected by layoffs over the past several years while engineering and manufacturing have been relatively unaffected. Traditionally, strong divisional stovepipes with relatively inflexible, hierarchical organizational and management structures cause many employees to suffer from divisional myopia. However, significant progress has been made to break down the divisional stovepipes over the past several years through inter-divisional resource exchanges, increased teaming and cross-functional manufacturing support initiatives such as the implementation of Lean principles. Finally, employees in the salaried ranks, with an average of nineteen years seniority, tend to be skeptical and fairly

[§] The deck plate refers to the construction site whether in a building, on a unit or in a ship.

inflexible to change because of their experience with a multiplicity of change initiatives over their long careers at BIW.

Demographics

A more thorough analysis of the manufacturing workforce's demographics will be developed in the *Critical Skills Retention* portion of the *Building the Case for Change* section in the context of retaining critical shipbuilding skills in an era of acquisition decline and an aging workforce. More broadly, BIW has a very senior workforce and is on the verge of a situation similar to that of the aerospace industry of the nineteen eighties and nineties. The average age of the workforce is forty-seven and the standard deviation is nine.

The shipbuilding industry tends to be a traditional, male-dominated business with a disproportionately low number of women in either the blue or white collar ranks. Accordingly, some of the terminology found in later sections will not be considered politically correct (e.g., men on the payroll, men on the job, man-hours, etc.). While the shipyard vernacular has been evolving toward inclusive language, the author consciously used the extant shipyard terminology to focus internal readers on the themes presented and not on the terms themselves. Interestingly, there have been several management attempts to make the shipyard terminology more gender neutral and each time the loudest opponents to the movement have been the women of BIW. Their rationale has been that they had worked very hard to achieve their management positions and they did not want the perception that their accomplishments had been diminished by a change in title.

Organizational Structure

This section will discuss the organizational structure through which BIW operates. As depicted in Figure 17, BIW's president, Dugan Shipway, has ten direct reports, all of whom are vice presidents with the exception of the Director of Labor Relations. Of those ten, three are responsible for the vast majority of the workforce, namely the vice presidents of Operations, Planning and Material Control, and Engineering and Procurement. The remainder of Dugan's staff oversees and provides important support functions, but are not as resource intensive.

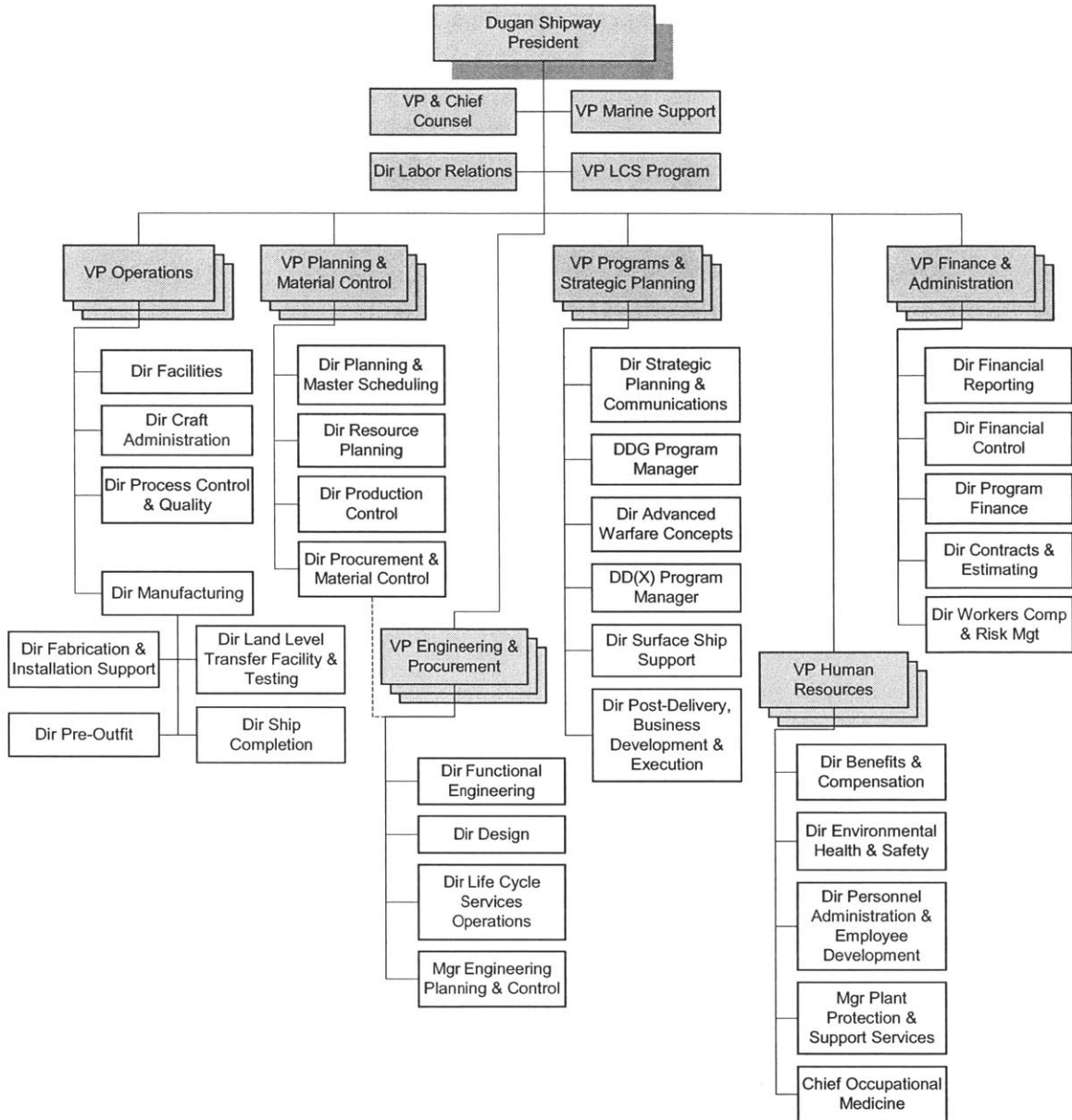


Figure 17: BIW Organizational Chart

BIW is a traditional, hierarchical manufacturing company, so understanding the organizational structure, the inter-divisional relationships and the sources of power is critical to successfully affecting change. The company espouses a shared company-level mission as well as specific cost, schedule, quality and safety goals; however, the performance measurement systems and incentive structures are focused toward divisional or group goals vice optimizing company-wide performance. The traditional existence of significant divisional stovepipes has gradually weakened over the past several years with the advent of more common projects and a unifying of some goals at the company level.

However, the static hierarchical organizational structures often lead to escalation of cross-divisional disputes to the top of one division, either a director or vice resident, and then down from the top of another division. This process tends to be cumbersome and bureaucratic, which is neither nimble nor conducive to innovation.

Leadership

The most important leader in any organization is the president. BIW has had significant turbulence in its leadership over the past 25 years. As previously stated, BIW's workforce is very senior with an average seniority of almost twenty years, so the corporate memory is quite long. This section will describe the leadership styles of the last four BIW presidents, which helped shape the attitude and culture of BIW today.

Bill Haggett became executive vice president, a position similar to chief operating officer, in 1978 and was named president of BIW in 1981. Haggett was from Bath, a third-generation BIW employee, and closely connected to the Newell family, some of the original owners of BIW. Haggett was well liked and ran BIW much like a family business, which led to a friendly workplace culture. During Haggett's tenure, BIW changed hands several times among several disinterested holding companies, was folded into Congoleum, a company generally associated with flooring products not ships, and became part of Prudential, the insurance giant, in 1986. The frequent changes in ownership allowed Haggett to run BIW largely as he saw fit, with little oversight. Haggett and several other executives were ultimately forced to resign in 1991 over a scandal involving inappropriate use of a competitor's business-sensitive information.

Duane "Buzz" Fitzgerald had been BIW's external counsel for many years before Haggett persuaded him to join the company, positioning him to become president upon Haggett's retirement. Fitzgerald became president earlier than expected following Haggett's resignation in 1991. Externally, Fitzgerald had to restore BIW's credibility and trust with the Navy customer. Internally, BIW began the transformation toward a more typical publicly-owned company with more formal relations with its corporate owners, workplace procedures were written and enforced, the organization was restructured, and the senior management group became a team with significant emphasis on corporate

strategic planning. Workplace healing began. Fitzgerald's father began working at BIW as a sweeper and ultimately retired as a well-respected, technically astute structural superintendent, the era's equivalent to a vice president. Fitzgerald continued the presidential tradition of being a respected, well-liked local insider** and was able to use this personal capital with the workforce to enhance labor relations. Fitzgerald forged a relationship with the union leadership and together they instituted a high performance work organization (HPWO). It was also under Fitzgerald's leadership that General Dynamics acquired BIW in 1995.

Allan Cameron was brought to BIW as chief operating officer with the intention of becoming Fitzgerald's successor, which occurred in 1996. One of Cameron's first tasks was integrating BIW's rich, independent spirit with the performance-driven expectations of General Dynamics. General Dynamics' influence over its individual business units is largely financial but demanding nonetheless. Cameron's style with the workforce was dramatically different than that of his predecessors. He was always considered to be an outsider and was not well received. HPWO was completely abandoned during contract negotiations in 1998 and BIW's largest union went out on strike for fifty-five days in 2001. However, Cameron was the driving force behind BIW's three hundred million dollar investment in the LLTF, which provided a state-of-the-art shipbuilding facility. Cameron retired abruptly in 2003.

John "Dugan" Shipway succeeded Cameron and was drawn from Electric Boat, a sister division within General Dynamics, after a distinguished career of more than three decades in the U.S. Navy retiring as a two-star admiral. Shipway's three main goals for BIW are to improve its competitive position, labor relations and safety, and he has vigorously pursued all three in a casual, enthusiastic style that has been well-received by the workforce. As an illustration of relating with the workforce, one of Shipway's first actions was to make the entire company business casual – "ships don't get built in suits." Shipway's challenges are exacerbated by the collective memory of the past as he attempts

** The concepts of "insiders" and "Outsider-Insiders" are more fully developed in *Change Agents - The Apostles of Change* portion of the *Change Overview* section.

to heal old management-labor wounds while attempting to fundamentally change BIW's culture, business processes and approaches. Edgar Schein, one of the founders of organizational psychology, in his enduring work, Organizational Culture and Leadership, describes a leadership situation very similar to that faced by Shipway. In his discussion of Leadership in Mature and Potentially Declining Organizations, Schein posits that the culture in mature organizations can become so strong that the culture and embedded behaviors can become blindly perpetuating and its assumptions regarding good leadership will evolve to suit. A new leader from the outside desiring to change the prevailing culture must possess insight to understand the existing culture and develop innovative solutions to evolve the culture in a manner that is acceptable to the workforce.¹² Shipway started as an outsider but has made a concerted effort to understand BIW's culture, as encouraged by Schein, and will become an insider over time as he works to change BIW. Unlike his recent predecessors, there is no apparent successor to Shipway. There is strong potential for the entrenched workforce to view this as another short-lived change initiative because they believe that Shipway could retire at any time and without a ready successor continuity could be lost.

Change Overview

“Putting lipstick on a bulldog won’t transform enough,
Makeup can’t hide everything; change takes deeper stuff.”
from Evolve! – The Song, lyrics by Rosabeth Moss Kanter¹³

As the lyrics imply and as evidenced by the vast array of literature, change is hard.

Numerous change identification, implementation and management theories exist, all with varying levels of credibility and intellectual rigor. This section will examine the frameworks and theories of some of the field’s leading experts. The selected methodologies have some common themes, but each has its strengths in specific aspects of planning or implementing the various stages of change. While introducing the salient features of each change philosophy, this section will not exhaustively describe each methodology as the author’s works cited are more appropriate to gaining a full understanding. The preceding sections of this document have described the industry in which BIW operates and the dynamics of BIW itself. This section will combine the selected theories, methodologies and features into an integrated framework for successfully planning and managing complex, enterprise-level change. Subsequent sections will use these principles to build the case for change and describe how it should be organized and implemented at BIW using systems thinking and analytic rigor to develop an integrated plan for affecting process and cultural change at BIW in a manner appropriate to the existing culture.

Janice Klein uses Figure 18 in her book True Change: How Outsiders on the Inside Get Things Done in Organizations to describe the ingredients and interactions necessary to affect true and lasting change in an organization.¹⁴ This section is organized using similar themes but with different names. Pulling Change and the fundamental elements of successfully implementing culturally compatible change initiatives will be described using Rosabeth Moss Kanter’s change wheel. Second, the critical role of change agents at all hierarchical levels within the organization will be described using a combination of Kanter’s seven skills of change masters and Klein’s Outsider-Insiders. Finally, the tactical processes for temporally-defining the details of change and determining the

requirements of the Support Infrastructure are investigated using the work of Richard Beckhard and Reuben Harris.

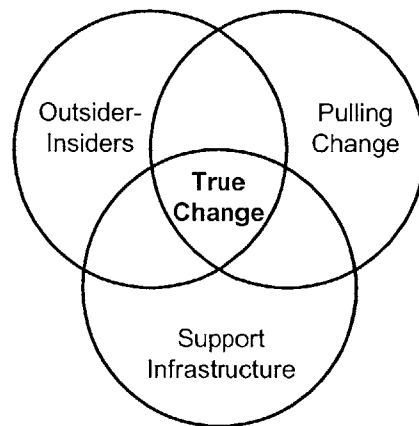


Figure 18: Three Ingredients Necessary for True Change¹⁵

The Elements of Successful Change

Lasting, sustainable change must be introduced to an organization in a manner that is acceptable to the prevailing culture, even if modifications to the culture are objectives of the change. There is no “change cookbook” that details change design, planning and implementation from conception to completion because the dynamics driving change, the prevailing culture and the change itself, to name a few factors, vary greatly among organizations. However, change theorists agree upon some common elements that must be present if change is going to be successfully implemented and sustained. Rosabeth Moss Kanter, a leading change consultant, developed the “change wheel” as a tool to guide the formulation of change and its subsequent implementation.

The ten slices of the change wheel, seen in Figure 19, contain groups of elements that should be present in any well-organized and executed change initiative. A wheel is used to depict change because there is not always a clearly defined starting point and there is rarely a common endpoint. In fact, there should really be no endpoint to change as an organization continually evolves and reinvents itself. The slices of the wheel do not need to be traversed in order as the initiative progresses, but all slices must ultimately be addressed. Generally, a logical order of the elements emerges based on the dynamics of the intended change.

The wheel should be traversed iteratively over the course of the initiative to maintain balance and focus. If this is not done in a conscious, rigorous manner, many change initiatives become change triangles or squares. It is very easy to get mired in the details of a specific change element while neglecting other elements entirely. When this is allowed to happen these initiatives lose support and ultimately fail because they don't address all of the required elements to keep the initiative rolling and the changes never become institutionalized.

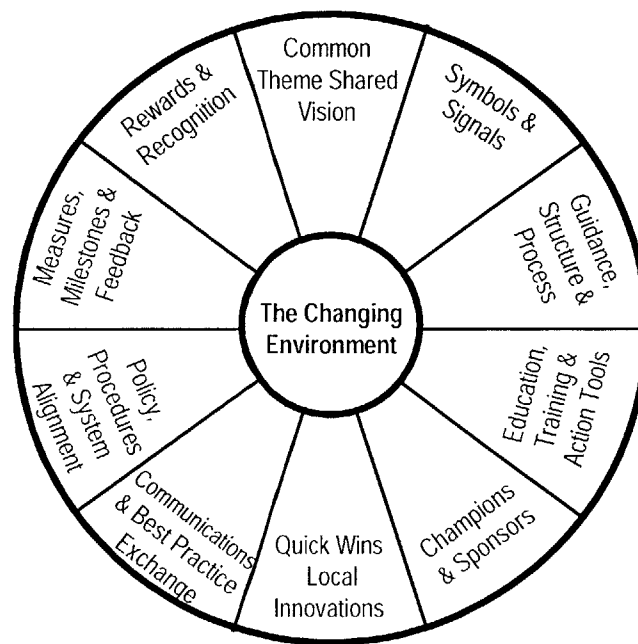


Figure 19: The Change Wheel¹⁶

The following excerpt from Kanter's book, *Evolve!*, describes each element of the change wheels and its intended purpose.¹⁷

- *Common theme, shared vision:* The change message must be well and widely understood. Initially, this is a matter of articulating it well and broadcasting it to many audiences. It can be crafted by a small group, but it becomes truly shared – internalized – as it is used by large numbers of people.
- *Symbols and signals:* People are always reading the organizational tea leaves, looking for signs of whether the change is serious and how it will feel. Small symbols can have big consequences. The right early signals can show people what the change will mean for them. (Eliminating reserved parking is how some companies signal a reduction of hierarchy.)

- *Guidance structure and process:* Change needs someone at the controls, even if ultimately everyone has to get involved in change. And there needs to be a process for steering it in the right direction. This involves the nuts and bolts of project management, on a large scale. Assigning accountability for the big picture – the overview of all the elements of change – is an important step.
- *Education, training, action tools:* How do people know what to do to make the change operational, to make it real in their activities? The same words can be understood differently by each part of the organization, interpreted from their own perspectives. Therefore education is necessary to communicate the why and what of change. Training is necessary for people to become adept at the new behavior implied by the change. And action tools help people relate the change to their own day-to-day work.
- *Champions and sponsors:* Changes need people who become passionate about seeing that they take place. Champions are the activists and cheerleaders for change, often carrying out mini change projects themselves. Sponsors make sure that the change has the backing of those with the power to fight for it.
- *Quick wins and local innovations:* Early successes show that change is possible and indicate what the change means in practice. It is important to get the grass roots involved in shaping the change by picking projects that particular units can tackle. This is improvisational theater at its best – a clear overall direction, but details created as units take hold of the change and make it their own. That’s why “shared vision” is directly opposite this element on the Change Wheel; pilot projects, demonstrations, and local modifications make the vision concrete and ensure its acceptance.
- *Communications, best practice exchange:* Change requires even more communication than routine activities. Top leaders need to know what’s happening in the field so they can make adjustments to support it or steer it in a different direction. Local units need role models to learn from the experience of their peers, to see what’s possible, and to be spurred on to new heights. Change can be chaotic without a way to communicate what’s happening everywhere.
- *Policy, procedures, system alignment:* Every organizational rule, routine, requirement, or procedure can either reinforce or undermine the desired change: human resource systems (hiring criteria, promotion criteria, compensation policy), information systems (what data are shared, with whom, when), policies about who gets to talk to customers or to the press. Rules and processes need to be reassessed and adjusted to support the new direction.
- *Measures, milestones, and feedback:* It is important to know whether the change is on track. Establishing measures of progress is important, especially for softer changes (such as a shift of culture) or ones that will not show up in conventional financial results. Dividing big changes into small increments with clear milestones is helpful for measurement and morale; each milestone successfully passed is a cause for

celebration, or each one missed a cause for readjustment. There needs to be a feedback loop based on agreed-upon measures of progress.

- *Rewards and recognition:* Who gets rewarded and for what reasons is an essential component of change. The organization's carrots and sticks combine with its publicity engine to create heroes of the revolution or enemies of the change.

When contemplating enterprise-level change and evolution, iteratively applying the change wheel is analogous to the concept of spiral development in systems engineering. Spiral development was originally created as a risk reduction approach for software; products were incrementally evaluated and released rather than attempting the entire project scope at once. The concept has been adapted by the DoD as an evolutionary acquisition strategy to introduce new technologies to platforms in incremental flights at a faster, yet safe, rate.¹⁸ Similarly, enterprise-level change, which is comprised of multiple levels of interrelated changes, can be decomposed into individual change initiatives; the change wheel can be used to describe and plan the change at each successive level. Figure 20 shows the enterprise evolving over time as overlapping change initiatives are executed to support elements on the change wheel. Each initiative further evolves the enterprise and eventually the enterprise and the culture are changed as all elements of the change wheel are addressed. Concurrently, each in-process change initiative iteratively traverses the change wheel as it works toward its goals.

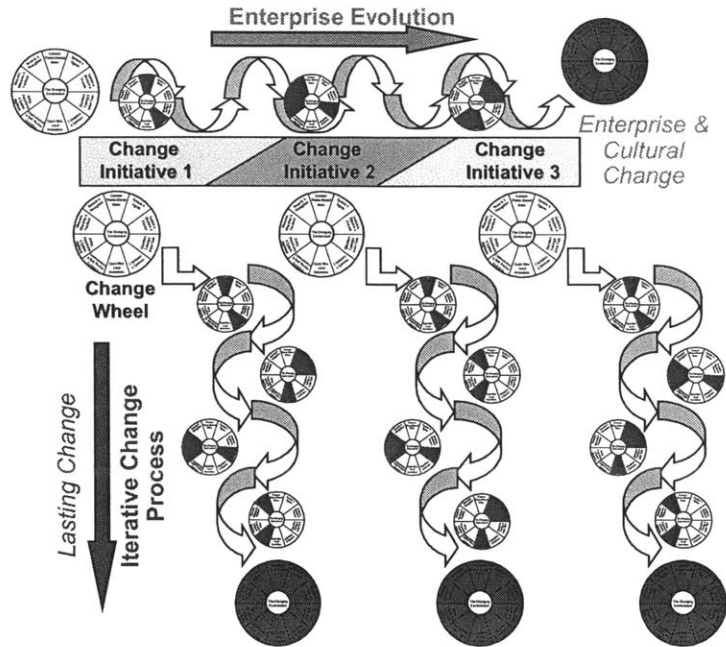


Figure 20: Evolving the Enterprise and Creating Lasting Change

The majority of this document addresses the macro challenges associated with enterprise and cultural change and the organizational strategies used to address them, which is appropriate when initially approaching enterprise-level change. However, such strategies are of limited use if the organization does not possess the critical skills required to translate them into actionable plans at the working level. Klein describes the process of aligning the strategic and tactical elements of change using Figure 21. Change necessarily brings challenges to an organization, but the challenges also present an opportunity to pull in new ideas.



Figure 21: Aligning Strategic and Local-Level Change¹⁹

Pulling in new ideas and identifying opportunities for change are analogous to a pull inventory system, as opposed to a push system. Push systems are based on forecasts and products are inventoried, sometimes in great quantities, based on the expected demand. Conversely, a pull system limits inventory and provides the product to the consumer as it is required. Pull systems are attractive because inventory carrying costs and the risks of oversupply are reduced, since only the amounts demanded are supplied.²⁰ Pulling in opportunities for change produces similar benefits; pushing a change where there is no demand is likely to meet with significant resistance whereas initiating change to meet an acknowledged challenge is likely to meet with less resistance because the need is already evident.

Klein stresses the need to align change actions and opportunities both vertically, as described above, and horizontally. Enterprise-level change can not be successful if efforts are fragmented and approached independently. She quotes one manager's description of effective horizontal alignment when approaching change:

“Piecemeal knowledge tends to get localized and then disappears. It is just noise in the bigger system. It is like hitting a hammer on the side of a big tanker. No one hears it. I want a hammer that goes "pong" to break the problem.”²¹

Creating a “pong” does not have to be one large solution to a problem; it can be the compounding effect of multiple, coordinated “pings.” Regardless of the approach, successful change must be strategically planned and integrated within an organization using a network of change agents.

Kanter's change wheel is not the only tool available for conceptualizing and organizing change, but it is a simple and flexible, yet encompassing, framework that logically decomposes and groups the key elements of change. It is easily described to those that are not familiar with change methodologies, but can be expanded in greater detail by change agents engaged in the effort. Consequently, the *Organizing and Implementing Change* section of this thesis is structured using the change wheel; each subsection is an element on the wheel and they are presented in clockwise order. The alignment of the macro and micro level challenges are addressed within each subsection using Klein's principles. The

totality of the *Organizing and Implementing Change* section represents an initial, comprehensive change plan.

Change Agents - The Apostles of Change

The term “change agent” conjures a multiplicity of images ranging from external consultants that promise to quickly change the world to those individuals embedded within an organization that demonstrate an understanding of what needs to be changed and possess the leadership to affect the change. Fundamentally, no change initiative will be successful, despite executive edict or expansive planning, if there is not a network of committed individuals capable of implementing the change in a manner that is in keeping with the culture of the organization. This discussion is broken into two main sections that will describe various types of change agents and their importance to bringing about true change. The first section will describe the attributes of “change masters” using Kanter’s framework. The second section is complementary to the first and will describe Klein’s Outsider-Insiders and their role in identifying opportunities and implementing true change.

Enduring Skills for Change Masters²²

Kanter defines “change masters” as people who know how to conceive and lead productive and effective projects, initiatives or ventures that bring new ideas into use and has identified seven fundamental skills change masters need to possess.²³ These skills were identified during Kanter’s hundreds of research and consulting projects and describe the well-rounded, multi-faceted attributes of change masters in concert with her change wheel.

- *Sensing Needs and Opportunities: Tuning in to the Environment.* As previously discussed, change needs to be executed in a manner that is in keeping with the prevailing culture, even if the objective is to evolve the culture. Change masters do not force change on organizations for change’s sake. They are aware of their surroundings, forward-thinking and nimble; they use emergent situations as opportunities for organizational growth and transformation.
- *Kaleidoscope Thinking: Stimulating Breakthrough Ideas.* Identifying needs and opportunities is the first step to initiating change, but these ideas need to be transformed into innovative and actionable solutions. Change masters look for

solutions outside their comfort zone and seek to bring in new ideas from all directions, not just from traditional sources. Activities designed to stimulate these radical, innovative ideas are generally undervalued in traditional organizations and may include fact-finding trips to seemingly unrelated organizations or off-site brainstorming sessions. In reality, these activities can free change masters from the rules and processes of the present and allow them to think about the emerging opportunity in a different and more innovative context.

- *Setting the Theme: Communicating Inspiring Visions.* Change masters need to bring breakthrough ideas to life. Change always brings risks in addition to rewards and it is incumbent upon the change master to create a vision in which the rewards overpower the risks. An inspiring vision is not simply a communication of the breakthrough idea or a description of what the change will be. An inspiring vision is much more; it is a combination of words and actions that draw on these six elements:
 - Destination: Where are we headed?
 - Dream: What will be different because of this goal? What will our world look like then?
 - Prize: What positive outcomes will be obtained? Who will benefit, how?
 - Target: What deadlines or metrics make the outcomes concrete?
 - Message: What memorable image, slogan, or headline conveys the essence of the goal?
 - First Step: What tangible step can be taken that will give reality to the goal?²⁴

People more readily commit to a charismatic leader with a vision that is honest, unambiguous and inspiring than they will to a stack of facts and lifeless statistics. However, change masters will extensively use available data as they communicate and reinforce their vision, but they will not solely rely on them.

- *Enlisting Backers and Supporters: Getting Buy-In and Building Coalitions.* Large-scale change is never successfully implemented without building a coalition of support. Change masters draw upon their extensive personal networks to establish backing for their ideas. Often times, a change master's personal credibility will begin the process, but must be followed quickly with evidence that support of the initiative is warranted. They must also use a variety of tactics when recruiting support ranging from early engagement of more senior powerbrokers to deal making and "horse trading." Change masters will adapt their tactics to the situation, but they will not move the initiative forward until a critical mass of support at appropriate levels within the organization is established.
- *Developing the Dream: Nurturing the Working Team.* Change masters are active participants in the change process; they rollup their sleeves and get dirty. At the same time, they are the chief cheerleaders of change and must provide leadership to support to their implementation team. Enthusiasm is easy when an initiative is new and fresh, but maintaining that enthusiasm for extended durations is difficult though critical to

motivating the team. Also, appropriately rewarding a hard working team in a timely manner is important.

- *Mastering the Difficult Middles.* Kanter's law of management and life is "Everything can look like a failure in the middle." Large-scale change takes time and involves a complicated array of technical, social and managerial interactions that must be shifted and realigned. Consequently, no matter how well-planned the initiative, things will happen during the course of implementation. Mastering these difficult middles means the difference between success and failure because most change initiatives live or die during this period. Enthusiasm, support and momentum are high at the beginning of a change initiative. As the change progresses, it becomes harder and harder to maintain these elements, and things begin to become uncertain due to four common problems: forecasts fall short, unexpected obstacles pop up, momentum slows and critics get louder. It is incumbent upon the change master to be a realist early in the process and anticipate the difficult middles so they can be addressed when they inevitably occur. The difficult middles are a change initiative's fog of war.^{††} If conquered successfully, the initiative generally regains its momentum and continues implementation. However, many initiatives are canceled or unproductively stagnate during the difficult middles.
- *Celebrating Accomplishment: Making Everyone a Hero.* Finally, change masters don't forget to reward and recognize the accomplishments of their teams. Rewards don't have to be monetary, and any reward will help keep employees motivated and validates their contributions to the effort. Good leaders recognize accomplishments as they occur, but they also formally reward their teams at the end of an initiative to thank them and symbolically bring closure to the change, even if a new change is right around the corner.

Summary

Kanter's final observations on the skills of change masters are broader and are not elements of a single skill:

"The most important personal traits a leader can bring to change efforts are imagination, conviction, passion, and confidence in others. Leaders must also heed political lessons:

- "Position power is not enough. Personal passion and force of personality isn't enough. Other people must become believers, too. Their behavior shapes what the change turns out to be.

^{††} Fog of war is a reference to the visual and informational impediments military commanders suffered on the 19th century battlefield. The term has evolved to mean a period of uncertainty in the midst of conflict.

- “Marshal data in support of change. Make the theme memorable and the vision concrete. Prototypes and test programs can be effective in demonstrating the power of change, and in building momentum.
- “Endorsers and investors lend credibility and wisdom. Tap into the experience of others inside and outside the organization. Utilize relationships to get resources.
- “Winning supporters can take time. Try iterative waves of coalition-building, in which many get the message and some become champions who reach out to many more.
- “Seek to minimize loss and uncertainty for those who will be impacted by change. Listen to the resisters; sometimes they are telling you things you need to hear. Walk in the shoes of resisters; show them you understand them and are on their side. Cooptation of your opponents through a role in the venture can be effective. If they can’t be converted, get them out of the way.
- “Choose the rhythm that fits the situation. Know the audience. Know what people and the organization can handle, and push - but not too much too fast. Stretch people, but not to the breaking point.
- “Persistence pays off. Stick with it. Follow up and follow through.
- “Respect and recognition wins friends. Throughout the process, make all those who are part of the change look good.”²⁵

Kanter’s seven skills define the highest-level attributes of good change agents and are in keeping with the elements of the change wheel. The following section will build on the seven skills, but will further define the specific competencies required within an organization and describe how those skills can be developed, fostered and used.

Outsider - Insiders

Outsiders on the Inside

As previously stated, change must be conducted in a manner that is appropriate to the prevailing culture. External consultants can recommend unbiased approaches and identify requirements for improving performance and affecting change, but they are not part of the organization, do not fully understand the cultural dynamics of the system, and generally bear no responsibility for the implementation of the change. They are outsiders. Conversely, employees are comfortable and intimately familiar with the operations and cultural dynamics of the organization, are the likely implementers of the change, have a vested interest in organization’s future success, and possess large internal contact networks. They are insiders. Klein has identified a hybrid change agent known as the

“Outsider-Insider” who can step back and simultaneously wear the hat of both an outsider and an insider. Outsider-Insiders possess an outside perspective while being inside an organization.²⁶

Outsider-Insiders can identify opportunities for change and implement solutions in a manner that is culturally acceptable because they are already operating within the culture. They maintain fresh perspective by seeking solutions from other industries and situations and are not confined to the mental models of their daily workplace reality. Figure 22 illustrates the development and benefits of Outsider-Insiders. The cycle begins when the assumptions of the organization or situation are questioned, which requires an open mind. The Outsider-Insider then identifies an opportunity to pull in new ideas using an outsider’s perspective; this can require substantial perseverance and creativity. The implementation of new ideas then becomes a challenge requiring a new iterative cycle of questioning. The Outsider-Insider’s continual exposure to alternative and external perspectives is important to maintaining outsider attributes; there is a tendency to become comfortable and complacent with the day-to-day realities of the inside, so renewal is important.

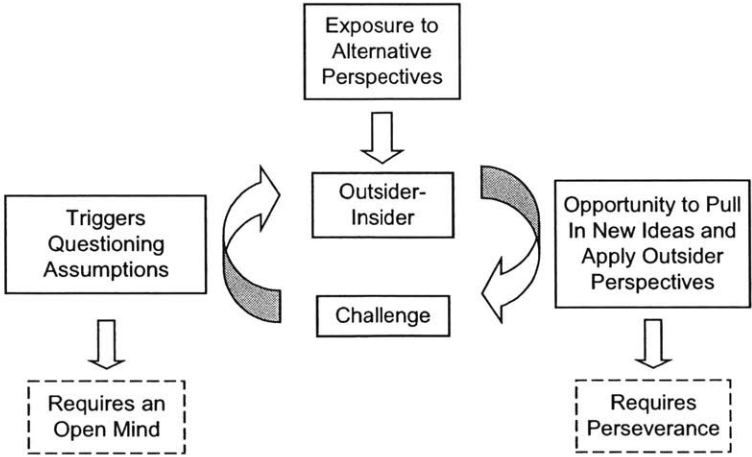
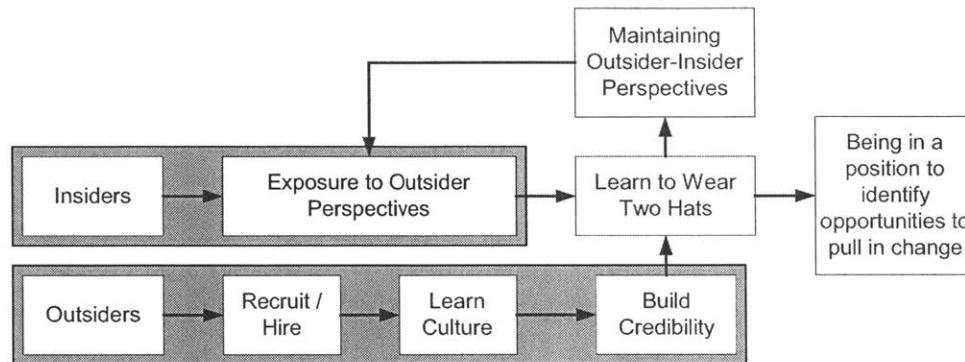


Figure 22: The Development of Outsider-Insiders²⁷

Building Organizational Capability and a Critical Mass

A “pong” can not be created by just a few Outsider-Insiders, no matter their position in an organization’s hierarchy. Affecting true change requires a dispersed network of Outsider-Insiders at all levels of the organization to compound one another’s “pings” to

create a “pong”. Creating this critical mass requires identification and development of potential Outsider-Insiders. Figure 23 shows two paths to creating a critical mass of Outsider-Insiders and establishing an organizational capability for change.



Note: Champions, mentors and networks are critical at each step

Figure 23: Building Organizational Capability for True Change²⁸

Candidate Insiders are identified and exposed to Outsider perspectives in the first path, so they learn the ability to wear two hats. This two step process sounds simple, but it requires hard work because these skills can not be taught in a classroom during a week-long training session. It takes commitment, time, motivated self-study and a change in mental models to become an Outsider-Insider while continuing to function in a solely Insider capacity within the organization. The alternative path is to recruit and hire Outsiders already possessing Outsider perspectives and functionally integrate them into the organization so they can learn the culture and build their personal credibility. Many elements of an organization’s culture are situational and take time to emerge, so fully understanding the culture can be a lengthy process. Also, credibility must be established and reinforced by performance over time.

Regardless of the path, once a candidate Outsider-Insider has successfully learned to wear two hats, they must be put in a position to identify opportunities to pull in change. This does not necessarily mean the creation of a new position, but it does require a support network of other Outsider-Insiders, at varying levels, and the ability to influence the actions of the organization. Finally, Outsider-Insiders require a means of maintaining their Outsider-Insider perspectives. This may be done through self-study, group

discussion, conference attendance or reading of scholarly literature, but is critical to keeping an open mind and a balanced approach.

Summary

Aligning macro-level change with the micro-level implementation is critical to affecting true change within an organization. The *Organizing and Implementing Change* section of this document is arranged using Kanter's change wheel, but Klein's principles of Outsider-Insiders and the compounding effects of a well-integrated change effort are employed to define the detail of each element. Developing an organizational capability for true change through a critical mass of Outsider-Insiders at all levels of an organization is critical to successfully implementing any change initiative.

Change Planning: Determining the Requirements and Defining the Details

While there is no comprehensive "change cookbook," there are some very good guides for procedurally defining portions of the overall change endeavor. In their book, Organizational Transitions, Richard Beckhard and Reuben Harris present several useful frameworks for determining the change requirements of the enterprise and defining the details.²⁹ The book was first published in the early nineteen eighties, but its simple frameworks are still used by change experts today and have not been significantly modified.

Making the Case for Change

Change doesn't happen spontaneously or easily, especially in large, complex enterprises. The decision to embark on large-scale change must be driven by either a current or future need that can be communicated in a compelling manner. Beckhard and Harris stress the importance of building a solid case for change that simply and clearly articulates the need for change that is substantiated by data, where possible; this is synonymous with Klein's principle of identifying opportunities to pull in new ideas and change. A common management pitfall in change implementation is falsely assuming that all members of the organization share the same level of understanding and commitment to the change effort, which is similar to Kanter's concepts of creating a shared vision and developing a coalition of champions and supporters. While seemingly straightforward, building the

case for change is critical to communicating the objectives of the change, fostering understanding and building early support. These concepts are further developed in the *Building the Case for Change* section.

Establishing Organizational Readiness and Commitment

Another preliminary element in the change process is establishing organizational readiness and commitment. Even among senior management, the level of commitment is likely to vary as is the level of required commitment for success of the initiative. Change implementation can become a very personal and political process if not carefully managed. People become defensive when their organization is a target for change, so honestly evaluating the principal participants and organizations in any change initiative is critical. The evaluation will: establish areas requiring additional communication and convincing as to the need for change, identify the resistance and the likelihood of converting these individuals to supporters, and identify the champions of change so they can be enlisted in the conversion of the nonbelievers. Beckhard and Harris present several simple matrices for establishing organizational readiness and commitment that are further described in the *Establishing Organizational Readiness and Commitment* portion of the *Building the Case for Change* section.

Defining the Details

After articulating the highest-level need for change and ascertaining that a critical mass of commitment exists, it is likely that significant ambiguity will surround the specific objectives of the change. Beckhard and Harris present a five-step change management process, shown in Figure 24, to guide organizations through initial change planning. The process begins with fully defining the intended change. Next, the future state is defined using the primary attributes of the change followed by the development of a corresponding view of the present. Only then is the transition plan developed to move from the present state to the future state. Finally, the effort must be carefully managed as it is executed. Even though the Beckhard and Harris process looks dramatically different from the change wheel, they are quite complementary. The change wheel is arranged by the elements of change with no temporal dimension whereas the Beckhard and Harris model presents sequential process steps containing elements similar to the change wheel

with implied iteration. The change wheel is a simple, comprehensive view that organizes the information at a high level, but the Beckhard and Harris model facilitates lower-level detailed development. The tenants of the Beckhard and Harris model are used extensively throughout the *Building the Case for Change* and *Organizing and Implementing Change* sections.

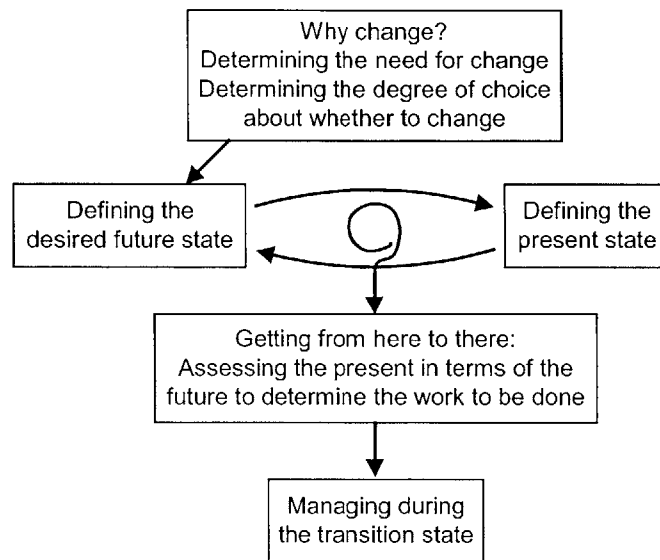


Figure 24: Map of the Change Management Process³⁰

Determining the Need for Change

Even though the need for change may have been previously determined and articulated, it is likely that further, more analytic definition will be required. As seen in Figure 25, the change needs to be defined in terms of core mission, competencies, the demand for change, the dynamics of the system, and capacity of the organization to affect the change. The need should be defined as discretely as possible with supporting data to reduce ambiguity and should describe why, what and who will be affected. The when and how of the change will be developed during subsequent stages.

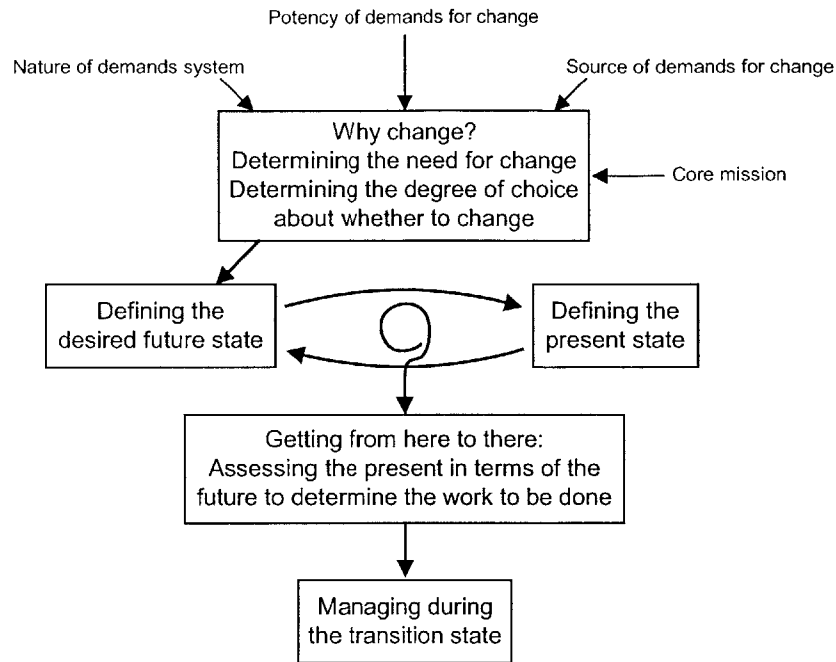


Figure 25: Determining the Need for Change³¹

Defining the Desired Future State

The duration required for lasting enterprise level-change is usually measured in years, which presents both opportunities and challenges. Positively, beginning the process by defining the desired future state allows planners to detach themselves from the realities of the present and to think innovatively about the enterprise post-change. In many respects, this can be considered a “what do I want to be when I grow up?” exercise that allows the vision of the future to be defined without the encumbrances of how to get there from the present state. Figure 26 contains some of the key factors that must be considered when defining the desired future state. It is important to define the future with as much specificity as possible, which is one of the biggest challenges. Gaining general agreement on the broader aspects of the desired future is generally not too difficult, but defining the details to a level that is actionable is a far different matter and requires a systematic design and integration approach to manage the complexity of enterprise-level change. Often times there are multiple scenarios that would alter these lower-level details and ambiguity surrounds ill-defined or as yet unknown aspects. The scenarios quickly become complex as they are defined in more detail, but creating a wide range of likely

future scenarios is important to reducing uncertainty and developing a plan for change that will achieve the desired objectives.

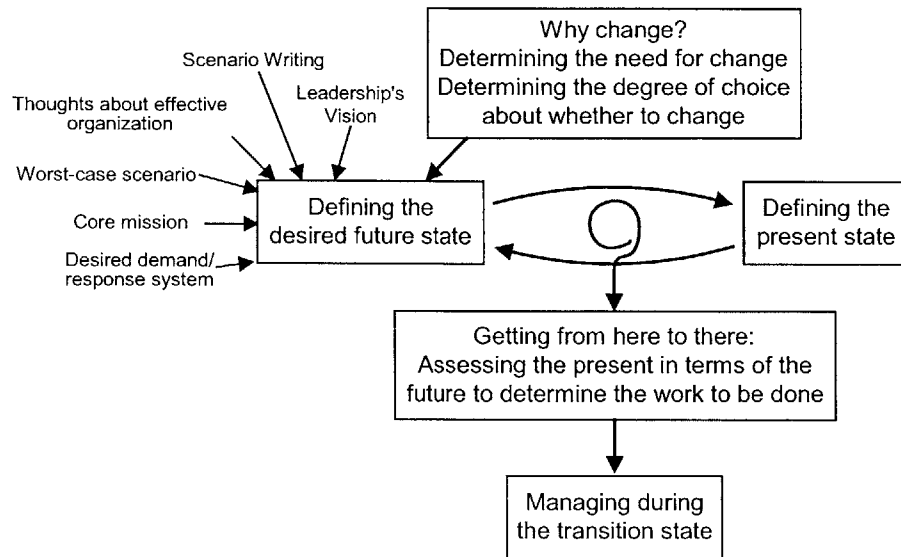


Figure 26: Defining the Desired Future State³²

Defining the desired future state at the beginning of the process also tends to remove some of the emotional and political aspects associated with change. By choosing a desired future state that is several years removed, the personal threat to managers that may be affected by the change is mitigated because the impact is in the future and does not bring an immediate sense of urgency. These same managers are more likely to offer their experience and insight if they don't feel personally threatened or that their performance is being assaulted. It is important to reach consensus as to the desired future state before moving on because each successive step is predicated on the goals and objectives of the future state.

Analyzing the Present State

The present is generally well-known and well-understood. The challenge is to define the present in a similar manner to the desired future state. If the desired future state is significantly different from the present, this may not be completely possible or will require an even more robust transition plan. Figure 27 contains some of the items that should be considered when creating the definition of the present state.

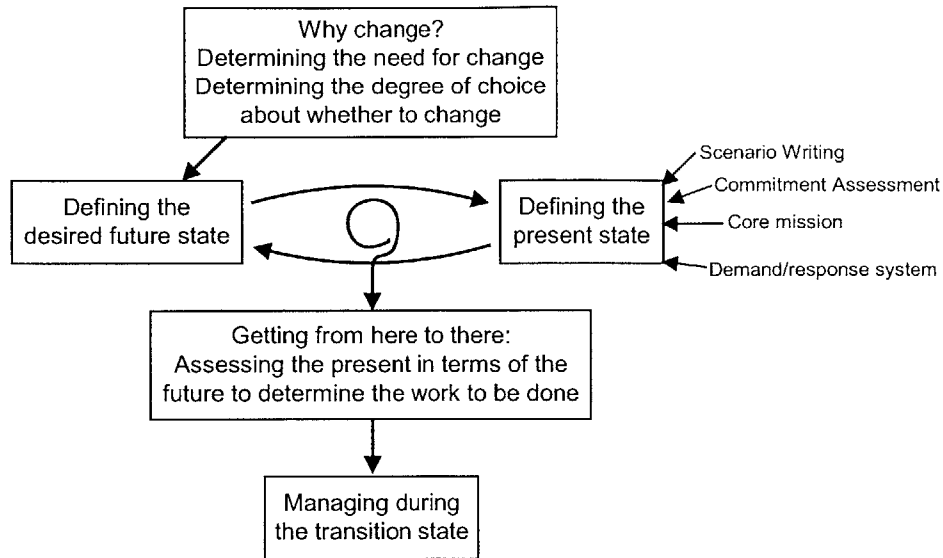


Figure 27: Analyzing the Present State³³

One of the major challenges in defining the present is doing it honestly. The admission that change needs to be made is a statement that the present is not perfect and something is awry in the system. Honestly assessing the present can be difficult and politically charged. Care should be taken not to assess blame for the problems of the present and to use value neutral statements wherever possible. However, there is likely to be some disagreement and resentment of the present state scenario by those that feel unjustly accused. These feelings will be compounded if the disgruntled are among those that are not committed to the change effort or are part of the resistance.

Developing the Transition Plan

Defining the transition plan between the present and desired future states will form the basis of the execution plan; it is intentionally developed after defining the desired future state so as not to influence the vision of the future or stymie planners with the interim challenges of transition. The transition plan must connect the present description to the future vision of the enterprise such that the desired change is achieved within the allowable timeframe and is done in a feasible manner given the organization's culture and core competencies. It must contain elements of organizational behavior and processes, project management, and system design. The plan forms an integrated roadmap to the future that contemplates the tactical and strategic elements the enterprise

will encounter during implementation. Figure 28 presents the primary considerations from the Beckhard and Harris model.

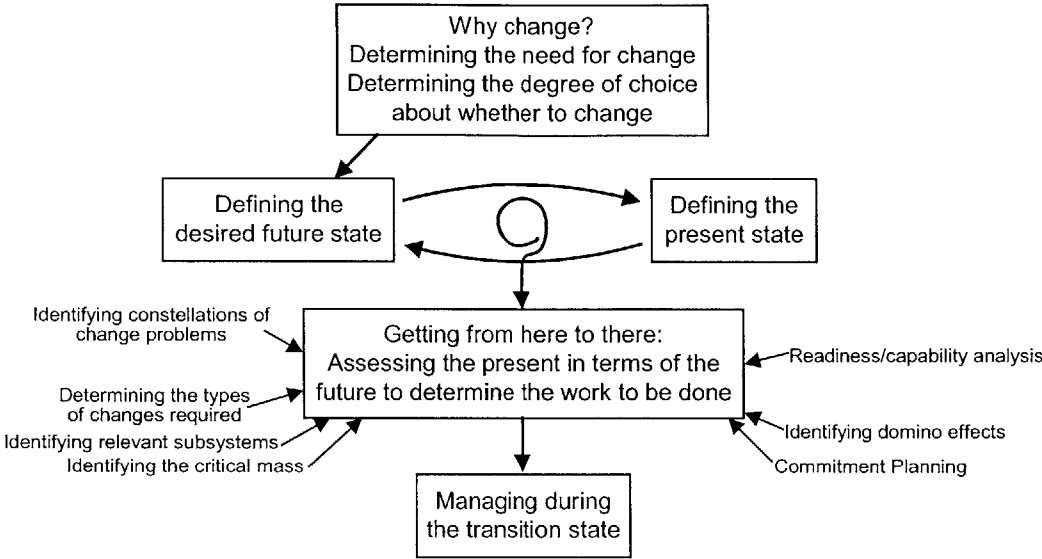


Figure 28: Getting from Here to There³⁴

Personal biases and concerns are likely to surface as the transition plan is being created. For example, organizational shifts and changes are likely and, in some cases, entire departments may be eliminated or combined. These actions directly threaten the affected constituencies and will generate significant opposition. Ultimately, some people will likely leave the organization by choice or necessity. Controversies can be mitigated through a critical mass of senior-level support that will guide the initiative and make the difficult decisions that will arise.

Managing the Transition State

The transition state will span several years during enterprise-level change efforts. Kanter refers to strategy development as improvisational theater; there is a general theme, but all of the details are not known.³⁵ It is important to plan the elements of change to the extent possible, but managers must also recognize that opportunities for innovation often emerge in response to a change in the system and could not have been previously foreseen – much like the impromptu action and dialog of improvisational theater. Consequently, traditional project management tools should be used to guide the transition state, but they must be flexible enough to allow for innovation (i.e., opportunities for

micro-level pulls emerge). Figure 29 presents some of the more traditional elements of project and change management that should be considered during the transition state.

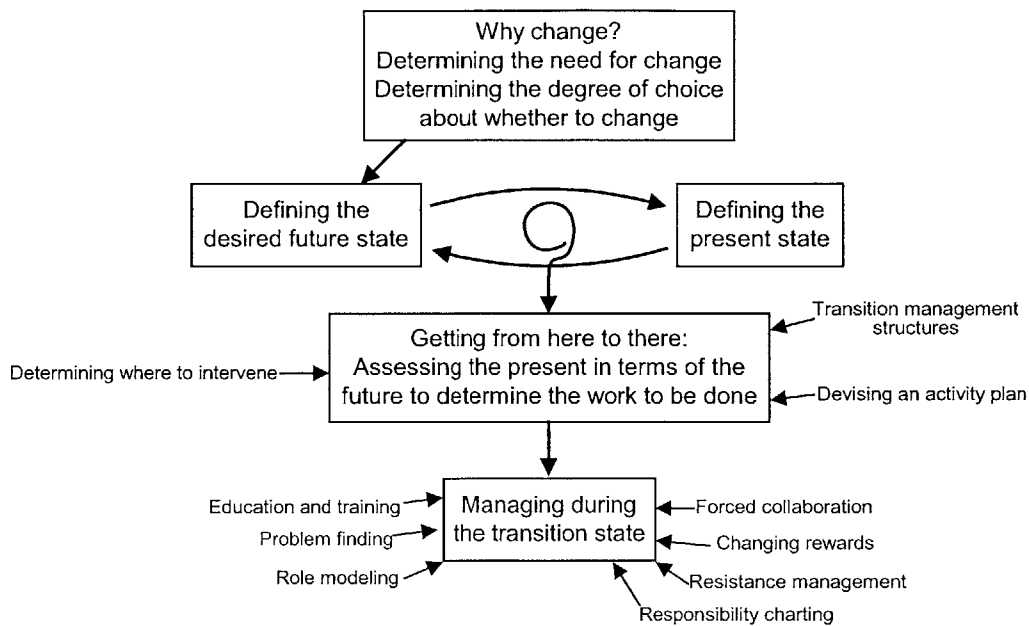


Figure 29: Managing the Transition³⁶

Summary

The preceding sections have described three different, yet complementary, approaches to designing and implementing change. Kanter's change wheel is a useful, holistic framework for developing the highest-level definition of a change initiative. Her seven skills for change masters describe the attributes of good change agents in a manner that is consistent and complementary to the change wheel. Klein's Outsider-Insiders embody Kanter's seven skills and provides specific implementation guidance and a process for building a critical mass of talent within an organization. Klein also bridges the gap between strategic change design and actual implementation by pulling opportunities for change into the organization through a network of Outsider-Insiders at the working level. Finally, the work of Beckhard and Harris provides a procedural framework for determining the requirements of change and defining the subsequent details. The combination of these approaches provides a holistic model that contemplates the where, why, what, when, who and how, which is necessary for the design, integration and management of complex, enterprise-level change, starting with earliest definition of the

change and systematically progressing through each successive planning and implementation step leading to true and lasting enterprise-level change.

Building the Case for Change

To affect real change, a clear, compelling case for change must be constructed. The analyses should be straightforward enough to be readily explainable, yet provide reasonable representations of reality using existing data, where possible, and *a priori* assumptions as required. However, the case for change must be packaged in a manner that enables clear communication to all involved constituencies at an appropriate level of detail. This section will describe the year-long process used to build the case for change at BIW through assessments of the internal and external realities and dynamics. This work was conducted by BIW's Strategic Planning and Communications Department, which has broad experience, expertise and internal and external visibility. The analyses presented are from this team's point of view as communications and interactions with other portions of the company are described. The section concludes with a discussion of strategies for communicating the case for change, establishing the required sense of urgency and evaluating organizational readiness for change.

External Influences

Changing Programmatic Priorities

As discussed in the *Naval Acquisition* section, the programmatic priorities within the Navy and the Department of Defense have shifted significantly over the past decade as officials have attempted to develop sustainable strategies and force structures in the interest of national defense. Gone are the days when a mighty blue water fleet was required to meet the foe on the high seas; missions of today's Navy are generally much closer to shore, requiring significantly different strategies and types of ships. Navy planners were moving in this direction prior to 2001, but September 11th and the ensuing wars in Afghanistan and Iraq have forced a further strategic revision.

While it is appropriate for the Navy to revise its priorities to meet evolving threats, the results of the dramatic shifts in spending patterns and force structure are extremely disruptive to the industrial base as it removes any semblance of workload stability. Shipbuilders base their business plans and workload requirements on potential future ship acquisitions. Since the number of ships ordered is relatively small and the prices are high,

any shift in scope or schedule has a dramatic impact on not only the affected building yard, but also to the industry as a whole.

Programmatic Assessment to Determine Likely Future Outcomes

The first step in evaluating any potential internal change was to assess all major known current and future external programs in which BIW may be involved. The most likely candidates would then be assessed for their internal impact. This assessment started as a largely qualitative exercise, but it quickly became evident that there were too many variables and opinions to draw meaningful conclusions without employing a more structured, holistic, systems view of the situation.

Defining the World

The first task in the analysis was to define BIW's world within the naval universe. This terminology was used to force the participants to broaden the way in which they thought about the future rather than focusing solely on the here and now. The criticality of appropriately defining the future was recognized by the strategic stakeholders, so it was decided to hold an informal joint off-site meeting of the strategic planning and senior program management organizations of BIW and Electric Boat, a sister division within General Dynamics Marine Systems. This approach ensured the broadest range of thinking, a healthy amount of debate and the group setting encouraged intellectual honesty. Also, the joint meeting employed the Outsider-Insider perspective even though this specific terminology or mental model was not used at the time of the meeting.

The primary objective of the joint meeting was to define all current and planned surface combatant programs, critical programmatic milestones, likely numbers of ships to be purchased, competition within each program and available funding. Compiling these data was reasonably straightforward among the participants of the meeting. However, developing the likely outcomes (e.g., program cancellation, competitive award, sole source award, etc.) and relative probability of one outcome with regard to the others proved to be problematic. Opinions varied widely in some instances and, despite vigorous, open debate, a clear consensus could not be reached.

The meeting was successful in completing its primary objective despite the lack of perfect information. An additional benefit of the meeting was the development of a top-down model using projected Navy ship construction funding and known strategic imperatives to validate the more rigorous, lower-level, programmatic assessment that would be conducted based on the data generated from the meeting. Total available funding for naval ship construction was developed using Navy projections tempered by historical trends. These projections were then allocated to types of ship, like surface combatants, aircraft carriers or submarines, in a similar manner to the high-level funding. The surface combatant projection was further decomposed into types and numbers of ships like DDGs, DD(X)s or LCSs. This model provided an upper limit as to how many ships by type the Navy could likely afford regardless of the stated need.

Developing Likely Scenarios

It should be noted that the author was a member of the BIW strategic planning team described above, and had primary analytic responsibility for the project. Consequently, it fell to the author to take the results of the off-site meeting and develop a rational set of likely outcomes for further in-depth analysis. BIW's world, as defined by the off-site meeting, had many variables and multiple levels of complexity. Consequently, qualitative development of scenarios based on intuition and personal biases was deemed too risky even though a quicker path to a solution. A rigorous systems approach was adopted employing decision analysis as the overall structural framework and Monte Carlo analysis to evaluate the uncertainty.

Structuring the Analysis

Based on the data from the off-site meeting, there were eleven major programmatic variables affecting BIW's prospects for future work and each variable had a variety of potential outcomes, e.g., program proceeds, program is canceled, or program proceeds but is delayed. An extensive decision tree was developed as shown in Figure 30 to organize the analytic effort. The tree is navigated by starting on the right side and following a path to an end node and then continuing on the left side until a terminal node is reached and all eleven variables with their attendant outcomes have been traversed. This decision tree has 2,592 different potential outcomes with varying probabilities of

with the potential outcomes was developed to simplify the complexity of the analysis for discussion with the stakeholders. Each major stakeholder from the off-site meeting was individually interviewed using this simplified and focused format to develop a relative ranking for each item. The following are typical questions for a given program from the interviews.

- Is outcome A more likely than B and far more likely than C? (Relative probability of outcome alternatives)
- Is the level of risk surrounding these outcomes perceived as high medium or low? (Uncertainty quantification band)
- Is the design's maturity considered high or low? (Uncertainty and schedule risk)
- Is this program included in the Navy's stated priorities? (Programmatic risk)
- Is Congressional support strong? (Programmatic and schedule risk)
- Is BIW leading or following in the program? (Uncertainty quantification)

The results of the interviews were two-fold. First, the interview format avoided the potential for the groupthink influence of a meeting setting, which could sway the assessment by each stakeholder through personal biases, hierarchical organizational pressures, and fractured presentation of information. Second, the relative rankings were easily translatable after the interviews into rough probabilities with an associated band of uncertainty surrounding each assumption. The terms probability and uncertainty were avoided in the interviews to ensure that people did not become fixated on the precision of the number while ignoring the accuracy of the overall evaluation.

Conducting the Analysis

The purpose of this analysis was to determine the most likely outcomes so that they could be more fully developed and evaluated for financial impact. It was not feasible to assign financial outcomes to each scenario, as is customary in decision analysis, since the time to complete the analysis would diminish its utility. Additionally, it was assumed the behavior of each major program was largely independent and mutually exclusive with regard to other programs. In reality, this is not entirely true, but the impact of the influence would add significant complication to the analysis without adding commensurate value to the fidelity of the outcome.

As with any strategic analysis, many of the data are speculative and there is significant uncertainty. To quantify the uncertainty of the analysis, a Monte Carlo simulation was performed on each of the 2,592 scenarios using the probabilities and uncertainty bounds derived from the series of stakeholder interviews. The results of the analysis were inconclusive as to establishing ten to fifteen of the most likely scenarios for further evaluation. However, the data were clear that some of the programmatic variables had little to no influence in the outcome as the relative outcomes were highly skewed in a single direction. Consequently, the highly unlikely scenarios were eliminated and the decision analysis was condensed to 186 scenarios without fear of elimination of likely scenarios. (See Figure 31.)

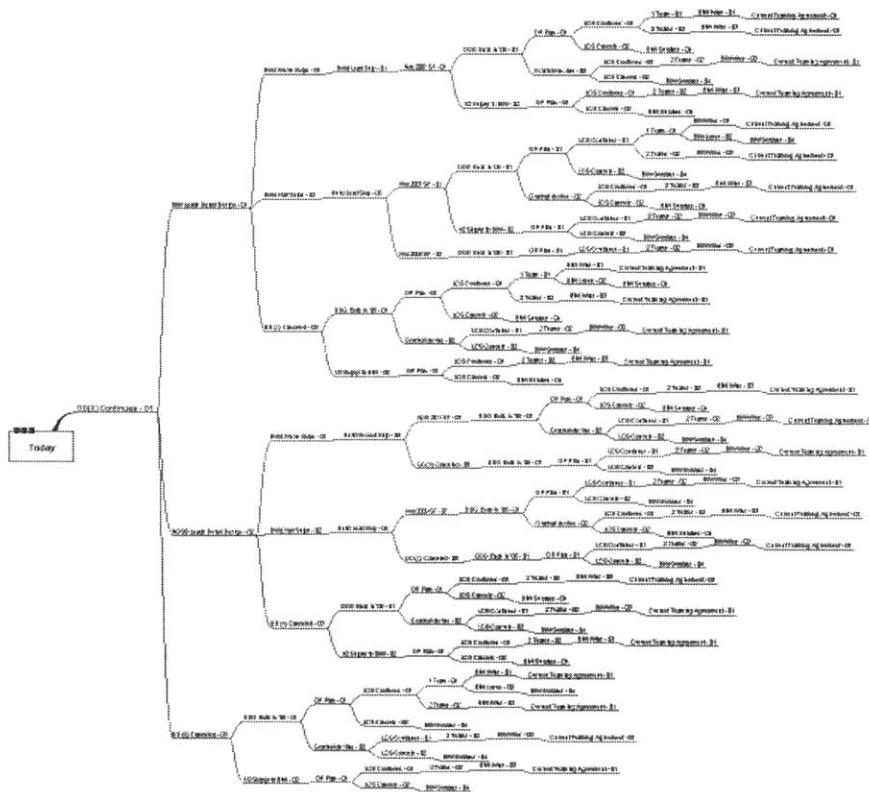


Figure 31: Consolidated Decision Tree of Programmatic Outcomes

Further analysis of these 186 scenarios showed that the top fifty represented approximately seventy-five percent of the likely outcomes, which led to a high level of confidence. (See Figure 32.)

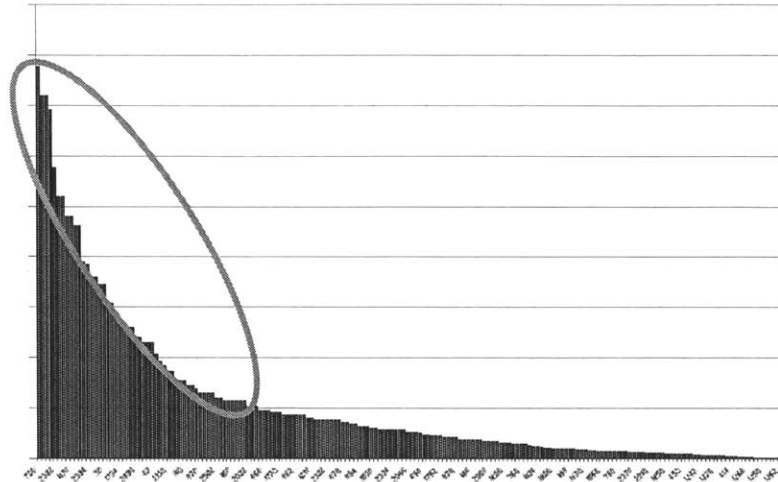


Figure 32: Distribution of Likely Outcomes

It was determined that the top eighteen scenarios within the top fifty were the appropriate for further evaluation. The top eighteen outcomes represented a majority of the expected outcomes and the uncertainty, as illustrated by the error bars, showed significant overlap within the top eighteen, but reasonable separation from the other scenarios. (See Figure 33.) It should be noted that several scenarios were consistent with intuition, but there were some likely scenarios that were not initially considered.

The final step was to use the previously described top-down model to ensure that none of the derived scenarios violated the top-level funding requirements and strategic imperatives. This evaluation caused several of the scenarios to be discarded as they represented stated Navy intentions but had a very low likelihood of receiving sufficient funding. Additionally, this straightforward model reinforced the results of the analytic investigation and was readily understandable by those that did not wish to fully understand the more detailed analysis.

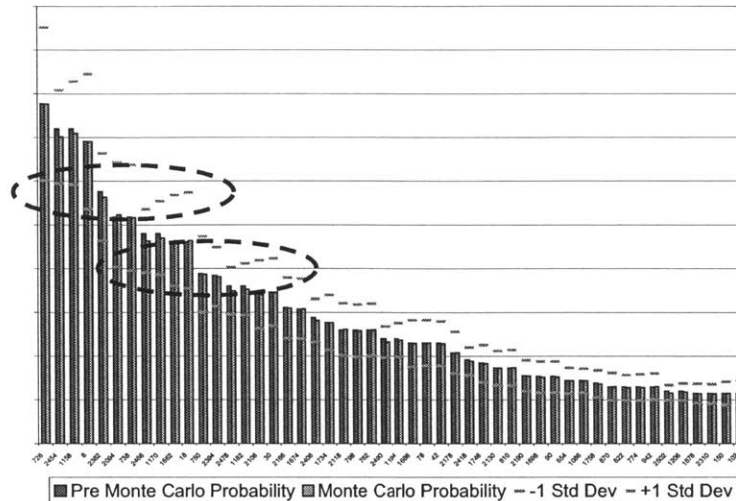


Figure 33: Final Scenarios for Analysis with Uncertainty Quantification

Final Results

The systematic process described above was simplified for presentation to the primary stakeholders, principally a subset of BIW’s senior management, to give them visibility into the process and to become comfortable with the results. The stakeholders agreed with the results of the analysis, which was of primary importance. However, the secondary effect was almost as important. This analysis applied a systems approach to a very complex situation where analysis had traditionally been qualitative and fractured. The analytic results from both the top-down and bottom-up analyses helped give clarity to the situation and, in the process, were able to dispel some false hope, force recognition of some painful facts and begin building a foundation for change based on a logical series of facts and well-founded assumptions. The analysis also provided the guiding parameters for assessing likely financial outcomes and resource requirements for each of the most likely scenarios.

For the purposes of this document, the relevant results of this analysis are that BIW will finish building the ships of the DDG 51 Class on schedule and the next major construction program will be DD(X).

Internal Influences

The results of the external programmatic assessment were then assessed for their impact to BIW, largely in terms of workload and financial outcome. As previously noted, people and their unique skills are the essence of shipbuilding; however, they are the most variable and costly recurring portion of the business. Consequently, most internal analyses are conducted in hours or equivalent people (EQP), representing the effort required to accomplish the scope, with a goal of producing a predictable and manageable resource profile by trade that fits within the capacity constraints of the facility. Unfortunately a flat or increasing workload is not always possible and dips are often induced, however, workload predictability is an essential component to preserving critical skills and being able to make solid business planning decisions. Material and purchased equipment are certainly important, but are not primary drivers when assessing future prospects as it is generally assumed that the material will be available for purchasing in a timely manner somewhere in the world. The purpose of this section is to strengthen the case for change through the translation of exogenous factors into terms and analyses that are internally understandable and appropriate. It is far easier to embrace change when the impacts are presented in the context of day-to-day realities using simple, familiar vernacular. The secondary purpose of this section is to use data to dispel common misconceptions and excuses. The section is segregated into Facilities, Processes and People as these are the three primary internal drivers. Figure 34 below shows the mapping the process flow, presented in the *Process Flow* section, to these broad categories. As noted above, purchased material is assumed to exist from external sources and is excluded from this portion of the evaluation.

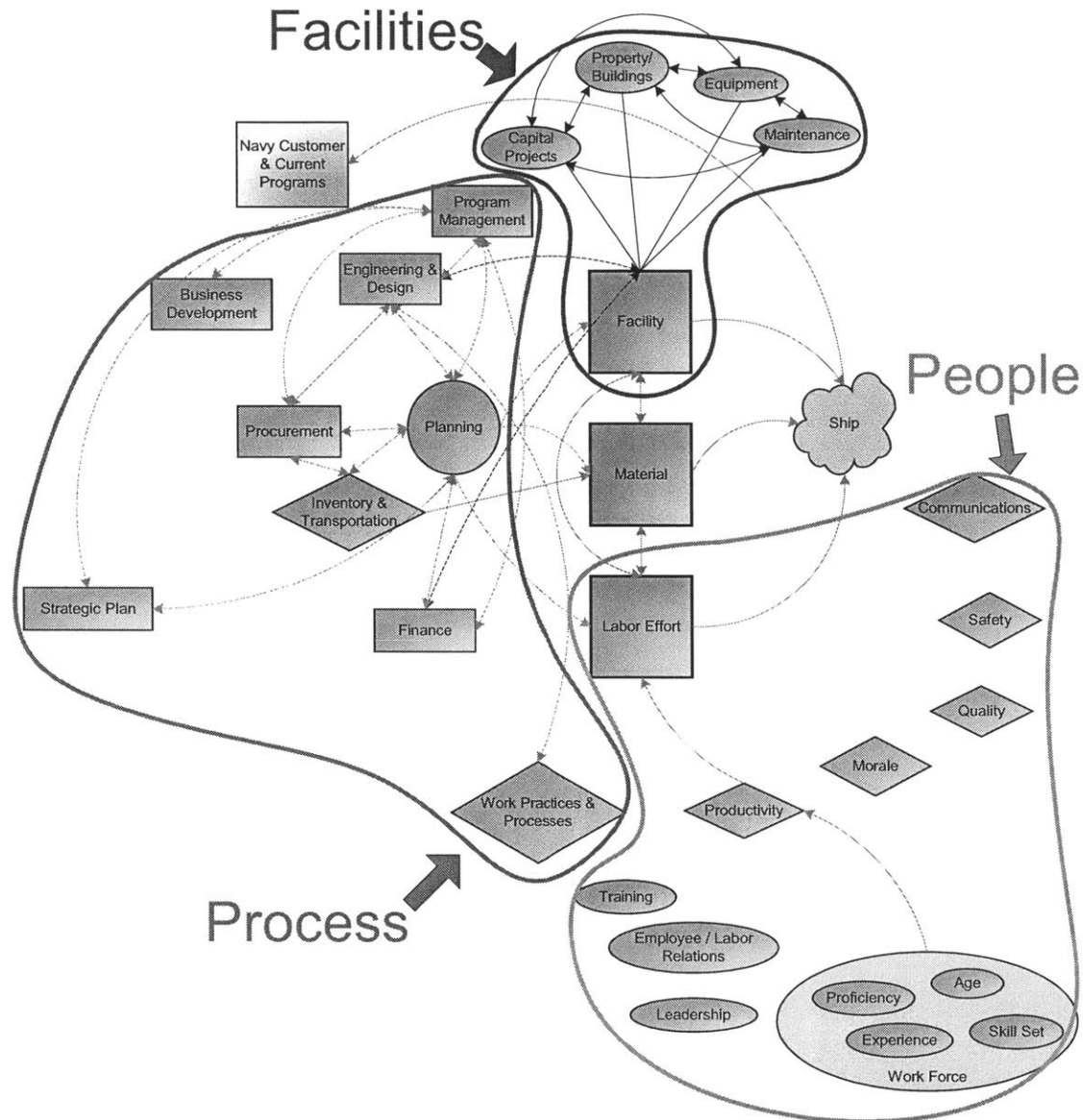


Figure 34: Facilities, Processes and People

Facilities

Barriers to entry in defense shipbuilding are traditionally high because military ships are among the most complex, largest, self-sustaining manufactured products in the world, requiring substantial, sustained investments in personnel, property and plant. Consequently, any discussion surrounding change at BIW generally begins with a facilities analysis to assess the available capacity and capital expenditure requirements.

A capacity analysis must contemplate all aspects of the physical plant required to construct a given type of ship and generally assumes labor will be available with skills consistent with current practice unless there are new or different processes requiring alternative assumptions. Some factors considered in the capacity analysis are as follows.

- Maximum allowable ship dimensions as driven by river navigation and Land Level Transfer Facility constraints
- Maximum crane lift capacity in each portion of the facility
- Door dimensions in various production buildings
- Number of available construction stations
- Special tooling requirements
- Weight restrictions including maximum capacity of building floors
- Proportion of structural scope to outfitting scope (BIW's facilities and workforce are heavily biased toward heavily-outfitted complex surface combatants vice largely empty commercial ships)

The capacity analysis identifies potential bottlenecks in the facility, shows the strengths and weaknesses of the facility, as compared to the ship's construction requirements, and helps define the requirements for capital expenditures. The capacity analysis conducted to assess the construction requirements for the DD(X) class of ships identified some required capital improvements to build the design efficiently, but the facility was judged to be adequate overall.

Capital improvements generally require large outflows of cash and require corporate approval, so they tend to receive significant scrutiny. The DD(X) Program will require some capital expenditures, but the impact of the annual expenditures on the overhead budget is far less than the overhead associated with the workforce. In the context of this largely people-centered change initiative, this finding is significant since it removes ambiguity and focuses attention toward the workforce and away from the potential distractions and excuses associated with capital expenditures.

Processes

As illustrated in Figure 34, a wide range of industrial processes of various kinds influence virtually every aspect of ship construction and are critical to a successful outcome. Processes include design, manufacturing and planning processes in addition to work practices and instructions. This is a large grouping of seemingly diverse elements, but

each element must be logically decomposed or integrated with other elements within the system. For example, planning processes drive the order of construction, which, in turn, drives engineering practices and, ultimately, construction work practices and instructions, not to mention procurement specifications and material delivery requirements. Even a casual analysis of Figure 34 leads to a conclusion that Planning and the area designated as Process govern the functioning of the entire business. Optimization of existing processes can incrementally improve business performance while radical changes can offer the prospect of transforming business performance at the risk of throwing the business into absolute chaos if improperly managed.

As discussed in the *Business Model* portion of the *Industry Overview* section, the ship design and construction cycle is measured in years so fully implementing change and obtaining quantifiable results requires long-term commitment, sustainability and patience. This reality is exacerbated at BIW by the large number of ships in the DDG 51 Class of destroyers. The price of a ship is dictated by its position on the class' learning curve with adjustments made for customer-directed change. In other words, the more ships of the same class that are built, the cheaper they should be. However, following a learning curve presumes a stable, repeatable process. Any changes can introduce significant disruption to the construction process and erode or erase profitability in a quest to become more efficient. Consequently, introducing radical process changes late in the construction life of a class must be done with caution and in consultation with the customer. With the full-support of the U.S. Navy customer, BIW inaugurated its new, world-class Land Level Transfer Facility in 2001, as described in the *Facility and Process Description* section, requiring a complete process overhaul and creating the potential for significant disruption throughout the entire system. The transition was managed successfully and the new facility is beginning to produce cost, schedule and process dividends; no additional, large-scale process changes are not anticipated in the DDG 51 Program as the final ships are constructed.

The transition to the DD(X) Program will provide a unique opportunity to apply new, more efficient processes while incorporating the lessons learned from the transition to the LLTF. The beginning of DD(X) production will be BIW's first new construction program

since the DDG 51 construction program began in 1987. One of the largest process changes is likely to involve Material Requirements Planning (MRP). A shipyard lives and dies by the MRP system that controls the scheduling of work and material from the time the information is initially extracted from the engineering models, to the cutting of steel, to the installation of the components at various construction stages, to the final outfitting and completion of the ship. The core of BIW's current MRP process has been in use since the beginning of the DDG 51 Class and has performed well, but the technology employed in the design and construction of DD(X) will require a more robust system with significantly enhanced capability, control and integration with other systems.

Developing the work breakdown structure and appropriately sequencing work at each stage of construction for a warship is an extremely complex undertaking, involving the integration of thousands upon thousands of details. Yet this is absolutely critical to generating work paper to enable efficient construction of a new class of ships. The system must be rigorous, repeatable and highly-automated. As a point of reference, a typical DDG 51 Class destroyer has over one hundred thousand work orders associated with its construction and the number is projected to be significantly higher for the DD(X) Class. Given the criticality and magnitude of this task, the new process and associated data requirements must be established before detail design begins in mid-2005 so the Product Data Manager (PDM) can be structured appropriately. Subsequently, the new MRP platform needs to be chosen and piloted in parallel with the current system so that it may be customized to BIW's requirements and stabilized, which is anticipated to take several years. First-of-class ships have unforeseen issues regardless of the supporting platforms, so the maturity and stability of the tool and associated processes is important to eliminating a source of potential disruption.

While the previous discussion addressed the highest-level process drivers, there are significant lower-level processes that will have to be realigned or developed in response to these higher-level changes and evolutions in technology. The technologies aboard DD(X) will have new and different skills requirements and construction procedures than are currently employed today. For example, the combat system will require more

electronics test and integration support than is required on today's ships. These requirements will drive new trade classifications and more detailed work instructions.

Some technical process changes will be required for DD(X) construction, as described above, while others are highly desirable to make shipbuilding at BIW more competitive. Changes to process and corporate culture must be contemplated together as they inextricably linked. Process changes must be accepted by the culture to be effectively implemented, while culture change requires processes to be aligned with the new behaviors. These changes will require years of prior planning and introduction to the workforce with requisite training in a manner that is congruent with the culture.

People

In his book *Who Says Elephants Can't Dance?*, Louis Gerstner, former CEO of IBM, states that "In the end, an organization is nothing more than the collective capacity of its people to create value."³⁷ The product lines of IBM and BIW could not be more different, but this statement is no less true at BIW. Shipbuilding has always been, and will continue to be a very specialized craft. These skills range from the technical ability to design the ships to the craftspeople required to form steel into ship's structure to the delicate work of installing the sophisticated electronics of the combat systems. Military shipbuilding is a labor-intensive enterprise that is not conducive to significant automation. Many of these skills are not found in any other industry and take years to master. Any change initiative must fully contemplate the dynamics of the system and have a plan to address them prior pursuing a course of action. The discussion of people will be segregated into *Critical Skills Retention* and *Cultural Change in a Changing Environment* as these are the two major dynamics at BIW.

Critical Skills Retention

The shipbuilding industrial base is approaching a point similar to that experienced by the aerospace industry during the nineteen eighties and nineties – a majority of the workforce will be eligible for retirement in the next decade and the demand for the product is decreasing. The problem exists at BIW in both the union and non-union environments, but preserving these critical skills is a more significant challenge in a seniority-based

union environment as there is limited decision-making ability because of contractual obligations. Also, the majority of BIW's employees are unionized and engaged in the core business of ship construction, so the analyses presented will focus on core manufacturing critical skills but similar analyses are required in other realms, like engineering. BIW's relative geographic isolation must also be considered, since Maine does not have many other major industries requiring technical or manufacturing skills similar to those of BIW. Consequently, there is no cushion from resource fluctuations among similar industries and no other source of skilled craftspeople.

Critical Skills Definition

Any discussion of critical skills preservation requires a succinct working definition to eliminate ambiguity. Initial internal critical skills research indicated significant variance as to what were and were not critical shipbuilding skills and how they should be defined and evaluated. The following definition and factors for evaluation were developed.

Critical skills are those trades unique to shipbuilding that require time to gain skill and proficiency and may or may not require certification from the Navy or another entity. Critical skills must support core shipbuilding capabilities (e.g., custodial services are important but not core shipbuilding capabilities whereas shipfitting is a core capability). Some skills may not strictly fit these two criteria, but may be considered critical if those skills are not obtainable in external job pools and must be developed internally. Finally, the population distribution of critical skills must be congruent with the product line. For example, boilermakers were once a critical surface combatant shipbuilding skill but the demand for their skills disappeared over time as steam systems were largely eliminated in favor of gas turbines or diesels.

Factors for evaluating critical skills are as follows:

- Core capability – Does the trade meet the definition presented above?
- Cost to rebuild – What is the cost to rebuild the skill through hiring or training if the skill is allowed atrophy?
- Training capacity – What is the internal or external capacity to rebuild or enhance the skill? Do the projected demands outstrip the capacity to produce proficient mechanics?

- Geographic influence – Are the skills or similarly trained individuals available in external pools within a reasonable radius?
- Outsourcing – Is the skill or scope a candidate for outsourcing to a subcontractor?
- Workforce reaction – What is the likely reaction to any policy change by the workforce? Can a compromise be negotiated? Will the secondary impacts overtake the benefits?

The following trades were determined to possess critical shipbuilding skills. This partial listing of shipbuilding trades does not diminish the importance of trades not on this list, but those not listed did not meet the critical skills definition or evaluation criteria and are considered easier to replace or reconstitute.

Table 1: Critical Shipbuilding Skills

- | | |
|----------------------|-------------------------|
| • Electricians | • Ship and Yard Riggers |
| • Insulators | • Shipfitters |
| • Outside Machinists | • Tinsmiths |
| • Pipefitters | • Welders |

Critical Skills Modeling

Government and industry have been concerned about critical skills retention within the shipbuilding industrial base for the past decade and several industrial base studies have been conducted. These evaluations recognized an impending problem, but were always qualitative, so the sense of urgency was never fully established. In 2003 the U.S. Senate directed the Navy to conduct another surface combatant shipbuilding industrial base study with emphasis on retention of critical manufacturing skills. In the course of providing input to the study, a model to quantify the effects on critical skills was developed by BIW.

The goal of the model was develop an accurate, yet simple representation of the future using existing data with minimal assumptions. The audience for these data was senior Navy and industry officials, so it was important that the information be directionally correct and easily explainable over a span of workload scenarios. Figure 35 illustrates the basic model architecture. The model was constructed around three basic inputs. First, the anticipated manufacturing workload, provided by Resource Planning, established anticipated staffing requirements for the future. Second, discrete baseline demographics for the workforce by trade were developed using appropriately sanitized data from

Human Resources. Finally, assumptions and rules to guide the analysis had to be established. The workload, as provided, was in equivalent people, representing the effort required to accomplish the work not the actual number of employees, so assumptions for lost time (vacation, sick time, jury duty, etc.) and overtime were applied based on recent historical data to convert the EQP workload to people on the payroll. The model then iterated the resource requirements of the workload with the available resources in the workforce within the confines of the rules and assumptions. An average manufacturing retirement age was established based on historical data, so individuals were taken off the roles once they reached that age. Layoffs were conducted by seniority by trade per the union contract. New hires were assumed to enter the workforce with no experience at an average age consistent with current hiring experience. Historically, voluntary attrition has been relatively low at BIW, so no specific adjustment was incorporated. It was assumed that retirements and layoffs would capture the major effects of attrition. This allowed a demographic profile of the manufacturing workforce to be developed by year by trade.

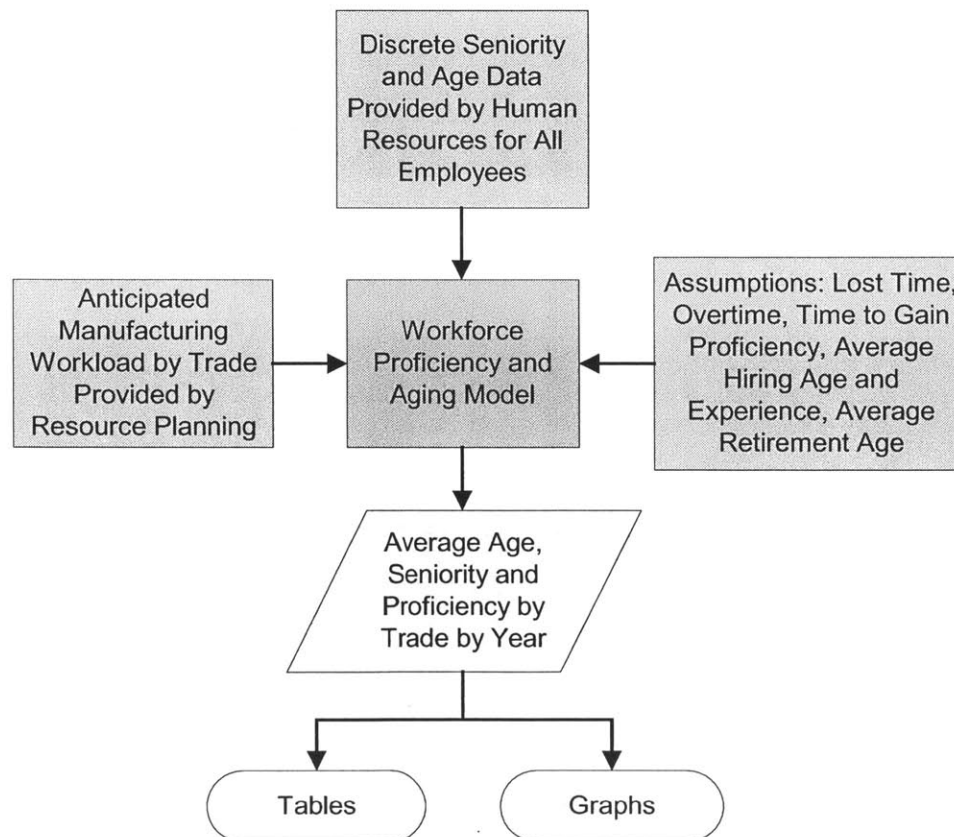


Figure 35: Critical Skills Model Architecture

Assessing the proficiency of the workforce and the subsequent impact on critical skills proved to be a more difficult matter. BIW has been able to adapt to the declining U.S. Navy shipbuilding workload largely by attrition over the past decade with modest hiring and few layoffs. Consequently, the workforce was assumed to be fully proficient at this time. The time to gain proficiency was not a metric that had been rigorously tracked since its impact was negligible at the working level given the low rate of hiring. Qualitative interviews were conducted with various levels of manufacturing management to assess training requirements, both formal and on-the-job, time required before being allowed to work alone, etc. on a trade by trade basis. The data gained through these independent interviews correlated very well and were easily manipulated to develop a proficiency-over-time curve. These rules were then added to the model to show the effect of retirements, layoffs, and hiring on proficiency. No attempt was made to dynamically adjust the workload for the variations in workforce proficiency, but it was acknowledged to be a significant factor to be incorporated in the future as a valuable means for assessing cost and schedule risk. The lowest acceptable overall proficiency within a trade was established and was used to quantify the impact on critical skills retention. These data could then be aggregated by area of the shipyard or to the total manufacturing level. It was found that graphs of proficiency and average age and tables showing ratios of experienced personnel to inexperienced personnel were most effective in communicating these data. (See Figure 36 and Table 2.)

The multi-year “tax” new hires placed on proficiency, compounded with significant retirements and a dramatic swing in anticipated workload, produced some surprising results. The data indicated that the average age of the workforce will increase by seven years over the next five years – a previously unrealized and disconcerting statistic with significant medical cost and productivity implications. Also, there are currently almost six times as many manufacturing employees over the age of fifty as there are under the age of thirty, which is a staggering statistic by itself but also represents the standard deviation implicit within the data. It was found that presenting the data in these sorts of formats “humanized” them and made them readily understandable instead of becoming mere dull statistics.

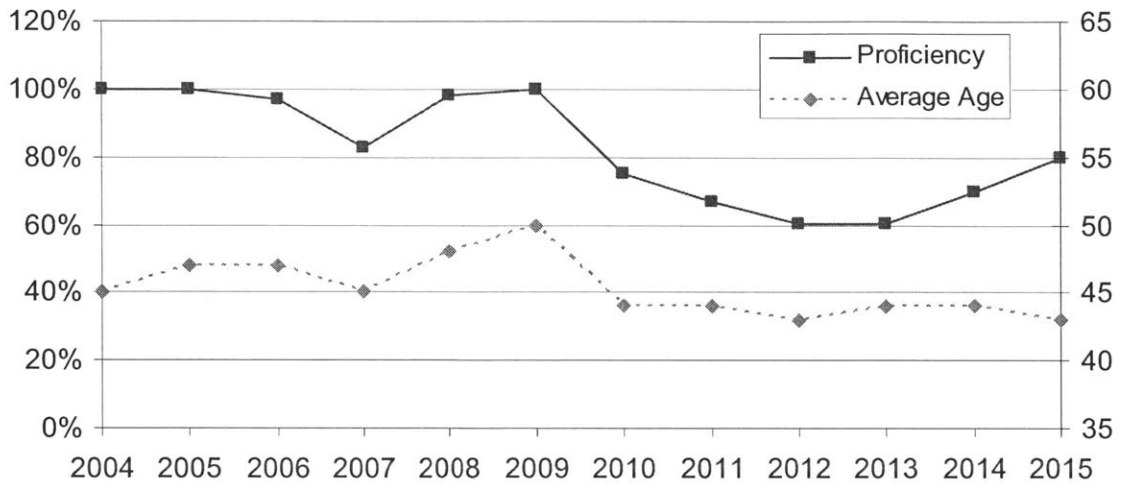


Figure 36: Sample Workforce Aging and Proficiency Chart

Table 2: Sample Workforce Aging and Proficiency Table

	Experienced Workers : Inexperienced Workers			Average Age			
	2004	...	2015	2004	2009	Change in 5 Years	>50:<30
Electricians	X:Y	...	X:Y	Z	W	5	1
Insulators	X:Y	...	X:Y	Z	W	7	1
Outside Machinists	X:Y	...	X:Y	Z	W	4	1
Pipefitters	X:Y	...	X:Y	Z	W	3	4
Ship & Yard Riggers	X:Y	...	X:Y	Z	W	10	2
Shipfitters	X:Y	...	X:Y	Z	W	5	1
Tinsmiths	X:Y	...	X:Y	Z	W	14	1
Welders	X:Y	...	X:Y	Z	W	5	1
Total Manufacturing	X:Y	...	X:Y	Z	W	7	6
Total % Proficient	97%	...	60%				

The primary purpose of the model was to quantify the impact on critical skills of workload variations and an aging workforce. However, the analysis also highlighted additional challenges that will face BIW in the future, namely large fluctuations in the workforce through retirements, layoffs and hiring. The need to train significant numbers of manufacturing workers in the future was quantified and clearly is beyond BIW's recent experience to accommodate internally, so innovative solutions need to be pursued. A likely candidate would be through a partnership with the state technical college system.

In summary, the modeling of critical skills quantified the demographic and critical skills challenges BIW will face during the transition from the DDG 51 Program to DD(X). The results were presented in several ways depending on the anticipated audience in an attempt to convey the impact beyond a series of statistics. The analysis also highlighted the need to plan for knowledge transfer and retention as the workforce ages and a majority prepare for retirement. This reality coupled with an anticipated dip in workload prior to the start of DD(X) construction will require significant hiring and training in the future. The preceding analysis addressed the manufacturing workforce, but the same trends are present within the salaried workforce (e.g., engineering, management and support).

Cultural Change in a Changing Environment

The preceding section addressed the workforce in an abstract, analytic manner, which is important but considering the workforce as individuals, functioning in the context of the prevailing culture, is certainly as important. The best-laid plans can be quickly derailed if change is not introduced in a manner that is culturally acceptable. As described in the *Bath Iron Works Overview* section, a contentious relationship between labor and management has existed for several decades. There has also been a significant amount of turbulence within senior management's priorities. BIW's future success is dependent upon successfully bridging the transition between the DDG 51 and DD(X) Programs and implementing significant process changes to enhance its competitive position. This transition would be difficult under the best of circumstances, but without a significant level of trust and cooperation between labor and management it will be nearly impossible.

As previously described, BIW's future is uncertain and largely governed by exogenous factors beyond its control. Uncertainty unsettles people making them more risk averse as they attempt to cling to the certainty of the present because the future is full of unknowns. Changing a company's culture is typically a long and painful process rarely occurring under ideal circumstances. Cultural change introduces a certain amount of vulnerability and risk for all involved as "new ground" is explored together in an attempt to build a healthier and more secure future. Attempting cultural change during periods of

uncertainty can reap tremendous rewards, as opportunities to introduce change are the greatest and the sense of urgency is already established. However, the risk of failure increases as well due to increase vulnerability of the organization. Failure to achieve successful cultural change can be catastrophic if the effort is improperly implemented or not sustained. This has been recognized at BIW and efforts are already underway to change the company culture in advance of taking on tactical process and programmatic changes. Efforts to date and early evidence of change are described in the *Compelling Communication* section. These ongoing changes must be intensified, better integrated, sustained and accepted by all constituencies so that the conditions for future transformation can be created. Gerstner best summarizes these sentiments when he wrote: "in the end, management doesn't change the culture. Management invites the workforce itself to change the culture." He went on to say "We all had to talk openly and directly about culture, behavior, and beliefs - we could not be subtle,"³⁸ which further reinforces the need for trust and mutual respect within the process.

Change in a traditional, hierarchical environment is generally driven from the top. Significant time is spent coalition building and communicating at the highest levels, but the task of actual implementation falls to the frontline supervisors (FLSs). While it is incumbent upon senior management to negotiate policy with the collective bargaining units, it is up to the FLS to achieve the results. This large, senior group, largely drawn from the blue collar ranks for their specific shipbuilding expertise, has seen so many initiatives come and go over the decades that they are unwilling to jump onto the band wagon without some sort of proof that this is not a "program du jour." The daily, core-business requirements on the typical FLS are ever increasing, which leaves little time to support initiatives that don't appear to help "send ships down the river." There is a prevailing attitude that "this too shall pass if I just wait long enough." Management resistance is present higher in the organization too, but these attitudes have begun to change as information regarding the objectives of the change and the changing external environment has been more intensely communicated. This attitude is not unique to shipbuilding and has no easy solution.³⁹ Actions to change this attitude are described under *Workforce* in the *Compelling Communication* section below.

The demographics of the FLSs are both barriers and enablers to change. Large-scale retirements of the most entrenched within the population can enable change by infusing new ways of thinking as new FLSs are added. Additionally, new additions within the manufacturing middle management ranks have tended to be open-minded, technically astute individuals, such as engineers, with managerial experience rather than blue-collar roots. There are also potential risks if there are too many simultaneous retirements and core shipbuilding competence is lost, or if the new management is rejected by the workforce for being perceived as a group of “college boys and company men” that don’t understand how ships are actually built.

Compelling Communication

The various analyses and issues cited above only provide the most general overview of the complex environment in which BIW operates. The company has multiple constituencies, each with different biases and informational needs that must be addressed in building support for change. Communicating a common understanding of the most important internal and external facets of the environment, in a format appropriate to the audience, is a key challenge to building the case for change. Actually achieving change requires a well-structured plan supported by firm commitment and integrated efforts of the entire enterprise. The following paragraphs describe how BIW will simultaneously use top-down (senior management) and bottom-up (workforce) approaches to implement a plan for change drafted by the Strategic Planning and Communications department.

Strategic Planning and Communications

BIW’s Strategic Planning and Communications department has been the primary architecture and analysis team for this far-reaching change initiative. This team is well positioned given their broad access to BIW senior management and knowledge of internal and external forces affecting BIW. Additionally, this team brings a tremendous diversity of knowledge and experience of BIW and the shipbuilding industry. A key challenge in building the case for change was to extract the multiplicity of opinions and issues offered by the team over an extended period. The author found mind mapping to be an effective means of capturing the information and eventually logical groupings and a

natural hierarchy emerged.^{‡‡} This exercise assured team members that their input was being captured and a foundation of consistent understanding was built.

The author was considered to be the “resident academic” on the team given his current standing as a student with links to academic resources, so part of his function on the team was to communicate current change methodologies, theories and structures, relevant scholarly papers and best practices from case studies. Ideally, this communication would be a healthy flow of information to the rest of the team, but it is not reasonable to expect all team members to have time to read each article, book or paper. Consequently, the author developed a database summarizing relevant facts and findings of case studies to which the entire team had access. Books and papers were similarly handled – the key findings were summarized and distributed to the team members. Papers of interest were available to those members that desired deeper knowledge. Occasionally, some items were sent as “must reads,” but these were limited so as not to diminish their impact. Finally, the author successfully introduced the principles of systems thinking and change management whenever possible to teach members of the team the fundamentals and to engage their interest.

The result of these various efforts over time was to build a strong coalition with a common understanding and language that injected knowledge of BIW and industry practice to create an integrated vision for BIW in the future with the required interim steps. Another challenge for this team was to successfully and succinctly communicate their findings to the president and his direct reports, so they could take informed ownership of the initiative and drive the process from the top as has been customary in BIW’s hierarchical environment.

Senior Management

Dugan Shipway, BIW’s president since April 2003, is the linchpin to enterprise-level change. Shipway is an enthusiastic supporter of change at BIW and has been actively

^{‡‡} Mind mapping is means of organizing, displaying and managing a large variety of information quickly and easily in an intuitive graphical manner.

identifying BIW's opportunities and challenges to allow change to be pulled into the organization since his first day on the job. The work done by Strategic Planning and Communications has provided verification of Shipway's intuition, in some cases, and has provided the next level of detail in others. Shipway's change actions to date have begun to incubate cultural change, but full engagement and integration among the various divisions is required if the change is to become lasting. However, as with most companies, BIW's senior management tends to be fully engaged in the daily operation of the business with its attendant challenges; the effect of which is twofold. First, the group doesn't have the time to get together as a team as often as required to think about BIW as a systems issue and how to address change systematically. Second, it is very difficult to disengage from daily pressures and think innovatively about five or ten years in the future. This is where Strategic Planning and Communications adds value by providing a staff function to senior management. The challenge is communicating the detailed analyses and recommendations in a clear and unambiguous manner to the higher-level decision makers.

Strategic Planning and Communications traditionally conducts three annual off-site strategic planning meetings with BIW's president and his direct reports. Each meeting has a recurring generic theme with specific content developed based on current business issues. It was decided to change the format and dedicate an off-site to begin developing a roadmap for change. The purpose of the off-site was to lay out the case for change in specific detail to assure common understanding, brainstorm courses of action and develop a high-level framework for planning and implementation.

One of the primary communications vehicles developed by Strategic Planning and Communications was a single sheet nicknamed the Dottie Chart^{§§}. (See Figure 37.) The Dottie Chart was developed to provide a time-phased view of the most significant driving

^{§§} Dottie was the name of the asteroid threatening Earth in the 1998 film Armageddon. It was so named after the asteroid discoverer's wife since he considered her to be "vicious ... from which there is no escape." Although an unorthodox title, the Dottie Chart was conceived with similar sentiment and purpose and was so named by a member of the Strategic Planning and Communications team.

factors for use with senior management. The purpose was to provide enough data upon which to make decisions without being overwhelmed. This fact-based, compact data display helped dispel some commonly held beliefs and misconceptions that were traditionally used as reasons for maintaining the status quo, without assessing blame among the senior staff.

Bath Iron Works
A GENERAL DYNAMICS COMPANY

Representative Data Only

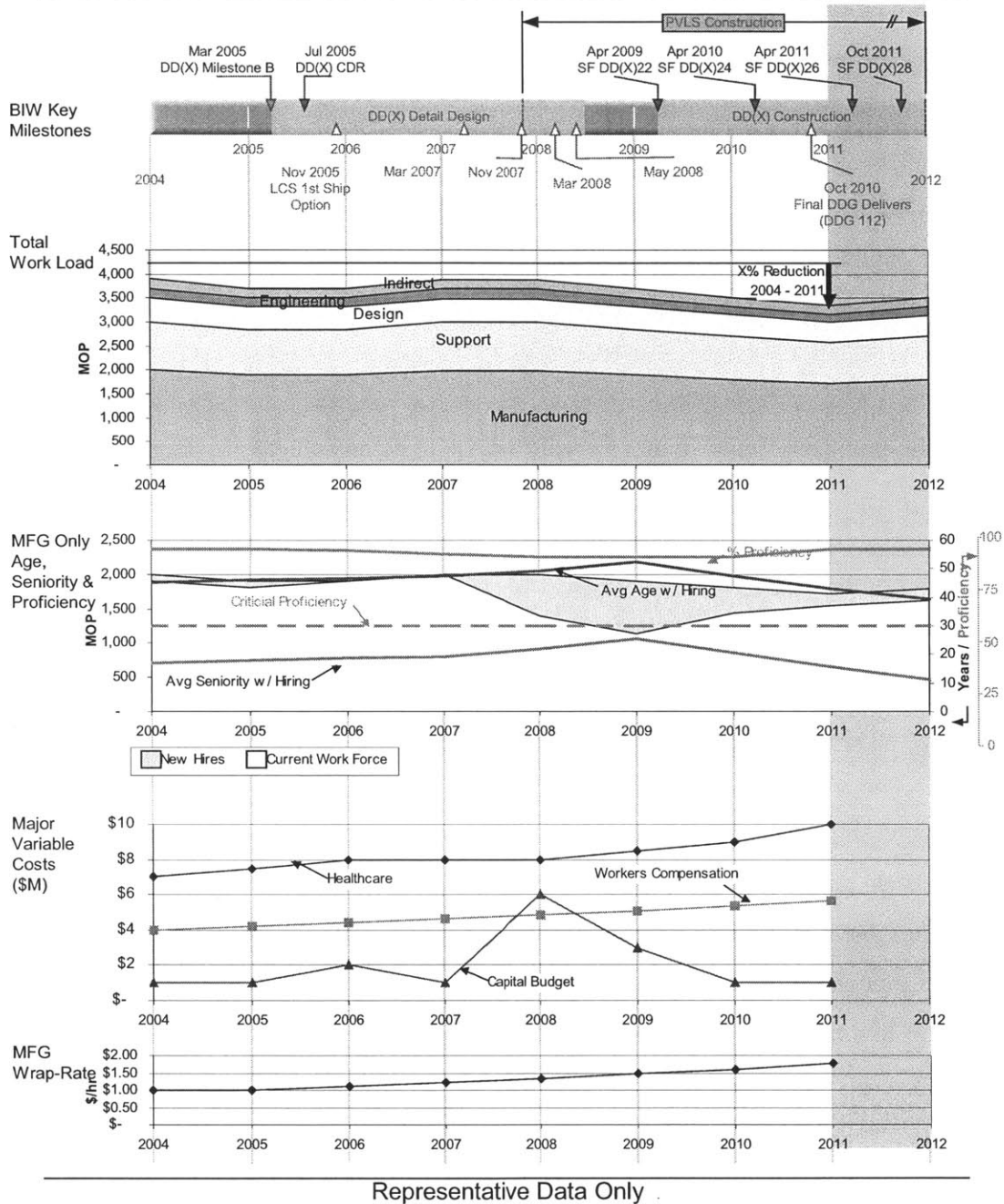


Figure 37: Representative Dottie Chart

Workforce

Significant efforts at all levels of the organization have been made to improve communications with the workforce during the past year over a broad spectrum of topics ranging from safety and business performance to employee recognition and charitable events. As with most initiatives, there have been varying degrees of success. This effort has been significantly enhanced by the decision to reorganize the Communications department approximately a year and a half ago and merge it with Strategic Planning. This move integrated the research and analysis capability with the information dissemination function yielding an integrated communications strategy focused on three basic goals:

- Reduce the number of labor hours to build DDGs to equal or beat any shipyard in the country
- Treat each other with dignity, act with integrity and use good old Maine common sense
- Have a workplace environment where every worker goes home from BIW in the same condition they arrived at BIW

These three goals address BIW's three most pressing internal challenges and have formed the foundation of most communications with the workforce. Reaction to the message has been positive and evidence of acceptance is being observed. Casual man-on-the-street interviews have shown that a majority of employees can recite the goals and can see varying levels of progress toward reaching these goals. For example, BIW's lost-time injury statistics have improved by almost thirty percent over the past year. Also, the language and themes of the three goals are routinely included in communications among various groups at various levels within the company.

Additional communications tools include a focus on people and their accomplishments in the company newspaper instead of just the product; the addition of "From the Helm", the president's monthly column addressing a timely topic; structured and sustained communication vehicles for items of interest and policy; and regular e-mail messages to all employees by the president. Each type of communication is provided in an appropriate medium to each constituency. For example, e-mail is most appropriate for office workers, while paper is more appropriate for manufacturing employees onboard the ships.

There has been enhanced dissemination of knowledge at lower-levels in the organization through increased staff meetings and divisional communications plans. Regular meetings are held within each manufacturing area to better inform the workforce about the technical, budget and schedule performance of their portion of the business, the company and the industry as a whole. Communication has been recognized as being important and implementation is beginning to follow.

As previously discussed, front line supervisors are the key to success since they are the workforce-management interface functioning as mentors in addition to leaders and managers. In an attempt to build the case for change among the FLS population, Shipway has instituted a recurring series of meetings called “What I See”. The road show targets every FLS and manager in the company in groups of twenty or thirty and they have been held for all three shifts in locations in or near their work areas. The meetings focus on BIW’s performance as a company against the three basic goals, BIW’s position in the industry and actions by the customer and Congress. After Shipway’s presentation, the divisional vice president has an informal session with the attendees to discuss what they just heard and how they fit into the overall picture. The objective of the meetings is to better educate the FLSs about the financial health of the business, performance on current work and prospects for new work in the future so that they are better prepared to answer the questions of their individual crews and to promote better communication across the layers of management. “What I See” has been through two complete cycles with good success. The author and other member of Strategic Planning and Communications department periodically conduct informal interviews with individuals throughout the shipyard to test the impact and transmission of the “What I See” messages. The level of awareness of BIW’s challenges has increased dramatically; however, the accuracy of some of the information as it is passed from the FLSs to their crews still needs improvement. Increased communication through other vehicles is attempting to address this communication gap and provide appropriate detail to the workforce.

Establishing Organizational Readiness and Commitment

Identifying the need for change is an important first step, but an important companion is evaluating the organization’s readiness and capacity for change. A change initiative is

destined for failure if the key stakeholders are not change champions or a critical mass of support does not exist. This does not imply that unanimity is required, but a fair evaluation of stakeholders and constituencies will show where support already exists and where additional effort must be expended to convince the detractors as to a course of action. Beckhard and Harris present two simple yet effective matrices for evaluating organizational readiness and commitment in their book, Organizational Transitions.⁴⁰

The first matrix evaluates an organization’s readiness and capability for change and should be used early in change planning. (See Table 3.) The stakeholders in the sample table are key individuals or groups within the organization. The format is flexible, so initial evaluations may aggregate stakeholders while successive evaluations may be more discretely performed as change planning penetrates deeper within the organization. Readiness refers to the degree to which a stakeholder has accepted that change of some kind is required and is willing to participate in the process. At this stage, readiness does not imply commitment to a specific course of action. The capability assessment gauges the stakeholder’s ability, power, influence or resources to affect the contemplated change.

Table 3: Assessing Organizational Readiness and Capability

Stakeholder	Readiness			Capability		
	High	Medium	Low	High	Medium	Low
Stakeholder 1	X			X		
Stakeholder 2			X	X		
Stakeholder 3		X			X	
Stakeholder 4	X					X
Stakeholder 5			X			X

In the example, Stakeholder 1 is the ideal with a high readiness for change and high capability to affect the process. Conversely, Stakeholder 2 is the nightmare scenario; this individual has low readiness yet has high capability. This should raise a red flag and the following questions should be asked: Is Stakeholder 2 required for success? Can Stakeholder 2 be converted? Will Stakeholder 2 be passively or actively resistant if conversion is unsuccessful? Does Stakeholder 2 have a place in the changing organization? Stakeholder 3 is a more benign case as Stakeholder 3 is moderately ready, but is not a clear capability broker either. It is likely that this stakeholder would delay commitment until the implications become clearer. Stakeholder 4 is a “nice to have”

since the stakeholder is clearly supportive but possesses little capability. Stakeholder 5 can be found in most organizations. These stakeholders are detractors, but their capability is low as well. Attempts should be made to gain their support for change, but they are not critical to the success of the initiative.

The second evaluation will gauge the present and required levels of commitment among the stakeholders to a specific course of action. A distinction needs to be made between readiness and commitment. As described above, readiness refers to a stakeholder’s openness to change whereas commitment gauges the projected level of involvement in the implementation of change once a path has been chosen. The commitment evaluation, as illustrated in Table 4, is more sensitive to the personalities of the individual stakeholders as personal biases and relationships become more important. The levels of commitment are somewhat self-explanatory and range from “No Commitment”, which indicates passive or active resistance, to “Make it Happen” - the fervent champions of change. The “Not Vital” category refers to individuals or groups that are classified as stakeholders by position or hierarchy only but have no real role in implementing change. An “X” indicates the present position of the stakeholder whereas an “O” indicates where their commitment needs to be for a successful outcome. Beckhard and Harris recommend the following intervention strategies to help foster the required commitment⁴¹:

- Problem finding
- Educational intervention
- Resistance management
- Role modeling
- Changing reward systems
- “Forced” collaboration

Table 4: Assessing Organizational Commitment

Stakeholder	No Commitment	Let It Happen	Help it Happen	Make it Happen	Not Vital
Stakeholder 1				(XO)	
Stakeholder 2	X →			→ O	
Stakeholder 3		X →	→ O		
Stakeholder 4		O ←		← X	
Stakeholder 5					X

Stakeholder 1, in the above, is ready to implement change because the present and required levels of commitment are the same. Stakeholder 2 is vital to the process, but has no level of investment. This stakeholder requires significant attention since commitment is vital. Stakeholder 3 is not at the requisite level of commitment, but moving one box may just take a little time or some further education about the change initiative. Stakeholder 4 has more commitment than is deemed to be required for successful implementation. Since Stakeholder 4 is clearly committed to success, it may be appropriate to change the plan to give this stakeholder a more active role. As noted above, Stakeholder 5's level of commitment is not critical for success.

These evaluations are subjective and not designed to single out "bad actors," but are helpful in simply and analytically evaluating the internal landscape for change readiness and commitment. High-level analyses were conducted at BIW. The results confirmed readiness for change but also showed some weaknesses in commitment. Several of these weaknesses were subsequently strengthened through education and peer pressure.

Organizing and Implementing Change

The changes planned at BIW will challenge traditional assumptions and processes as they evolve the enterprise, both structurally and culturally, and position the company for shipbuilding in the next decade. Successfully implementing these major, enterprise-wide changes is a multi-dimensional, nonlinear process. As described in the *Change Overview*, change can not be discretely planned to the lowest-level and simply applied to an organization using traditional project management and planning methods. Successfully implementing change in a large, complex enterprise requires a strategy, specific goals and plans that contemplate all elements of Kanter's change wheel, but at the same time these change planning documents must be flexible enough to adapt to emergent challenges and opportunities during implementation. The specific implementation sequence or timing of each slice of the wheel may not be known until the change is well underway, but it should be compatible with the overall goals and strategy and fit within the allowable change window. This section is organized into subsections that follow the change wheel, shown in Figure 38 for reference. The content and structure of each subsection varies, but their totality will develop an integrated top-level framework addressing the major elements and relationships for planning, organizing and implementing change at BIW. Many of the topics discussed could be distributed among several slices of the wheel, but, for clarity and consistency, topics are generally developed within one subsection with references to others as appropriate.

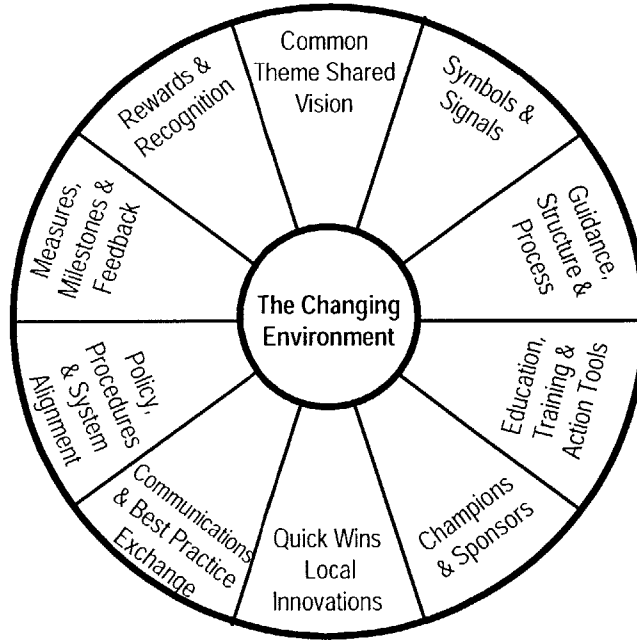


Figure 38: The Change Wheel⁴²

The implementation of each element of the change wheel has benefits, costs and risks that must translate to enhanced overall value to the business entity. Beckhard and Harris introduce the following formula to illustrate the costs, benefits and risks of change.⁴³

$$C = [ABD] > X$$

Where:

- C = Change
- A = Level of dissatisfaction with the status quo
- B = Desirability of the proposed change or end state
- D = Practicality of the change (minimal risk and disruption)
- X = “Cost” of changing

Qualitatively, the “costs” of introducing major changes, including overcoming internal resistance as well as monetary costs, have to be less than the combined effect of current dissatisfaction, the impact of the change and its feasibility within the current circumstances. In the abstract, this formula is a useful model to focus or structure the impact analysis of change and resistance to change, but actually applying it quickly becomes a qualitative exercise since there are no readily available units and measures in which to express dissatisfaction.

Table 5 provides an alternative, high-level framework to assess cost, schedule and risk that contains elements similar to the Beckhard and Harris formula, but allows for more practical, though still qualitative, assessments. Since all change wheel elements will not necessarily be implemented at once or in the order in which they are placed on the change wheel, this framework will be repeated at the end of each subsection so that they may be evaluated relative to one another and prioritized. These evaluations can then be used to develop a preliminary implementation schedule, estimate initial resource requirements and assess the risks and relative anticipated difficulty of implementing each slice of the change wheel.

Table 5: Value, Cost, Schedule and Risk Assessment Framework

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe			
Involved Employees			
Cost			
Resistance			

The terms used in the table and the assessment criteria are defined below. It should be noted that each assessment is relative to the other elements and is not an absolute measure.

- **Required Timeframe (Schedule)** – Classifies actions as being required in the near-term, medium-term or long-term to support successful implementation of change. Near-term actions are those that should be addressed over the next six months. Medium-term actions are required within the next six to eighteen months. Long-term actions don’t come into focus for at least eighteen months. There needs to be a logical sequence to implementing the elements of change so that, to the maximum practical extent, the effectiveness of each new implementation element is connected to and compounds the success of the prior elements. Also, there is a practical limit as to the number elements that an organization can approach simultaneously while maintaining appropriate focus.
- **Involved Employees** – Categorizes the expected number of employees actively involved in implementation as: localized to a workgroup or department (low), requiring a whole division (medium) or requiring active involvement of nearly everyone in the company (high). The assessment of involved employees only considers the number of employees involved in the implementation of the element - not the number of employees affected by the implementation. For example, all employees are affected by communications, but there are a limited number of people responsible for formally communicating information to the workforce.

- Cost – Assesses the expected costs associated with implementation of the element as: normal work product with few additional costs (low), within the limits of departmental discretionary budgets (medium) or capital investment required (high).
- Resistance (Risk) – Assesses the likely resistance of the organization to the implementation of the element as low, medium or high based on prevailing culture, past practices or similar initiatives in other organizations. There are other sources and types of risk, but resistance tends to be one of the most prevalent in change initiatives affecting culture and can destroy the effort if not properly addressed and mitigated.

Common Theme and Shared Vision

The first step in successfully implementing change is to establish a shared vision to which people can relate. The vision must be clearly articulated and have simplicity of purpose so that it can be remembered. President Kennedy established a vision for the nation when he uttered those now famous words:

“We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too.”⁴⁴

The words were simple, but the purpose was clear and they moved a nation to action. Neil Armstrong’s first steps on the moon on July 20, 1969, fulfilled Kennedy’s vision and began a new chapter in American space exploration.⁴⁵ A clear and inspiring vision will motivate people and build support, which is critical to starting and sustaining change.

Vision, Strategy and Themes

Louis Gerstner, in his book Who Says Elephants Can’t Dance?, emphasizes the importance of establishing a clear vision and supporting strategy. Gerstner draws a clear distinction between the two. Visions, he says “...play a role in creating commitment and excitement among an institution’s employees.” Strategies, he goes on to say, enable the vision to be achieved through “massive amounts of quantitative analysis – hard, difficult analysis that is blended with wisdom, insight, and risk taking.”⁴⁶

Collins and Porras maintain that a well-conceived vision consists of two major components: core ideology and envisioned future. These components are the yin and yang of a vision. The core ideology, the yin, represents the soul of the organization and its collective history and purpose. The envisioned future, the yang, describes the aspirations of the future that will require change and hard work to attain. Together, these two components describe the enduring purpose of an organization and its ambitions for the future in an inspiring manner.⁴⁷ Once the vision has been articulated, supporting strategies and themes to achieve the vision need to be developed.

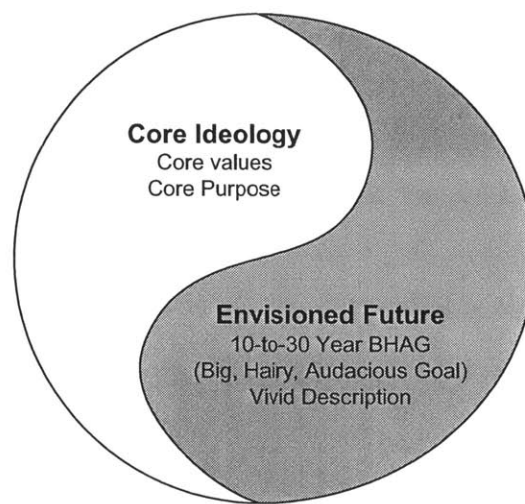


Figure 39: Articulating a Vision⁴⁸

"Together we can make a difference"

"Together we can make a difference" has become Shipway's signature line and ends most of his communications with the workforce. While it does not conform to the Collins and Porras definition of a vision, these few words represent a simple vision for the future with multiple dimensions. First, it conveys a sense that "we're all in this together" and that it takes everyone working in unison toward a common goal – it isn't just a labor problem or a management problem. Second, it speaks to the need to continue building a more positive relationship between labor and management. These words would ring hollow as nothing more than a management catch phrase if they were not reinforced by Shipway's own actions. As described in the *Leadership* discussion of the *Bath Iron Works Overview*, Shipway has a casual, "man of the people" style that has gained him the respect of the workforce. It is not uncommon to see Shipway roving the shipyard talking to mechanics

and supervisors on the deck plate about a wide array of topics. Shipway's actions coupled with his simple, consistent, unambiguous messages have become symbols of his commitment to BIW and its future, even though he is a relative newcomer. These two elements of the vision address near-term objectives, but, more broadly, "Together we can make a difference" can take on a variety of meanings including: making a difference in the defense of our nation, making a difference in BIW's competitive position, making a difference in how we interact with each other, making a difference in the safety of the workplace, or making a difference in shipbuilding in Maine in the coming decade.

More discretely, Shipway has articulated the following three supportive goals:

- Reduce the number of labor hours to build DDGs to equal or beat any shipyard in the country
- Treat each other with dignity, act with integrity and use good old Maine common sense
- Have a workplace environment where every worker goes home from BIW in the same condition they arrived at BIW

These three themes are simple, yet clearly convey the company's goals, imply that changes are required to meet them and are consistent with the vision of "Together we can make a difference". These goals and their effectiveness to date were introduced and more fully developed in the *Compelling Communication* portion of the *Building the Case for Change* section and will not be repeated here. BIW's internal communication strategy has allowed clear, consistent, recurring communications that use Shipway as a medium to the workforce.

It will be important to develop a more comprehensive and descriptive vision for BIW's future as the envisioned changes are better defined. A clear, concise vision sets a path for the desired changes, motivates employees and signifies that, even though there is uncertainty in future shipbuilding programs, there is also a firm view as to BIW's role as a provider of surface combatants regardless of program.

A Common Enemy

Another effective means of motivating people toward change and to build commitment to the effort is to establish a common external enemy. Ivan Seidenberg, CEO of Verizon,

credits part of his success in merging Bell Atlantic and GTE in 1998 to focusing employee efforts of each company toward beating AT&T together rather than actively working against the merger or one another.⁴⁹ Ultimately, the companies became Verizon and have beaten AT&T in all market segments. Seidenberg also stressed the importance of not blaming the customers or their fickle nature. The enemy should be completely removed from the enterprise so that it becomes a goal and a rallying cry but does not allow responsibility to be inadvertently shifted from where it belongs.

NGSS is BIW's only competitor in U.S. Navy surface combatant construction; however, while always considered the competitor, they have not traditionally been specifically targeted as the external enemy. Early in the DDG Program, the customer provided incentives to foster collaboration between the two entities during design and construction. This attitude was perpetuated by the system of modified competition under which DDGs have been procured, which guaranteed both competitors ships to build and the competition was largely for the fee associated with the contract. Additionally, the geographic separation between the two shipyards and the role of the customer as intermediary in most interactions has cultivated a fairly neutral attitude between the two entities at a working level. However, Shipway is working to redefine the BIW view of NGSS. In an effort to improve BIW's overall competitive position, he has begun a concentrated shipyard-wide campaign to compare BIW's performance to NGSS by setting goals relative to assumed NGSS performance based on available documentation and intelligence. Shipway's first goal for BIW, "Reduce the number of labor hours to build DDGs to equal or beat any shipyard in the country" more firmly establishes NGSS as the common enemy. Focusing the workforce on measurable performance improvement through comparisons with NGSS not only sets goals, but also reinforces "Together we can make a difference" because it becomes a "we" and "them" situation instead of an "us" blaming "us" situation.

Assessment

Table 6 assesses the value, cost, schedule and risk of establishing a vision and supporting themes and is followed by a brief explanation of each assessment.

Table 6: Shared Vision and Common Themes Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe	X		
Involved Employees	X		
Cost	X		
Resistance		X	

- Required Timeframe – The vision and supporting themes will guide any initiative and must be one of the first items pursued.
- Involved Employees – Creating or communicating the vision is limited to a relatively small group of people.
- Cost – There are few anticipated costs associated with this element.
- Resistance – Since the vision articulates that the status quo is no longer viable and that change is required, it is likely to meet resistance on many levels that range from the specific words used to the idea of change in general. Overcoming the resistance will take time and persistent reinforcement of the vision and themes to demonstrate management’s commitment.

Symbols and Signals

The power of symbols and signals should not be underestimated; world history is replete with examples of their profound influence. The Church and the cathedrals of the Middle Ages are some of the most striking examples of the power of symbols. Cathedrals are architectural marvels that serve no practical purpose beyond conveying the power and majesty of God and the Church to the masses. These physical man-made symbols of a transcendent being proved capable of altering the course of history from the Crusades, to the Inquisition, to the Reformation. On a lesser scale, symbols and signals are equally important to bolstering support and perpetuating true change – they can be considered the marketing campaign for change.

A Sense of Urgency

Establishing, communicating and maintaining sense of urgency is a powerful signal in any change initiative. When changes occur during times of crisis, the sense of urgency is already established; however, the task is far more difficult when change is initiated to preempt or avoid a crisis that may not surface for several years. Given the advance planning required for the extended cycle times associated with ship design and construction, BIW finds itself in this later category. Consequently, the case for change

has to be built in a manner appropriate to each constituency within the shipyard. BIW's activities in this regard are described in the *Building the Case for Change* chapter and will not be repeated here.

The seemingly sure conditions of the present that tend to obscure the need to change will also make maintaining the sense of urgency over time a continuing challenge. The terrorist threat level is a good illustration of maintaining a sense of urgency. Officials must be judicious in the decision to raise the terror threat level and must try to limit the duration once it is elevated. Otherwise, it is likely that the American public will become inured and desensitized to a potentially serious situation. Similarly, BIW management will need to continuously sustain the sense of urgency while not departing from the core vision and objectives of the change.

BIW 2011

Describing a picture of the future is both a symbol with emotional impact and a tool for planning the change initiative. Symbolically, as discussed in the *Common Theme and Shared Vision* section, a vivid description of the future is inspiring, motivating and reassuring. Strategically, a view of the future is required to develop the transition plan to guide the implementation and achieve the vision. This section will describe the genesis of BIW 2011, the emerging symbol of BIW's change initiative, and the process for developing the transition plan.

Beckhard and Harris offer a simple three-step process, as shown in Figure 40, to begin defining the details of the change once the need for change has been defined; the process is further described in the *Change Overview* section. First, the future or desired end state is defined. Next, the present is assessed using detail and terms similar to the desired future state. Finally, a transition plan is developed to move the enterprise from the present to the future.

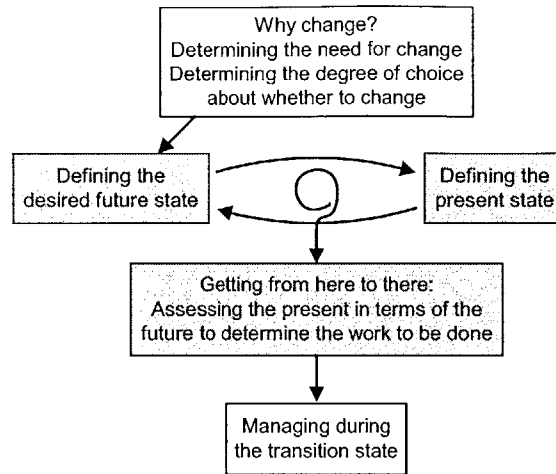


Figure 40: Defining the Details of Change

The Beckhard and Harris model was used to develop BIW’s high-level roadmap to change. The year 2011 was chosen as the desired endpoint to develop the desired future state for several reasons. First, 2011 is the first year after the last ship of the DDG 51 Class is delivered and BIW’s first two ships of the DD(X) Program will be well into the construction process, if the current program schedule holds. Consequently, 2011 represents BIW’s post program transition steady-state, which, in many respects, is a chance for a reasonably clean start as new tools and processes are introduced. Choosing a point in the future also draws focus away from the problems of the present and allows development of a more innovative, less biased vision of BIW’s future operations. For BIW, the future will bring unique challenges that are far different than the challenges of the present. For example, the resource plan will require hiring at a rate that BIW has not seen since the transition from the CG 47 to the DDG 51 programs in the 1980s. Innovative hiring and training solutions will be required to support the construction schedule with appropriately-skilled mechanics. Finally, 2011 is the beginning of the next decade and will symbolically mark a new chapter in BIW’s surface combatant shipbuilding heritage. Consequently the change plan became known as BIW 2011.^{***}

^{***} “BIW 2011” is used throughout later sections to reference both the plan itself and the totality of the change initiative and its implementation.

Since BIW has only one major construction program, defining the present state in similar terms to that of the future was not difficult at the highest-level. However, it quickly became evident that most of the future details will be significantly different than those currently in place as more technology and exacting standards are introduced into the process. Developing a clear, consistent view of the present, at an appropriate level of detail, that can be laid against a similar view of the future will show gaps and indicate areas requiring fundamental changes.

Defining the transition plan between the present and the future is a formidable task. History shows that shipyard programmatic transitions are rocky periods of substantial turbulence. This will be especially true with the DDG 51 to DD(X) transition because DD(X), unlike the progression in prior surface combatant classes, is not a series of incremental innovations to a base platform. Rather, DD(X)'s hull form, propulsion system, combat system and armament represent step-functions in surface combatant performance. Many of the new technologies will still be completing final development as ship construction begins, which introduces additional exogenous risk to the shipbuilding and integration process. These new technologies will also change the types and mix of skills (e.g. the proportion of pipe fitters to electricians) required to build the ships. A thoroughly analyzed, comprehensive transition plan will enable BIW to plan for and deliver the requisite new skills, processes, facilities and tools, as required, without impacting performance.

Fully developing, integrating and rationalizing the BIW 2011 plan will require input from subject matter experts from around the shipyard. Simultaneously, ideas, best practices and lessons learned from similar industries and situations need to be sought out and incorporated. As previously mentioned, the aerospace industry has significant experience in programmatic transitions during periods of low-rate production as does Electric Boat, one of BIW's sister companies within GD Marine Systems. To be successful, BIW 2011 must be an innovative, holistic company-wide plan that is developed and led by senior management with meritocratic input from all parts of the enterprise.

Next Steps

Many of the symbols and signals discussed are actions taken by Shipway, which is where enterprise-level change needs to start. Firmly establishing symbols and signals is important as is maintaining a sense of urgency. BIW 2011 is emerging as a symbol of the initiative, but the view of BIW in 2011 needs to be better defined and articulated to the workforce as an inspiring and desirable future for BIW. The longer-term challenge will be to sustain the sense of urgency over a period of years. Shipway's direct reports have begun establishing their own symbols and signals and applying them to the longer-term task of adapting and integrating Shipway's enterprise-level goals to the process and product-specific needs of their respective organizations. However, their actions have been more subtle and are developing along independent timelines. Establishing symbols and sending signals that change is occurring needs to be more overt and integrated; leading by example and sending strong, consistent signals will be critical as change efforts continue to mature and gather momentum. Similarly, new symbols and signals will have to be introduced over time to keep efforts from stagnating, but, at the same time, they need to retain continuity with the core objectives of the change effort.

Assessment

Table 7 assesses the value, cost, schedule and risk of establishing symbols and signals and is followed by a brief explanation of each assessment.

Table 7: Symbols and Signals Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe	X		
Involved Employees	X		
Cost	X		
Resistance			X

- Required Timeframe – Symbols and signals need to support the shared vision, demonstrate management commitment, and promote employee acceptance and commitment to change efforts.
- Involved Employees – Ensuring that the symbols and signals pervade all levels of the organization requires significant management commitment and energy. This does not require a lot of people or investment to achieve, but will require a lot of time by key individuals.

- Cost – Symbols and signals are essentially the marketing campaign of any change initiative, and have few material cost requirements.
- Resistance – Introducing new symbols and signals necessarily means that older, more comfortable signals and symbols are being displaced or cast in a new light. This is likely to cause high levels of resistance until the signals and symbols are believed and accepted into the prevailing culture, which will take time.

Guidance, Structure and Process

The organizational, schedule and process rigor required to implement enterprise-level change is discussed in this section. As previously discussed, change implementation tends to be a non-linear process with many later-phase details emerging over time that can not be planned or anticipated at the start of the initiative. This does not obviate development of an implementation process or plan; however, it becomes more difficult than traditional project management because more ambiguous variables are introduced and flexibility is required.

Structure

Adopting an appropriate organizational structure will be critical to the success of BIW 2011. Enterprise-level change takes years to accomplish and the organizational structure will evolve as the initiative progresses from initial planning, to piloting key initiatives to full-scale implementation; nonetheless a strong core team needs to be in place from the beginning to assure continuity and integration of the effort. Given the complexity of the changes contemplated for the product and the organization, there are many aspects that need to be investigated when establishing the organizational structure and composition of the BIW 2011 team. The following discussion is focused on the first-stage planning for BIW 2011, not the later implementation stages.

Large-scale change rarely, if ever, is successful without active support and participation from senior management, especially in a hierarchical, top-down culture like that of BIW. However, fully developing BIW 2011 will require a substantial time commitment and can not be allowed to disrupt core business operations, so it is not feasible to expect senior management to develop the entire plan. A balance needs to be struck so senior management owns the plan and is fully committed to it while appropriately staffing and empowering a group of change agents with its detailed development and implementation.

The BIW 2011 team needs a broad range of experience in all aspects of the business, including manufacturing, engineering, and support, in order to make rational, informed decisions. At the same time, the team needs a strong network of Outsider-Insiders that can draw external best practices into BIW, where appropriate, and find innovative solutions to traditional problems.^{†††} The initial reaction would be to staff the team from the experienced middle management ranks of each division. It is important that BIW 2011 draws on the company’s collective experience and has the best resources available, but assigning several key managers of core operations is potentially problematic for several reasons. First, any assignment of key management personnel is likely to be on a part-time basis, which means BIW 2011 efforts will be diluted by day-to-day issues. Second, while bringing significant experience to the team, managers, especially if assigned part-time, are likely to focus on incremental innovations to current practices rather than performance breakthroughs. This does not mean that these individuals are not capable of an Outsider-Insider perspective, but it is often difficult to think innovatively and about the future while mired in the tactical battles of the present.

Figure 41 illustrates a potential BIW 2011 matrix structure that is designed to address the issues discussed above. The organization is a combination of senior management, full-time dedicated Outsider-Insider change agents and subject matter experts and is broken into a Steering Committee, Working Groups and a core Integration Team. The functions of each group and the interactions among the groups are described below.

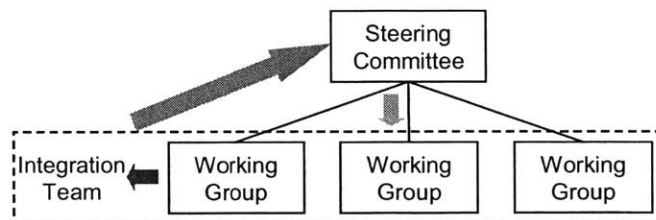


Figure 41: BIW 2011 Organizational Structure

^{†††} See the *Outsider - Insiders* subsection of the *Change Overview* for an explanation of the term Outsider-Insiders.

Steering Committee

The Steering Committee is a subset of the president's direct reports and has overall accountability for BIW 2011. Likely members of the committee would include the Vice Presidents of Operations, Engineering & Procurement, Planning & Material Control and Finance & Administration. The Steering Committee's main functions are to drive the process and to direct, prioritize and provide resources for the Working Groups. The Steering Committee will rely upon input from the Integration Team to make strategic decisions. The Steering Committee, though advisory, is not a passive participant in the BIW 2011 process; rather, it deals with higher-level information and decision-making.

Working Groups

Working Groups are chartered by the Steering Committee on an ad-hoc basis for short-durations to address specific aspects of BIW 2011. The group members are subject matter experts, capable of an Outsider-Insider perspective, and are chosen by the Steering Committee from the middle management and individual contributor ranks. Each Working Group will include at least one member of the Integration Team to provide continuity across BIW 2011. Working Groups will submit their findings to the Integration Team for incorporation into the BIW 2011 plan. The Working Groups will provide extensive experience from all aspects of the business while not over-burdening middle managers with extended committee obligations or interrupting continuing operations. The activities of the Working Groups are similar to those of Kaizen events during the implementation of Lean principles.^{†††}

Integration Team

As the name implies, the Integration Team integrates the broader view and maintains a balanced approach to developing BIW 2011. The Integration Team reports directly to the Steering Committee and functions as the Steering Committee's staff to develop the lower-level details of BIW 2011. The Integration Team will be led by the Strategic Planning and Communications department with representatives from Operations,

^{†††} A Kaizen event is a focused, intense, short-term project to improve a procedure or process.

Planning, Engineering and Finance. As noted previously, the Integration Team will be represented on each Working Group and will integrate individual Working Group inputs into a well-balanced plan. Unlike members of the Working Groups, members of the Integration Team will be assigned on a full-time basis.

Members of the Integration Team need to be innovative systems thinkers because it will be their job to integrate BIW 2011 into a cohesive plan for successful enterprise-level change. They need to be Outsider-Insiders with extensive contact networks and credibility within the shipyard to pull in the best solutions to the challenges of BIW 2011. However, this does not mean that they must be managers. Members need to be good facilitators, communicators and teachers because they will have extensive interaction with the Working Groups as they guide the execution of these ad-hoc teams of experts that may or may not understand the entire scope of the effort. Similarly, the Integration Team will have responsibility for keeping the Steering Committee informed and making recommendations for their action.

Finally, it is critical that the Integration Team be fully endorsed and empowered by the Steering Committee to act reasonably on their behalf as the central organizational entity for BIW 2011. Without this endorsement, Figure 41 becomes a bureaucratic continuous loop rather than a simple, rational, empowered organization.

Organizational Roles and Responsibilities Chart (RACI)

Table 8 presents the previously described roles and responsibilities in a single, high-level RACI chart.⁵⁰ The action terms used in the table, Accountable, Responsible, Consult and Inform, assign the roles and responsibilities to each participating group and eliminate ambiguity. The terms are defined below.

- **Accountable** - Single individual or entity (only one) who must ensure that the function is completed in a timely and quality manner – ultimate ownership.
- **Responsible** - Individual(s) or entity(s) that actually complete the activity or task or make the decision.
- **Consult** - Individual(s) or entity(s) who must be consulted prior to an activity, task, or decision being completed. “Consult” implies two-way communication. Those being consulted provide input or perspective only.

- Inform – Individual(s) or entity(s) who must be informed after a decision or action is taken because they, in turn, may take action or make a decision based on the result. “Inform” implies one-way communication.

Table 8: BIW 2011 Roles and Responsibilities⁵¹

Tasks	Steering Committee	Working Groups	Integration Team
Make the strategic decisions	A/R	I	C
Drive the Process	A	C	R
Do the work	A	R	C
Integrate the broad view	A		R
Implement the change	A	R	C

Process

BIW 2011 Planning

Planning for BIW 2011 will require sustained, long-term effort; it must be done thoroughly and carefully to ensure the highest probability of success. Within the organizational structure described above, BIW 2011 planning will require an iterative series of Working Groups combined with periodic Steering Committee and senior management off-site meetings. Figure 42 illustrates a representative planning sequence;

- The Integration Team is appointed and reports to the Steering Committee.
- The Steering Committee then charts several Working Groups with specific tasks.
- The Integration Team and Working Groups fulfill their charters and have some interaction with members of the Steering Committee as they go about their tasks.
- The Integration Team then brings the results to the Steering Committee for their action, which starts the process over again with a new series of Working Groups.

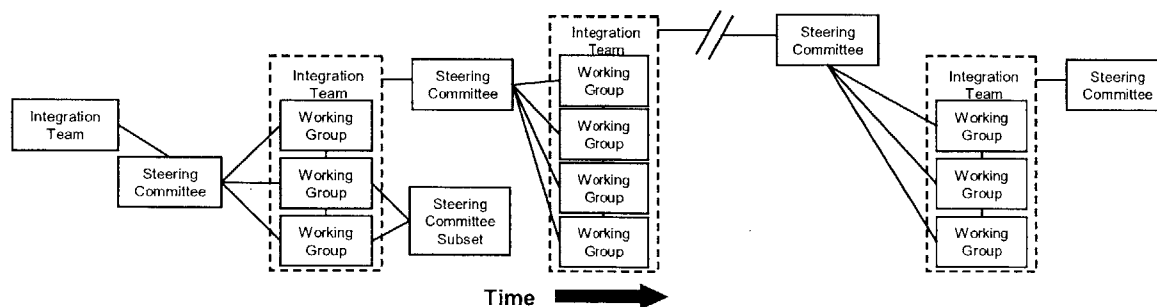


Figure 42: Representative BIW 2011 Planning Sequence

Schedule

Traditional project management processes are well understood and fairly linear. Conversely, the implementation of major change, especially change targeted toward culture, generally has well-defined beginning and end points driven by mandate or imperative, but imperfectly-defined scope can lead to optimistic schedules and significantly underestimated durations. With regard to changing culture, Gerstner relates, "I knew it would take at least five years. (In that I underestimated.)"⁵² The extended durations and ambiguity inherent in the process necessitate a flexible yet rigorous and innovative planning process that can react to emergent opportunities and problems while integrating efforts across the enterprise and gauging progress at an appropriate level. Much of the following material is also applicable to the *Measures, Milestones and Feedback* section, but is presented here for continuity and consistency.

The plan for implementing change needs to be decomposed to a level that is appropriate and actionable within the organization yet maintains the integration and continuity of the initiative. The elements of the process flow introduced in the *Process Flow* subsection of the *Bath Iron Works Overview* will be used to define the attributes of the change. These elements then need to be mapped to the organizational structure using a RACI chart, as defined in the *Organizational Roles and Responsibilities Chart (RACI)* section, since elements of the process flow may be associated to multiple areas within the organization. For example, responsibility for the Safety process flow element resides with all departments, not solely with the Safety department; however, the actual implementation of the change attribute may vary by department.

Progress of elements toward specific goals in support of enterprise-level change need to be tracked using a variety of methods as some elements can be assessed using traditional project management techniques while others are not readily quantifiable. For example, Safety can be tracked using standard, OSHA-defined (Occupational Safety and Health Administration) recordable and lost time injury statistics. Conversely, Morale is an element that is extremely important but is not easily quantifiable even though its impact is observable in the behavior of the workforce. In such situations, progress needs to be assessed on a relative basis rather than in absolute terms using either representative

metrics or a modified Capability Maturity Model (CMM). CMM was developed by the software community to assess an organization’s ability to perform their software process successfully against a common set of criteria and to delineate the characteristics of a mature, capable software process.⁵³

Figure 43 illustrates a modified CMM. Across the top are descriptions of the present and desired future states, as presented in the *BIW 2011* section, and three interim states. Down the side are associated process flow elements and their supporting attributes. Progress of each attribute is assessed against the continuum of descriptions. For example, Attribute A is assessed to have progressed to Interim State 1 while Attribute B has progressed to Interim State 3, which leads to an aggregate assessment that Element 1 has progressed to Interim State 1.

	Description of the Present State	Description of Interim State 1	Description of Interim State 2	Description of Interim State 3	Description of the Desired Future State
Element 1		X			
Attribute A		X			
Attribute B				X	
Process Elements and Associated Attributes					

Figure 43: Sample Capability Maturity Model

The relative description, number, timing and duration of the interim states will vary from element to element because of differing requirements and the amount of change required, but the descriptions of the present and future states must represent similar points in time across elements. For consistency, the more easily quantifiable elements, such as Safety, can be presented in a similar format. Instead of using descriptions across the top, metrics appropriate to the particular element would be substituted.

Figure 44 summarizes the integration of the entire effort. Enterprise-level change is planned at the highest-level using the change wheel. Elements from the process flow are allocated to areas on the change wheel and mapped to the organizational structure using a RACI chart. For each organizational element, goals are established with interim milestones and objectives. The goals may be quantitative or qualitative depending on the process element and are presented in a CMM-like format. An additional level of decomposition within an area may be required to accurately assess progress, but any lower-level decomposition must be traceable to higher-levels. This flexible format allows the implementation of the change initiative to be integrated across the enterprise and enables progress assessments at various levels within the organization ranging from deck plate implementation to executive oversight.

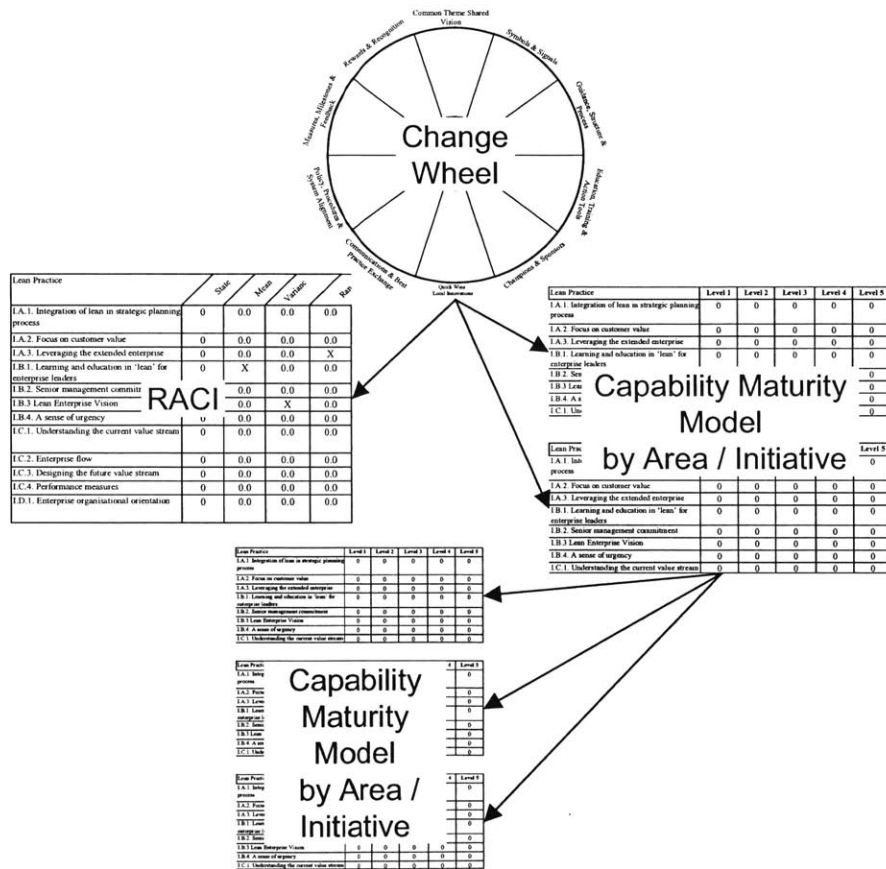


Figure 44: Integrated Planning Architecture

As previously discussed, clear and simple communication is important. The preceding discussion and associated figures are useful for collecting and organizing data, but they are too complex to clearly show the progress of the change initiative against the schedule

as an integrated roadmap to enterprise-level change. Figure 45 uses the results of the lower level analyses and presents a concise view of the implementation progress in terms of the process flow elements. The relative milestones and associated progress of each element are presented as is the enterprise's total progress. This format is similar to the Dottie Chart described in the *Compelling Communication* portion of the *Building the Case for Change* section. Although not shown for the sake of clarity, the process flow elements could be grouped by their associations to the change wheel, to gauge progress traversing the wheel.

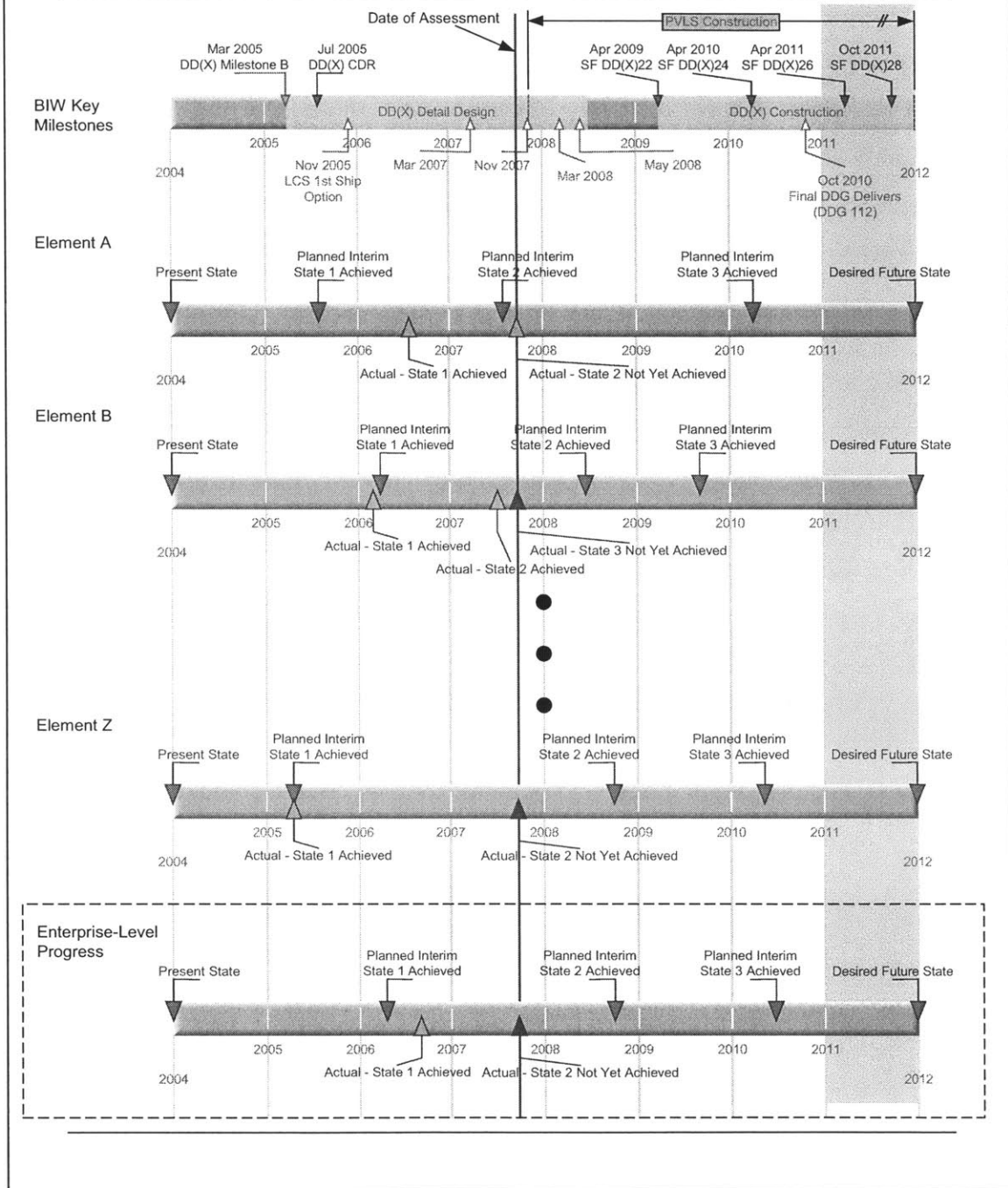


Figure 45: BIW 2011 Integrated Schedule and Progress Chart

Assessment

Table 9 assesses the value, cost, schedule and risk of developing appropriate guidance, structure and process in support of the BIW 2011 initiative and is followed by a brief explanation of each assessment.

Table 9: Guidance, Structure and Process Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe	X		
Involved Employees		X	
Cost			X
Resistance			X

- Required Timeframe – Guidance, structure and process provide the basic framework for implementing the vision of BIW 2011 and must be firmly established early in the process if the initiative is to be successfully integrated and executed. This is especially true of the organizational structure.
- Involved Employees – Establishing these elements will require the involvement of resources from across the enterprise for varying lengths of time to staff the Working Groups, in addition to the Steering Committee and permanent Integration Team.
- Cost – Some capital investment in modification of existing systems or purchase of new systems is likely.
- Resistance – Resistance is likely to be high because the whole purpose in developing BIW 2011 is to think differently and to make dramatic changes, which will be unsettling to people. Engaging the right group of Outsider-Insiders will be critical to neutralizing the resistance and developing reasonable transition plans.

Education, Training and Action Tools

As with any job, the proper tools, education and training are key enablers to a successful outcome. This section will describe an approach to develop an overall strategy and implementation plan that includes the tools, education, training and resource requirements needed to make the early stages of BIW 2011 successful. The required skill mix and commensurate training programs needed to implement BIW 2011 will evolve over the next two to five years and will not be addressed here. Also, this section will not address the requirements of the workforce to perform core shipbuilding tasks (e.g., training of new welders to build ships will not be addressed).

The ultimate success or failure of BIW 2011 will be dependent on the innovation and hard work of the men and women of BIW at all levels of the organization. The challenges

of BIW 2011 are complex and affect all aspects of the organization, so appropriately educating and training participants is critical to success. As discussed in the organizational structure portion of the *Guidance, Structure and Process* section, it would be ideal to largely staff BIW 2011 with true Outsider-Insiders. However, this is neither feasible nor practicable given considerations of time, funding and continuity of the core business. Consequently, a tiered organizational structure was adopted to make full use of the Outsider-Insiders as change agents while educating other participants in the goals, objectives and approaches required for true change. This will begin the “conversion” and educational process of developing Outsider-Insiders from within. The expected outcome would be a growing population that is conversant in the terminology and basic theories of change and is supportive of BIW 2011. Education and training plans need to mirror this approach. Figure 46 illustrates this hierarchy of participants and their relative populations within an organization; “True Outsider-Insiders” are the smallest population at the top of the pyramid and are followed by the larger group of “Outsider-Insiders in Training & Change Leaders.”

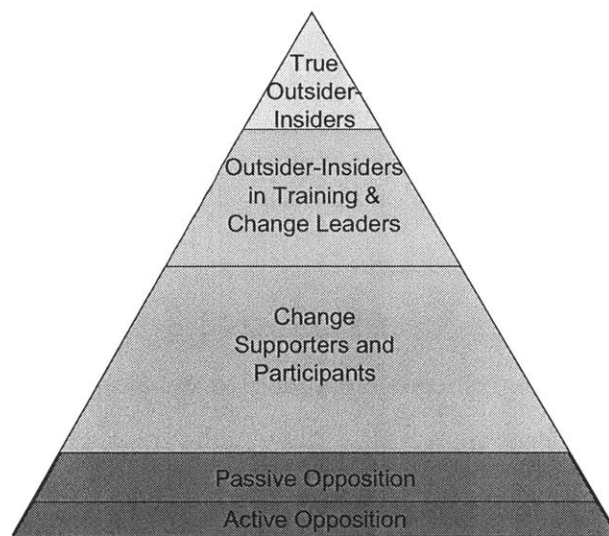


Figure 46: Representative Distribution of Participants in Change Implementation

The next population consists of those that are supportive of the change initiative and are participants in its implementation, but not necessarily leaders or developers of the initiative. They have communication and comprehension requirements more so than education and training needs, given their role in the initiative. The needs of this group will be addressed in the *Communications and Best Practice Exchange* section. The next

level of the pyramid, the passive opposition, can be a powerful, caustic force and has been the death of many promising change initiatives because many of these individuals may masquerade as supporters and are not discovered until it is too late. Finally, there is always an element of active opposition, but these individuals are generally easily identified and consistent in their opposition. It is desirable to identify and neutralize both forms of opposition to the extent possible. The most desirable method is to convert opponents to supporters, but sometimes this is not possible and these individuals need to be moved to other parts of the organization or completely removed from the organization, as circumstances dictate.

Early identification of the team members required for BIW 2011 will allow for an assessment of their current attitudes toward change and the level of Outsider-Insider perspective. A simple assessment methodology, similar to that presented in *Establishing Organizational Readiness and Commitment*, may be employed. This assessment will establish a baseline and provide insight as to how much education and training will be required given the role these individuals are expected to play in BIW 2011.

Recommending specific action tools or training and development options for BIW 2011, beyond those already identified, would be premature until the initial planning stages are completed. However, Table 10 presents some potential education and training requirements for successful planning and implementation.

Table 10: Potential Education and Training Requirements

Requirement	Description
Developing a critical mass of Outsider-Insiders	Outsider-Insiders are the innovative change agents that will develop and implement BIW 2011. Outsider-Insiders can be created, but it is not a skill solely developed in a classroom. (See the <i>Change Agents - The Apostles of Change</i> subsection of the <i>Change Overview</i> for more detail.)
Educating in change management theory	Participants in the development and implementation of BIW 2011 will need to understand the fundamentals of change management. This can be a combination of On the Job Training (OJT) and classroom instruction.
Exposing to competitive benchmarking	Competitive benchmarking allows an organization to gauge performance against other organizations with similar processes and products. This will become important as best practices and lessons learned from other industries are explored. Competitive benchmarking could be introduced in a classroom setting or through self-study.

Fostering innovation and an environment of learning	Change requires innovative thinking and an environment conducive to calculated risk taking. These do not just appear without realigning the mental models of those involved. Leadership is fundamental to fostering the environment. Principles can be taught in the classroom but OJT is required to develop proficiency. (See <i>Quick Wins and Local Innovations</i> for more detail.)
Enhancing communication skills	Clear and concise communication is essential in any business, but change initiatives require even more communication. Enhancing existing skills depends on the constituency and can range from setting expectations to providing classroom instruction in specific skills. (See <i>Communications and Best Practice Exchange</i> for more detail.)
Providing access to learn from external sources	Access to external sources of information will be important to finding innovative solutions to challenges and learning from the experience of others. This may include access to information services, such as LexisNexis, access to literature and studies or visits to observe other companies.
Developing future leaders	Change requires strong leadership at all levels of the organization. Leadership fundamentals can be taught in the classroom, but OJT and/or developmental rotational assignments help gain proficiency. (See <i>Policy, Procedures and System Alignment</i> and <i>Champions and Sponsors</i> for more detail.)
Developing new skills within the manufacturing workforce	New skills will be required within the manufacturing workforce as processes and procedures are changed and new technologies are introduced. A combination of hands-on classroom instruction and OJT will be required to train the workforce. If large numbers of employees require new skills, external training options may need to be investigated.
Anticipating emergent requirements	Education and training systems need to be flexible and nimble enough to react to emergent requirements. This may be a combination of organic capability and a network of external support.

Additionally, when specific tools are required to support implementation it will be imperative that participants are given appropriate training in how to use them. It will also be important to educate those that are peripherally impacted, but not directly affected, in the purpose of these tools.

Assessment

Table 11 assesses the value, cost, schedule and risk of education, training and action tools and is followed by a brief explanation of each assessment.

Table 11: Education, Training and Action Tools Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe		X	
Involved Employees		X	
Cost		X	
Resistance	X		

- Required Timeframe – The preliminary plan for BIW 2011 must be reasonably mature before significant education and training investments are made. Early training will be on the job; conducted within the teams by the change agents. Subsequent training will need to be larger scale and formally conducted.
- Involved Employees – Initial requirements will be low, but as more people need to be trained by formal means, the number of involved employees will grow.
- Cost – The costs associated with training are assumed to be reasonably modest during the early phases of implementation. Some sources of cost are likely to be for training courses, training materials and external training personnel.
- Resistance – Resistance from the majority of the population should be relatively low since this is an opportunity to learn about the planned changes BIW 2011 will bring before they are implemented. Appropriate training and education prepares employees to perform the job expected of them and helps build commitment and broaden the base of support for the program.

Champions and Sponsors

Strong, high-level champions and sponsors are critical to the success of any change initiative. Champions are required to clear barriers and to be supportive; sponsors fund the project and provide resources. Most importantly, change requires strong, active, leadership by example to foster the commitment of others. Good leaders are implicitly champions and sponsors. Gerstner’s description of leadership needs no further explanation as to what it is or why it is important:

"All great business executives - CEOs and their subordinates - have passion and show it, live it and love it. Now, don't get me wrong. I'm not talking about superficial rah-rah optimism or backslapping and glad-handing. Remember my description of personal leadership. It starts with the hard work of strategy, culture and communications. It includes measurement, accountability, visibility and active participation in all aspects of the enterprise. Without that, passion is simply a cheerleader doing flips on the sideline while the team gets crushed 63-0."⁵⁴

The importance of leadership to the success of any enterprise or initiative cannot be over-emphasized. The most obvious leaders are the company’s executives and managers, but in truly successful companies, key personnel with effective leadership skills pervade the organization. Their contributions are far more than simply “managing” as Gerstner so eloquently states. Leaders don’t have to be executives, managers or supervisors; individual contributors bring leadership and add value based on their expertise. This distributed leadership model recognizes and extracts value from the contributions at each level of the hierarchy even though the leadership roles change at each level. Executive leadership is far broader and more strategic than supervisory leadership, which requires motivating teams and individuals or guiding performance of specific tasks.⁵⁵ Employees are generally well-intentioned people that want to do a good job but good intentions alone will not suffice; good leadership is essential to develop successful teams to maximize their potential. Table 12 was developed by Gerstner to describe “What it Takes to Run IBM”, but most of the attributes are applicable to leaders at any level, not just CEOs.

Table 12: "What it Takes to Run IBM" - Attributes of Good Leaders⁵⁶

<p>Energy</p> <ul style="list-style-type: none"> • Enormous personal energy • Stamina • Strong bias for action <p>Organizational Leadership</p> <ul style="list-style-type: none"> • Strategic sense • Ability to motivate and energize others • Infectious enthusiasm to maximize the organization's potential • Builds strong team • Gets the best from others 	<p>Marketplace Leadership</p> <ul style="list-style-type: none"> • Outstanding oral communications • CEO-level presence and participants in the industry and with customers <p>Personal Qualities</p> <ul style="list-style-type: none"> • Smart • Self-confident, but know what he/she doesn't know • Listens • Makes hard decision – in business and with people • Passion that is visible • Maniacal customer focus • Instinctive drive for speed/impact
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BIW 2011 will require strong and visible leadership, starting with the president and his direct reports. As described in *Bath Iron Works Overview*, BIW is a traditional, hierarchical organization that has been subjected to many “initiatives of the week” over the past several decades. Consequently, the workforce is entrenched and skeptical of any changes in the status quo without visible proof that senior management is fully

committed. Machiavelli succinctly describes these leadership challenges in the following excerpt from The Prince.

“...And it ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new. This coolness arises partly from fear of the opponents, who have the laws on their side, and partly from the incredulity of men, who do not readily believe in new things until they have had a long experience of them...” - Niccolo Machiavelli, The Prince, Sixth Chapter - Concerning New Principalities Which Are Acquired by One’s Own Arms and Ability⁵⁷

The challenges associated with developing effective support for the underlying vision and goals embedded in BIW 2011 among senior management are further described in the *Senior Management* portion of the *Building the Case for Change* section. Additionally, a distributed network of leaders needs to be developed at all levels of the organization to support implementation of BIW 2011 through a combination of formal instruction and experience. Leadership development is further described in the *Leadership and Succession Planning* portion of *Policy, Procedures and System Alignment*.

The preceding discussion has focused on leadership within BIW’s managerial organizational structure, but tapping the active support of the leadership of BIW’s four unions is also very important. The *Collective Bargaining Units* subsection of the *Bath Iron Works Overview* describes each union, however, the largest and most influential union, LS6, which represents more than eighty percent of all hourly paid employees, will be discussed in this section as the behavior of the other unions would likely follow that of LS6. As previously discussed, relations between LS6 and BIW management have been strained in the past, but are improving. Continued improvement and the strengthening of credibility and trust between the two parties in the future will be important as BIW 2011 begins to be implemented. It is likely that the union leadership will not be members of the BIW 2011 Integration Team, but they will certainly be involved in the implementation and their support and endorsement of BIW 2011 will go a long way toward building commitment within their membership.

LS6 is part of the International Association of Machinists and Aerospace Workers (IAM), the parent union of most labor organizations in the aerospace industry and an active participant in MIT's Lean Aerospace Initiative (LAI). LAI has published a number of papers and case studies on innovative labor and management initiatives and practices that were implemented as the aerospace industry experienced the turbulence of the nineteen eighties and nineties; the IAM was an active participant in many of them. BIW's situation today is remarkably similar to the conditions present in some of these case studies and makes a compelling argument in favor of the leadership of both BIW and the LS6 jointly pursuing similar initiatives as naval shipbuilding enters a period of low-rate production. However, care must be taken to respect the boundaries between the company and the unions so that the credibility and the rights of both entities are protected.

IAM and Boeing Joint Quality Through Training Programs – Case Study⁵⁸

Boeing Corporation and the IAM contractually established a joint union and management Quality Through Training Program (QTTP) during 1995 contract negotiations. QTTP is financed at a rate per payroll hour with a guaranteed minimum annual budget and has provisions for additional expenses. Originally, QTTP had responsibility for workplace knowledge and skills training and was jointly administered by members of the union and management. Over time, QTTP built considerable credibility with the company and the union membership through its successful initiatives and the mutual consideration and respect of the group members as they approached difficult decisions.

September 11, 2001, devastated the airline industry, which severely affected Boeing's commercial aircraft construction business and forced the company to announce the layoff of 30,000 workers. In addition to the massive workforce reductions, Boeing was implementing lean manufacturing and preparing for the upcoming training of a new workforce as thousands of aging workers prepare for retirement in the coming years. This complex and difficult situation changed the role of the QTTP as it began to use its credibility and connections with the company and the union membership to lead organizational problem solving and function as change agents. The QTTP innovatively promotes activities that are mutually beneficial to both the company and the union membership, given the business realities of the commercial aircraft construction business.

Some of QTTP’s activities include: outplacement assistance of those laid off, rigorous and transparent training processes, skills auditing and accountability, and return to work issues and policies for an aging workforce.

Union and management members of the QTTP admit that organizational dynamics are present, but the mutual respect among the members helps to mitigate these effects and does not paralyze their work. Neither party wanted the workers to be laid off, but, by working together, labor and management were able to adjust to the new business realities while helping those leaving the organization to the extent possible. QTTP is an excellent example of joint union and management leadership in the midst of a difficult situation.

Assessment

Table 13 assesses the value, cost, schedule and risk of gaining champions and sponsors and is followed by a brief explanation of each assessment.

Table 13: Champions and Sponsors Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe	X		
Involved Employees	X		
Cost		X	
Resistance		X	

- Required Timeframe – Strong, overt leadership must be center stage from the beginning; champions and sponsors need to be very visible and sustain their commitment for the full duration of the initiative.
- Involved Employees – Initial resource requirements are low because the leadership requirement is at the higher levels and involves a fairly small group. As detail planning and implementation progresses, the requirement for leadership will increase, as will the requirements for leadership training.
- Cost – Costs are likely to be relatively low, but there will be some costs associated with leadership training.
- Resistance –If champions and sponsors openly display resistance, the project will fail before it begins. Reaching consensus on the appropriate lower-level goals of BIW 2011 and demonstrating commitment to the effort is likely to meet with some initial resistance but should be resolvable. Longer-term resistance will surface as people are asked to leave their comfort zones and take more active and proactive leadership roles.

Quick Wins and Local Innovations

There is no better way to build large-scale commitment to an initiative than rapid, visible progress. Enterprise-level change is a time-consuming process measured in years, so quick wins are critical to sustaining the sense of urgency, demonstrating visible progress and piloting new ideas for diffusion to the rest of the enterprise. Ultimately, change has to be accepted and implemented at all levels in the organization, which quick wins and local innovations help promote. Beyond their symbolic importance, they can serve as key entry points for innovation. This section will: discuss the importance of aligning and focusing projects with the objectives of BIW 2011, describe the types of innovation, and discuss implementation of quick wins and local innovations.

Supporting BIW 2011 Objectives

Prior to initiating any new projects, a thorough evaluation of ongoing initiatives must be conducted in order to assess their: alignment with the company's objectives, return on investment, potential business impact and potential workforce morale impact. Projects that don't measure up should be terminated. Canceling ongoing initiatives is not risk-free, but the number of initiatives must be focused and if there are too many or they do not directly support the primary goals and objectives of BIW 2011 they must go. All future initiatives must also be aligned with the enterprise's core competencies and should not exceed six or seven, as greater numbers will dilute the impact of each initiative and divert management attention.

Innovation

Moving beyond the broad Webster's Dictionary definition of innovation as "the introduction of something new" or "a new idea, method or device," innovation can be subdivided into incremental and radical categories.⁵⁹ Using technology s-curves to represent the lifecycle of a given technology, Figure 47 illustrates the differences between incremental and radical innovation at either the macro or micro level. Ferment represents the early life of the technology where performance remains relatively flat as the basic technology is refined. Performance increases rapidly during Takeoff as the technology is refined and rapid incremental improvements are made. These incremental improvements represent incremental innovation. As the technology reaches Maturity, the

s-curve begins to flatten out. Incremental innovation is still occurring, but the incremental increase in performance per time (and likely per cost) is low compared to the Takeoff portion of the curve. Finally, a new technology, with a new s-curve, is introduced to replace the old technology. The initial transition from old to new induces some disruption and a transient dip in performance as the new technology begins to climb its own s-curve. Performance of the new technology quickly exceeds the performance of the old technology. Moving from one s-curve to another as new technologies are introduced with large increases in performance represents radical innovation. It should be noted that s-curves are illustrative and not drawn to scale. S-curves describe cycles of innovation and show trends, but are not good tools, in and of themselves, for forecasting performance or the time to gain such performance.⁶⁰

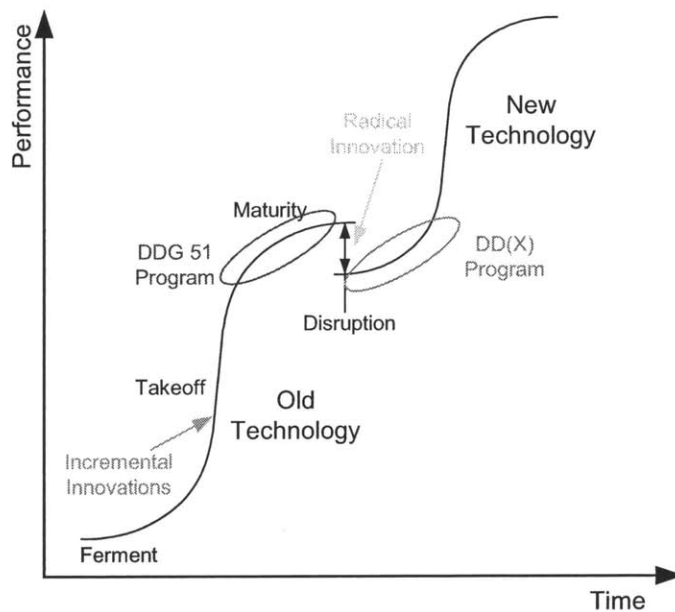


Figure 47: S-Curves Illustrate Innovation Patterns

At a macro level, Figure 47 presents s-curves of current surface combatant programs. The DDG 51 Program has reached maturity as a stable program with slightly increasing, but largely flat performance. The DD(X) Program is shown as the replacing technology in the coming years. The initial transition from DDG 51 to DD(X) is likely to experience disruption as DD(X) contains many new technologies that must be integrated into a system for the first time aboard the ship. However, once the initial issues are resolved,

DD(X) Program performance should increase rapidly and exceed that of the DDG 51 Program.

At a local level, s-curves can be applied to specific areas or processes. The remainder of this section will address quick wins and local innovations, which can be considered as radical and incremental innovations, respectively. Figure 48 illustrates quick wins as projects that introduce innovations designed to provide dramatic increases in performance and represent new ways of thinking. Local innovations generally provide incremental increases in performance to existing technologies or processes. It can be seen that there is an area of overlap between quick wins and local innovations as they can occur in concert. S-curves provide a useful framework for understanding quick wins and local innovations as they illustrate the potential expected outcome of certain types of initiatives and aid in resource allocations. These concepts will be further described in the following sections.

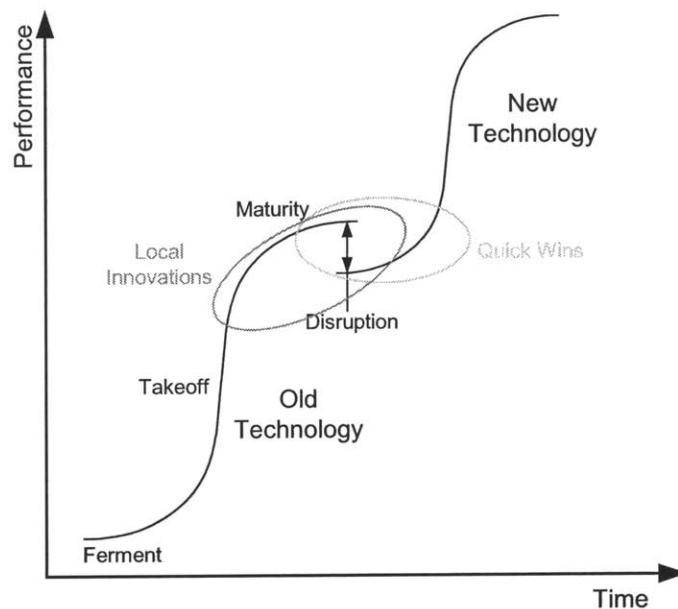


Figure 48: Quick Wins and Local Innovations S-Curves

Quick Wins

As previously discussed, BIW 2011 has to overcome the perception that it is just another “initiative of the week,” which have generally only resulted in quick, localized wins and have not translated into enduring, enterprise-level change. Overcoming this perception with the workforce and demonstrating that these quick wins are part of a larger plan will

be difficult, but this must be done to bolster the credibility of the entire initiative. Quick wins can take many forms including mini-initiatives, localized testing of a broader application or full-scale pilot projects. For simplicity, quick wins and pilot projects are used synonymously, and their strategic intent is generally to introduce radical innovation through planned initiatives or projects.

Clear objectives and evaluation criteria must be established before embarking upon any pilot project. Primarily, pilot projects should have a low probability of affecting performance of the core business during their early implementation and should, ideally, improve existing performance. Pilots must support the primary objectives of BIW 2011 and be aligned with the core competencies of the implementing organization. Finally, pilot projects need to demonstrate the concept or move the initiative forward, but must be simple and nimble so the project does not become bogged down under its own weight. The accuracy and speed of pilot projects is more important than precision in establishing quick wins; the primary purpose of pilot projects is to quickly demonstrate concepts and may not incorporate all attributes necessary for integration into the standard processes and procedures of the enterprise without further development.

The manner in which such projects is introduced to the organization and the people assigned to implement the project is very important. Performance expectations must be carefully managed because high-profile pilots generally have high performance expectations. It is imperative that only projects with a high potential to deliver the intended performance are allowed to continue and costly, marginally-performing projects yielding modest incremental innovation are avoided. Similarly, the implementing team, especially the team leader, needs to be capable of thinking innovatively, yet practically. It is not reasonable to expect radical innovation from a team that has been using the same tools and processes for decades if they are not challenged and reinforced with good leadership to think beyond their comfort zone. However, these same employees, if properly trained and motivated, can be invaluable during the implementation phase as they are transformed into Outsider-Insiders.

Local Innovations

Local innovations are incremental innovations that manifest themselves as the change initiative gains momentum and the workforce becomes excited and empowered to think creatively. Empowering a workforce to take ownership of an initiative or process change without fear of negative repercussions can create a fertile environment for innovation because the workforce understands the problems with the status quo and generally knows how they would like to change the daily reality of their workplace. Local innovation can not be rigorously planned, but conditions and prevailing attitudes can be created to increase the probability that improvements and changes will emerge. Increased performance expectations are not generally as high with local innovations as with quick wins, but the compounding benefits can produce some surprising results. Using Klein's terminology as described in the *Change Overview*, the "pings" of quick wins and compounding local innovations will culminate to create the resounding "pong" of change that will resonate throughout the organization.⁶¹

Implementation of Lean Principles in Pre-Outfit II – Case Study

There is not necessarily a clear line between quick wins and local innovations. For example, the implementation of Lean principles in BIW's Pre-Outfit II stage of construction is a case of incremental innovation turned radical.^{§§§} Implementation of Lean principles began with a charter to improve performance given to a team of production managers. Within the union workforce, the implementation of Lean principles was widely considered to be a move by the company to eliminate jobs, so initial resistance to the implementation team was high. Also, implementation of Lean principles within a shipyard is different than in a typical factory setting because the "factory" (i.e., large units or the ship itself) is temporary in any given production area and must be continually recreated.

^{§§§} See the *Facility and Process Description* of the *Bath Iron Works Overview* for a description of Pre-Outfit II.

The team began Lean principles implementation with 5S, a Lean process designed to remove clutter and keep the work area clean, free of excess material and accessible. Through a campaign of education and action, performance increased and 5S became an accepted process. The team sought new projects, building on their previous achievements, and successfully implemented several more incremental innovations, which continued to bolster the team's support and credibility with the workforce.

The team recognized that one of the biggest bottlenecks within the Pre-Outfit II stage was the initial setup of the unit as it entered the production building. Briefly, the units enter the Pre-Outfit II building for continued outfitting after they have been blasted and painted. Before mechanics can begin working on the unit it must be brought into the building, leveled and equipped with stair towers and staging for access, temporary lighting and other temporary services such as compressed air, gas and welding machines. This process could take close to a week to complete before the first mechanic began installing equipment aboard the unit. The team set a goal of reducing the duration to less than a single shift of eight hours.

Drawing on suggestions from the workforce and their own observations, the team began detailed process mapping and planning of a typical unit set-up. The final plan was a combination of incremental innovations, such as pre-building stair towers on wheels rather than stick building them in place, and radical innovations, such as forming a yard-wide team of temporary service electricians to provide concentrated service around the yard to shorten individual unit set-up durations. To the surprise of many, the team met their goal of a single shift set-up on the first unit they attempted. The setup duration has continued to decrease over time and currently averages a half shift.

The combination of quick wins and local innovations employed by this team has produced dramatic performance increases. Given the number of ships already constructed in the DDG 51 Class and the maturity of the design and the construction processes, performance increases of only a couple percentage points per hull are generally expected at this stage of the program. However, Pre-Outfit II managed to reduce the hours expended during this stage of construction by twenty-five percent as compared to the

prior hull completing the same stage of construction. This radical decrease is largely due to the quick wins and local innovations facilitated by the implementation team and embraced by the workforce within the building. The future challenge will be to sustain these practices within Pre-Outfit II and to diffuse them to other parts of the shipyard.

Assessment

Table 14 assesses the value, cost, schedule and risk of quick wins and local innovations and is followed by a brief explanation of each assessment.

Table 14: Quick Wins and Local Innovations Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe		X	
Involved Employees		X	
Cost			X
Resistance			X

- Required Timeframe – Quick wins and local innovations are generally the first visible manifestations associated with enterprise-level change initiatives. They are important in supporting the plan and promoting workforce acceptance, but should not be initiated until the overall BIW 2011 strategy is fully developed. Starting pilot projects too early may lead to diminished impact of the pilot or misaligned objectives.
- Involved Employees – Pilot projects can require significant numbers of people to implement and local innovations, although of generally shorter duration than pilot projects, can involve substantial numbers of people as well.
- Cost – Pilot projects are likely to require capital investment, so projects should be carefully chosen and prioritized. Local innovations are generally less costly, but may still require investment.
- Resistance – Quick wins and local innovations bring change implementation to the lowest-levels of the organization and provide visible progress of change to the greatest numbers of people. Consequently, resistance is likely to be high as employees are asked to behave differently and think innovatively. Also, fear is likely if these projects potentially threaten the job security of a segment of the workforce. Resistance will be overcome as the quick wins and local innovations demonstrate their value and begin to gain acceptance; also, pilot projects allow for small-scale testing, refinement and risk reduction of applications destined for enterprise-wide implementation

Communications and Best Practice Exchange

“Communicate, communicate, communicate – until you are sick of hearing yourself. Then communicate some more.” – Jack Welch, former CEO of General Electric

The value of communications is generally acknowledged but its scope and importance is often understated. Communication encompasses all forms of information transfer; in the workplace this would include: official memoranda, e-mail, newsletters, phone calls, videos, press releases and interviews, best practice exchange, meetings and deck plate conversations. When viewed in this manner, effectively communicating is huge task that is critically important to virtually all aspects of a business. This section will primarily address the enterprise-level communication and best practice exchange in support of BIW 2011.

Importance

Noted researcher Kenneth Kovach repeated a study of 1,000 industrial sector employees and 100 supervisors several times over a period of four decades to assess influences on employee motivation from both the employees' perspective and the managers' perception of the employees' perspective. The results, shown in Table 15, were remarkably stable over the span of the studies with only two study items, "Feeling 'in on things'" and "Appreciation of Work", swapping positions. The studies show some surprising mismatches between what employees actually value and what managers perceive they value. The most striking finding is that "Feeling 'in on things'", the result of effective communications, is among the most important to the employee, but the least valued by management.⁶² Ironically, communicating with employees pays tremendous dividends with relatively-low resource requirements and is almost completely within management's control and discretion, as compared with more restrictive and expensive yet less-valued items like "Good Wages" and "Promotion/growth".

Table 15: Employee Motivation⁶³

What Employees Want	Items	What Employers Think Employees Want
1	Interesting work	5
2	Appreciation of work	8
3	Feeling "in on things"	10
4	Job security	2
5	Good wages	1
6	Promotion/growth	3
7	Good working conditions	4
8	Personal loyalty	6
9	Tactful discipline	7
10	Sympathetic help with problems	9

Strategy

Indiscriminant release of information is easily accomplished but produces few tangible benefits; however, effectively and meaningfully communicating with the workforce at an enterprise level requires a tiered strategy with specific objectives. No case studies of over-communication were found during research for this section, but there were multiple instances of inappropriate methods, miscommunication and poorly-phased communications. Consequently, a good communications strategy must provide for frequent, well-planned and phased communications that deliver a focused message that is appropriate to the intended constituency.

The *Compelling Communication* discussion within the *Building the Case for Change* section described some of the vehicles that BIW's president and Strategic Planning and Communications Department have used to communicate with the workforce in building support for enterprise-level change. Each means of communication is traceable to the following set of objectives and strives to be:

- Credible - Be credible in all communications with each other, workforce and press
- Consistent – Messages are consistent and support the company's goals
- Timely – Communication must be timely to be useful
- Appropriate
- Reinforce goals
- Address different constituencies – salaried, hourly, etc.
- Do no harm
 - Minimize risk of misinterpretation
 - Easy to use
 - Not business sensitive

- Accessible – appropriate information is available in an appropriate format
 - Communicated to all (e.g., important company announcements are distributed to everyone in the company)
 - Provided to the interested (e.g., e-mail reminders are sent that a new newsletter is available or newsletters are provided in a news box)
 - Provided to a subset within group (e.g., industry news clips are distributed daily to the interested and provided on an intranet page for those not on distribution)
 - Casually available to the interested (e.g., industry news clips are provided on an intranet page for those not on distribution)
- Resource Conscious – communications must optimize value
 - Personnel
 - Material

The communications objectives associated with BIW 2011 should not change significantly, but the implementation will evolve and delivery will likely intensify over time.

Enterprise-Level Communication

BIW's workforce is comprised of multiple constituencies with differing communications requirements, as described in the *Workforce* portion of the *Bath Iron Works Overview*. A key communications challenge is serving each constituency in a manner that is appropriate, effective and efficient. Consequently, BIW has adopted a tiered approach to diffusing information, as shown in Figure 49. The highest-level of the left pyramid contains the most focused and important themes to be communicated. Each successive layer of the pyramid contains more detailed information, but is not as focused in its delivery. The inverted pyramid on the right segregates the workforce by desire for information and the relative effort that an individual is willing to expend to receive the information. It is assumed that the greater the desire for information, the greater the effort an individual will expend to receive it.

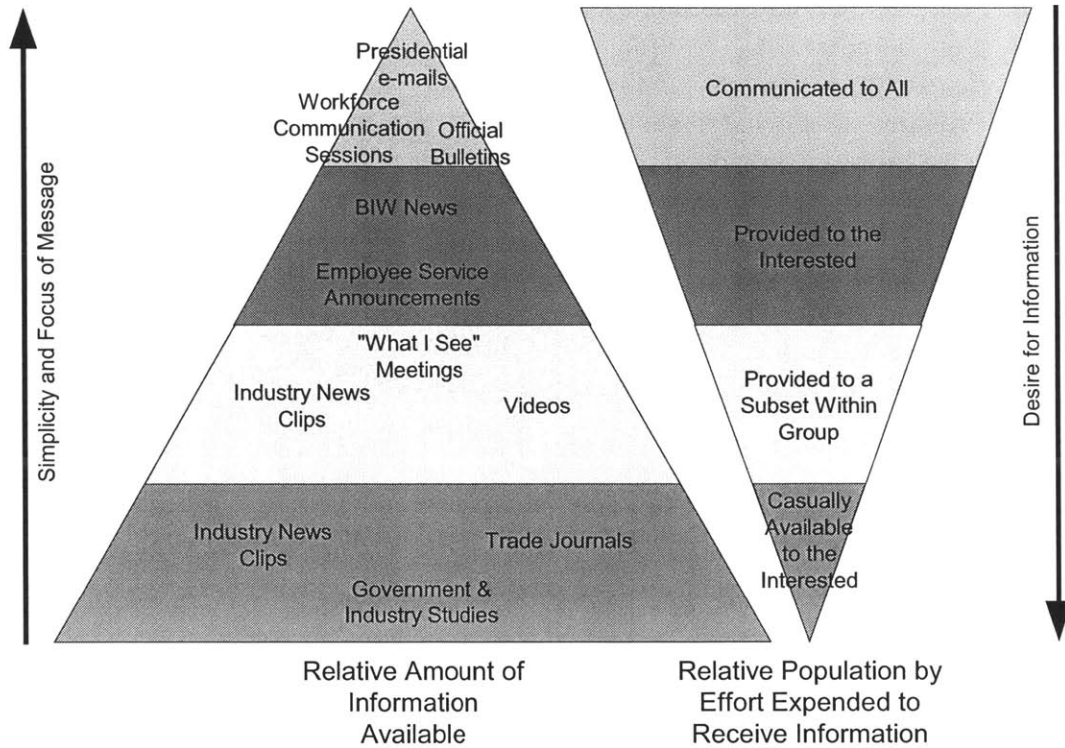


Figure 49: Tiered Communication Approach

Table 16 describes the different communication vehicles shown in Figure 49 and their intended purpose. The *Compelling Communication* discussion within the *Building the Case for Change* contains more detailed descriptions of some of these items and will not be repeated in this section.

Table 16: Enterprise-Level Communication Vehicles

Communication Vehicle	Description
Presidential e-mails	Periodic communication to the workforce to deliver a specific, personal message (See <i>Appendix D – Sample E-Mail from Shipway to the Workforce</i> for example.)
Workforce Communication Sessions	Monthly communications sessions with the workforce by area management to discuss performance, safety and shipyard-wide topics (See <i>Manufacturing Workforce Communication Sessions - Case Study</i> for more detail.)
Official Bulletins	Periodic one or two page announcements containing timely, company-related information. (e.g., organizational changes)
BIW News	Monthly publication to recognize the service, accomplishments, innovation and contributions of BIW's employees and to provide information on matters that are of interest to the workforce.

Employee Service Announcements	Periodic one or two page announcements containing timely service-oriented information. (e.g., upcoming blood drive)
“What I See” Meetings	Recurring series of meetings with front line supervisors focusing on performance, challenges and the state of the industry
Industry News Clips	Articles related to the customer, General Dynamics, or one of its business units from various media outlets
Videos	Periodic internally-produced videos for a specific purpose
Trade Journals	Defense industry publications featuring current industry and Government activity and news
Government & Industry Studies	Periodic studies regarding shipbuilding produced by industry groups and various branches of the Government

Development of communication media follows the process shown in Figure 50. The process is simple yet ensures the intended communication is aligned with the objectives, is of high quality, addresses the desired population and has a feedback loop for continuous process improvement.

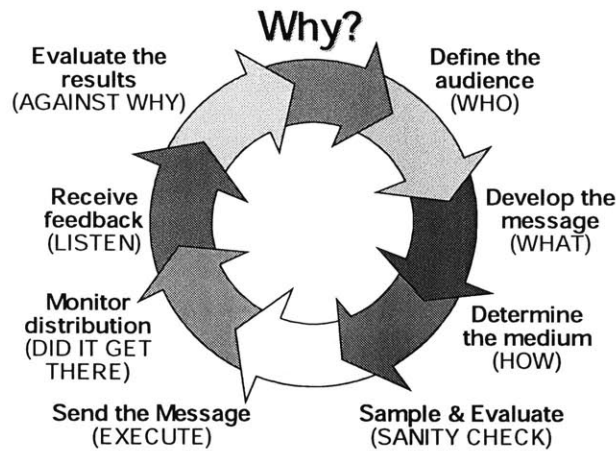


Figure 50: Communication Process

Communications content and process within BIW have improved dramatically over the past year and continue to progress. The consistency and timeliness of communications has lessened workforce resistance and skepticism and has increased the demand for information while uncovering some emergent needs. Implementation of BIW 2011 will not change the communications strategy appreciably, but it will present new and different challenges and requirements. Primarily, a strategy on how and when to describe BIW 2011 needs to be developed. It is important that employees understand the

objectives, anticipated duration and the contemplated changes of BIW 2011. However, the specifics of the plan should be incrementally communicated in a manner that is understandable and not apt to cause undue alarm within the workforce. It will be important to maintain consistent communications with the workforce as BIW 2011 implementation progresses even if the communication is that there is nothing to communicate. Regular information will add a component of stability for the workforce during a period of significant uncertainty and turbulence.

Manufacturing Workforce Communication Sessions - Case Study

The manufacturing directors hold monthly communication sessions for all of their supervisors and mechanics to discuss the prior month's performance, safety, company-level information and items of general interest. Generally, the director will shut down a manufacturing area for an hour and hold the meeting in a space that is large enough to contain all of the area's employees. These communication sessions are the primary opportunity for the director to address that area's workforce as a group and provide a forum for discussion and team building.

Manufacturing management approached the Strategic Planning and Communications Department for help in developing appropriate themes and company-level content to support these meetings. A meeting was held with all of the stakeholders to establish the requirements and to discuss alternative content delivery methods. The need for continuity with the themes of the president's monthly BIW News column and the content of the "What I See" front line supervisor meetings was quickly established. The manufacturing directors acknowledged that much of the information they were requesting was already available from a variety of sources, but required significant time to distill into a presentable format and ran the risk of deviating from the month's primary communication themes. All agreed that consistently-provided information on company events and central themes would be the most efficient to develop and most effective in communicating with the workforce. Four primary methods of delivery were discussed: a monthly video, a quarterly video, centralized PowerPoint content, or decentralized (produced at the division level instead of the company level) PowerPoint content.

Following the meeting, the Strategic Planning and Communications Department analyzed the relative merits of each content delivery alternative against the communication objectives. Each alternative was rated as strongly supports, moderately supports, neutral, moderately against or strongly against each communication objective. The communication objectives were weighted as to their relative importance in the evaluation; most primary objectives were considered to be of equivalent importance. The relative ratings were then translated to a one to five scale and multiplied by the importance of each objective so that each alternative could be scored. Figure 51 shows that the centralized PowerPoint content alternative best supports BIW’s communication objectives. Beyond the analytic evaluation, the preferred option facilitates management-workforce interaction and builds credibility because the leader of that particular area delivers the content. Although the video format alternatives offered a flashier delivery, they would effectively preclude interpersonal interaction.

	Monthly Video	Quarterly Video	Centralized PowerPoint Content	Decentralized PowerPoint Content	Weighting
Credible	++	++	++	=	17%
Consistent	++	++	++	--	17%
Timely	++	=	++	++	17%
Appropriate					
Reinforce goals	++	++	++	+	6%
Different constituencies	=	=	=	++	6%
Do no harm					
Minimize misinterpretation	++	++	++	=	2%
Easy to use	++	++	++	=	2%
Not business sensitive	++	++	++	-	2%
Accessible	++	++	++	+	17%
Resource Conscious					
Personnel	--	-	=	++	12%
Material	--	-	++	++	5%

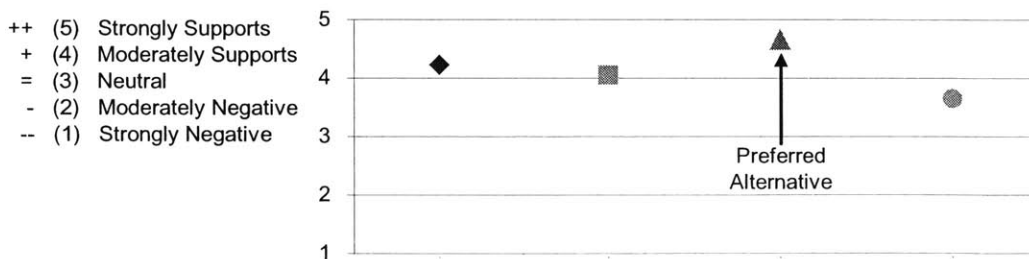


Figure 51: Content Delivery Alternatives Evaluation

A second meeting was held with the stakeholders and the Strategic Planning and Communications Department recommended the centralized PowerPoint content as the best means of communicating with the workforce and provided proposed content for the

following month. All stakeholders agreed that the centralized PowerPoint content was the best method for delivery and that the gathered group would meet monthly to ensure that all had a common understanding of the themes and content for the month.

This meeting represented a good first-step in further diffusing Shipway's goals for BIW and increasing employee knowledge of the business and BIW's future. The challenge will be to sustain both the communication sessions themselves and the monthly meeting of the Strategic Planning and Communications Department and the manufacturing directors. Historically, communication-related activities are among the first to be deferred during busy or stressful periods.

Best Practice Exchange

The exchange of best practices is another form of communication that is generally acknowledged as being important but falls short in the execution. Often times, best practice exchange is the transfer of "tribal knowledge" by word of mouth through no formalized process. This method can be successful on a small scale, but it is not sustainable and is very difficult to diffuse to an entire enterprise. As BIW 2011 planning proceeds, formal processes and tools for collecting and diffusing best practices need to be contemplated. Also, best practices should not be drawn exclusively from internal sources. This is especially true during the planning stages of BIW 2011 since there are substantial, documented best practices and lessons learned from other large change initiatives in other industries. As previously discussed, the aerospace industry and Electric Boat are very good examples since their customers, products, workforce demographics and labor structures tend to be similar to those of BIW. However, care must be taken when introducing both internal and external best practices to the intended recipients because BIW has a strong culture of Yankee independence and a "not invented here"**** attitude, which can not be ignored as many aspects of BIW 2011, beyond Best Practice Exchange, are further developed.

**** "not invented here" refers to a tradition of internally reinventing the wheel and not readily adopting external input

Assessment

Table 17 assesses the value, cost, schedule and risk of effective communications and best practice exchange and is followed by a brief explanation of each assessment.

Table 17: Communications and Best Practice Exchange Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe	X		
Involved Employees	X		
Cost		X	
Resistance			X

- **Required Timeframe** – Communication supports and diffuses any of the prior elements discussed, is critical to building support for BIW 2011, and keeps the workforce informed with a clear set of facts during times of uncertainty. If communications don't keep pace with activity, the workforce may view BIW 2011 as a subversive plan rather than as a path to BIW's future.
- **Involved Employees** – Basic, effective communications do not require substantial personnel beyond those already in place. However, as BIW 2011 implementation expands so will the communication requirements, which will likely increase required resources.
- **Cost** – The expanded and more intensive communication requirements of BIW 2011 are likely to increase the costs associated with communicating because of the increased scope. Capital investment may be required if radical, higher technology means of communicating are adopted.
- **Resistance** – The workforce is likely to be resistant to initial communications regarding BIW 2011. Part of this resistance will be due to the previously discussed skepticism of the workforce regarding new change initiatives. Resistance will also be due to dislike of BIW 2011's message, which will clearly state that BIW will be a substantially different company in 2011 than it is today. As shown by the Kovach study, employees value communication and feel more connected to the organization when they are better informed. This is especially true during times of uncertainty when people are nervous and rumors will readily fill any gap in the flow of communications. Consistent and timely communications over a sustained period of time are required to overcome the resistance.

Policy, Procedures and System Alignment

An important, yet often overlooked, aspect of change initiatives is realigning the various policies and procedures to the structure of the new system. Initial changes to an enterprise are often treated outside normal company processes as they are being implemented and institutionalized. Subsequently, policies and procedures need to be changed to conform to the new way of doing business at an enterprise-level, which makes the changes

permanent and consistent throughout the enterprise rather than being transient perturbations to the system. These changes may include company policies, operating procedures, compensation structures, and organizational structures.

Employees will behave in accordance with the expectations of the system by which they are managed, evaluated and compensated. As Gerstner puts it, "Many used hierarchy as a crutch and were reluctant to take personal responsibility for outcomes."⁶⁴ Realigning the system to match the new expectations of the changed enterprise reduces ambiguity and encourages personal responsibility and performance as there is no longer an inconsistent web in which to hide. There will be many policies and procedures, some more important than others, that will need to be addressed through the creation of a prioritized plan as the implementation of BIW 2011 progresses. However, this section will only discuss planning processes, performance evaluations, leadership and succession planning and future union contract negotiations. These items are likely to be among the first to come into focus and the most important to align as BIW 2011 begins implementation.

Planning Processes

A shipyard lives and dies by the planning and MRP systems that control the scheduling of work and material, as described in the *Processes* portion of the *Building the Case for Change* section. The core of BIW's current MRP process has been in use since the beginning of the DDG 51 Class and has performed well, but the technology employed in the design and construction of DD(X) will require a more robust system. A key BIW 2011 system alignment activity will be to replace the current MRP system and the related higher-level resource planning, master scheduling, and financial and labor reporting systems with a single integrated system with significantly enhanced capability and control. Each of these elements currently exists, but these capabilities were developed over time and have resulted in variety of semi-compatible systems requiring significant human interaction to share data.

Similarly, the management reports generated from these data for both internal and external customers need to be reassessed. Internally, a large number of customized reports are created throughout the shipyard to meet the needs of individual managers. As

the reporting system is streamlined, a core set of reports should be established that will fulfill the needs of all users while eliminating the requirement to generate individualized formats and data. Some initial training and familiarization among the recipients of the data will be required, but standardizing these reports will reduce the required resources to generate them and will provide a more consistent framework upon which to discuss performance across the shipyard. Externally, BIW must provide progress reports to the Navy on a monthly basis in accordance with the approved Earned Value Management System (EVMS). Any changes to these processes or reports would have to be negotiated, but the Navy has also undergone significant process changes in an effort to reduce its own bureaucracy and streamline reporting requirements for its contractors. Reassessing the reporting requirements and manner in which performance is reported could yield benefits for both BIW and the U.S. Navy customer as BIW strives to become more competitive and efficient in its processes.

Performance Evaluation

The preceding discussion was focused on the macro behavior of the entire system; however, employee performance evaluations are an important means to assess and change the behavior of the individuals comprising the system. Transforming the performance evaluation process to make it consistent with the changes and challenges of BIW 2011 will be very important to aligning the motivation and performance expectations of individuals with the desired performance of the system. Since performance evaluations are also measurement tools, they are discussed in greater detail in the *Measures, Milestones and Feedback* section.

*Leadership and Succession Planning*⁶⁵

Within the salaried ranks, BIW has a very senior workforce that has been largely managed by attrition as workload has declined over time, as described in the *Workforce* section of the *Bath Iron Works Overview*. Traditionally there has been a sizeable pool of qualified candidates to fill key management and leadership positions. However, a large number of current managers will be eligible to retire in the next few years, as will many of the senior individual contributors that would have been likely successors, and there is no clear succession path for younger employees. To address this impending gap, a

leadership development team comprised of representatives of varying seniority and from different divisions was formed to establish a company-wide leadership development program and associated strategy for succession of key shipbuilding roles.

In the past, BIW has had several leadership and management development programs, generally consisting of developmental rotations and formalized instruction in leadership and business practices. These programs had varying levels of success, but a common attribute of the programs was that many of the graduates left BIW for other jobs after they had completed the program, thus defeating the intended purpose. Consequently, BIW management has been reluctant to invest heavily in formalized leadership development in recent years and has tended to sponsor employee development on a case-by-case basis. The current leadership development team gathered significant data on these past programs and has evaluated the successes and failings of each as they developed their approach. BIW's Engineering and Procurement division has its own, long-standing Engineering Development Program (EDP), where competitively-selected engineers expand their corporate knowledge of the manufacturing, support and technology divisions through a series of three to six month rotations spread over a two-year period. The flexible structure of this program has made it very successful, equipping the graduates with a broader perspective of the business and a substantial contact network throughout the shipyard as they enter their post-EDP assignments. The final product of the leadership development team is likely to bear some resemblance to the EDP.

The team's work is ongoing, but their preliminary efforts have been in two major directions. First, in a manner similar to the analysis of core shipbuilding manufacturing skills described in the *Critical Skills Retention* portion of the *Building the Case for Change* section, linchpin positions were established. Linchpin positions are defined as those positions that are essential to the long-term health of the organization. They're typically difficult to fill, they are rarely individual-contributor positions, and they usually reside in established areas of the business and those critical to the future. By monitoring the pipeline for these jobs, BIW can focus development programs on ensuring an adequate supply of appropriate talent. Table 18 lists the team's assessment of

shipbuilding management linchpin positions and those that are potential linchpin positions, but do not meet the above definition even though important to the enterprise.

Table 18: Shipbuilding Management Linchpin Positions

Linchpin Positions	Potential Linchpin Positions
<ul style="list-style-type: none"> • President • VP Finance & Administration • VP Operations • Director Contracts & Estimating • Director Design • Director Environmental, Health & Safety • Director Labor Relations • Director LLTF & Testing • Director Planning & Master Scheduling • Director Pre-Outfit • Director Procurement & Material Control • Director Production • Director Program Finance • Director Ships Completion • Chief Operating Engineer • Program Manager LCS Programs 	<ul style="list-style-type: none"> • VP & General Counsel • VP Engineering & Procurement • VP Human Resources • VP Planning & Material Control • VP Programs & Strategic Planning • Director Fabrication & Installation Support • Director Facilities • Director Finance & Accounting • Director Financial Control • Director Functional Engineering • Director Human Resources Services • Director Production Control • Director Strategic Planning & Communications • Manager DD(X) Program

The leadership development team's second area of focus has been in the area of core leadership competencies and performance criteria for each linchpin position. The team has established the leadership competencies and has gathered most of the performance information for each linchpin position; they are now in the process of developing a standardized evaluation rubric. The rubric would be used to assess a candidate against the core leadership competencies and abilities and the specific performance criteria of prospective linchpin positions under the following broad attributes:

- Experience
- Business acumen
- Technical ability
- Results orientation
- Process orientation
- Leadership style
- Management style
- Decision making and innovation
- Personal commitment

The rubric would be used not only to identify potential candidates for linchpin positions, but would also assess gaps in competencies requiring further development of the candidate. From these data an estimate could be made of the required development timeframe before the individual would be ready to assume a given role. It is also anticipated that a performance-based evaluation process would be used to identify potential candidates for further evaluation. The goal is to develop a pool of future company leaders with several potential candidates for each linchpin position. Anointing a single heir apparent for each linchpin position is not the team's goal.

The next phase of development will be to benchmark other leadership development programs within General Dynamics and at other companies similar to BIW and to establish a formal leadership development program at BIW. Potential leaders within the company will then be identified and admitted to the program. The specific structure of the program is not yet clear, but it is likely to involve rotational and developmental assignments both within BIW and at other General Dynamics business units.

Appropriately aligning both company and the individual expectations will be key to the success of this program. It would be unreasonable for the company to try to guarantee advancement or a specific position to an individual, but guaranteeing interest and opportunity is imperative. The company will be asking for significant dedication from the members of this program, including rotational assignments that may remove them from their prior career path. In return, the company is making an investment in them. Therefore, there must be some guarantee of interesting and challenging work and opportunities to grow and advance in a manner that is mutually beneficial to both the employee and the company without being detrimental to the career aspirations of the employee. Without some sort of agreement, there is high likelihood that some of these future leaders will leave the company before their desired position becomes available. BIW 2011 will provide new and different opportunities demanding solid leadership at all levels of the organization. Cultivating a pool of future leaders equipped to address the challenges of BIW 2011 will be imperative to its success.

Future Union Contract Requirements

The two preceding sections have addressed aligning BIW's salaried population in the context of BIW 2011, but similar adjustments within the large represented populations will also be required. The competitive environment will necessitate changes in the labor-management relationship as flexibility and innovation become critical aspects for organizational survival. Traditional, rigid trade classification structures were manageable when shipbuilding volume was high, but as volume decreases more flexibility to move people across mutually agreed upon trades in limited numbers will be important. This will allow for absorption of variations in workload without having to continually layoff or hire employees within a trade classification. Trade flexibility would be beneficial to both the company and the union as it provides the company the required flexibility while providing employment stability for the union membership. Additionally, new skills and different proportions of traditional skills will be required to construct the surface combatants of the future. These shifts will necessitate changes in training, staffing and hiring practices and will have to be negotiated with the union to affect an outcome that is beneficial to all parties. As discussed in the *Champions and Sponsors* section, there is a considerable body of work, including case studies of successes in union-management collaboration, available from similar experiences in the aerospace industry that should be drawn upon in the future as the opportunities are explored.

Assessment

Table 19 assesses the value, cost, schedule and risk of aligning the policies and procedures of the new system and is followed by a brief explanation of each assessment.

Table 19: Policy, Procedures and System Alignment Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe			X
Involved Employees			X
Cost			X
Resistance			X

- Required Timeframe – The specific system alignment activities described in this section are more rightly classified in medium-term, but most activities are more likely

to occur in the longer-term as changes become institutionalized and the policies and procedures are formally evolved to match the new dynamics of the system.

- Involved Employees – These changes will be far reaching and require significant configuration management and control, so they will require efforts across the company to develop and sustain.
- Cost – Changing some policies and procedures is not likely to involve significant costs, but bringing new systems on line or replacing old ones will require capital investment. Costs are likely to include software, hardware and computing infrastructure and new tooling or equipment for manufacturing process modifications.
- Resistance – Resistance to aligning lower-level policies and procedures is likely to be low, but resistance to changing higher-level items, such as those described in this section, will be extremely high because these policies and procedures affect the compensation and employment stability of individual employees. Making these more radical changes needs to be carefully approached and done in a credible, consistent manner to minimize resistance. However, resistance may still be high to some of the changes and will not be overcome until the changes have been implemented and sustained for a period of time.

Measures, Milestones and Feedback

Milestones

Schedule and milestones were discussed in the *Guidance, Structure and Process* section and will not be repeated in this section.

Measures

“People respect what you inspect,” emphasizes Gerstner.⁶⁶ People generally want to meet expectations, but without management attention or specific goals and measures by which to assess progress, focus and performance may degrade. BIW 2011 will require significant changes in behavior and performance. These changes will require measures driven by data and metrics that are collected and developed in a manner that is useful for managing the various portions of the initiative without being overly burdensome administratively. BIW currently collects significant amounts of cost, schedule, safety, absenteeism and manufacturing process data that can be used to measure portions of BIW 2011’s progress. Other parts of the initiative, particularly those dealing with elements of culture and morale, will be far more difficult to directly measure so representative, indirect metrics will have to be developed. It is important that any new data that are collected and any reports generated add value and insight and are not a paper generation exercise.

Performance Evaluation

Performance evaluations of individual employees are traditionally dreaded by both the evaluators and those being evaluated, but are an important human resource measurement tool if properly applied. Performance evaluations can form the basis for employee development plans, merit increases, promotions and force rankings, should downsizing be required. Instituting a fair, objective, metrics-based performance evaluation process across a diverse organization is very difficult, but essential to creating a meritocratic, performance-based culture.

Annual reviews are performed for all salaried employees at BIW and are the basis for merit increases and promotion. The process is largely qualitative and is loosely tied to an employee's goals and objectives. Broad guidance is provided to supervisors, but there is significant variation in the administration of the process by division. Consequently, the majority of employees are ranked on the higher end of the scale and there is little deviation in performance rating because supervisors generally don't want their employees to be ranked lower than employees in other parts of the company. Union contracts govern the compensation and career progression of all represented employees, so they do not receive the same formal evaluation but are evaluated on a regular basis.

The challenges of the future require BIW to be focused on performance at all levels and in all areas of the business. Aligning the annual review process more tightly with the goals, objectives and performance of BIW 2011 will provide a better and more consistent basis upon which to reward high-performers and to identify areas for improvement or employee development for low-end performers. Resistance to such a change is likely to be extremely high at all levels. For example, evaluating and ranking employees is a difficult task for supervisors and will be more difficult if employees that were used to consistently high ratings receive lower ratings and become disgruntled and recalcitrant. Finding consistent evaluation criteria across the divisions and constituencies will be difficult, but instituting metrics-based performance evaluations will ultimately provide more consistent and useful annual reviews for both managers and employees.

Establishing a Performance-Based Appraisal System at Gillette – Case Study⁶⁷

Gillette was chosen as a performance-based appraisal system case study because it experienced many of the same issues when it changed its process beginning in the fall of 2001 that BIW is likely experience along the path to BIW 2011. Even though the products of Gillette and BIW are very different, the challenges associated with developing a performance-based appraisal system across a diverse enterprise are very similar since both companies: began with similar long-standing evaluation systems; have a variety of constituencies including engineers, manufacturing managers, and financial personnel; are comprised of a large number of employees with significant seniority in the company; and find themselves in a changing environment demanding enterprise-level change in many areas simultaneously.

After becoming CEO of Gillette, Jim Kilts discovered that the majority of the employees in the organization were rated as “highly effective” or “exceptional.” Kilts wanted to change the system to reward performance, not effort, and to reserve the “highly effective” and “exceptional” rankings for truly extraordinary accomplishments. Also, while easy, giving everyone approximately the same raise regardless of actual performance is not productive; it does not provide incentives to high performers and perpetuates the indifference of the poor performers. Figure 52 notionally illustrates the distribution of employee performance rankings under the old system and the desired distribution under a performance-based system. Expecting a normal distribution of performance rankings is reasonable if the population is statistically significant because in any group there are those that are truly exceptional, those that are poor performers when judged against their peers, and the majority is distributed around the midpoint. However, it would not be reasonable to expect a normal distribution within a supervisor’s immediate group where the numbers of employees are not statistically significant.

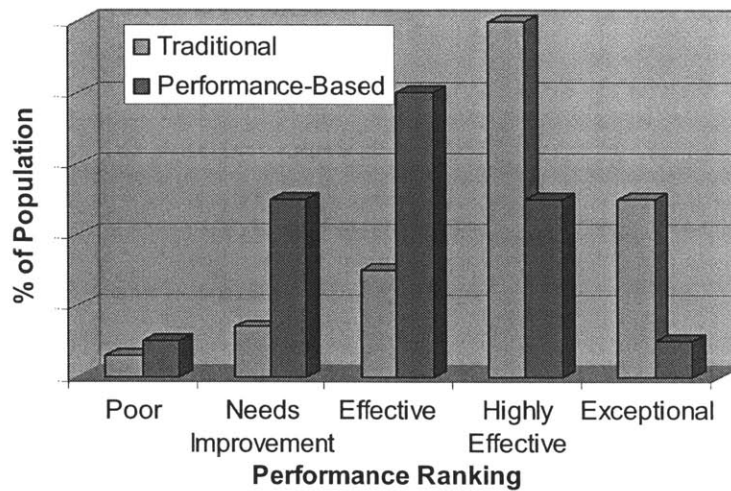


Figure 52: Representative Employee Performance Profiles

The new quarterly performance rating system affected raises and bonuses for Gillette's more than of nine thousand professional and managerial employees. All managers were trained in how to administer the new system and had to explain it to their employees as they were evaluated for the first time under the new guidelines. There was significant initial resistance as many employees felt that the new system was not fair and their contribution to the organization was being valued less even though they were working harder. Managers also had difficulty downgrading the ratings of employees that were working hard yet not demonstrating performance at a required level; executives held their managers firmly to the requirements of the new system despite their protestations.

After using the new performance ranking system for three quarters, employees became more comfortable with the system and began to see the value it provided. Resistance to the new process was eased as employees and managers gained experience with it and as employees saw similar levels of raises and bonuses being awarded as were seen under the old system. Also, testimonials by executives that had themselves been downgraded under the new system helped bolster the credibility and perceived fairness of the new system. For example, one senior executive described that he had been ranked as "highly effective" or "outstanding" for fourteen years, but had been downgraded to "effective" under the new system even though his performance hadn't changed. It had been feared initially that there would be a mass exodus of employees from Gillette because of dissatisfaction with the new system. There was some attrition; however, many of those

that decided to leave the company were the lower-performers and the feared mass exodus did not occur.

Feedback

It is incumbent upon management to provide feedback to the workforce on the progress of BIW 2011, celebrate its successes, and learn from the failures. It is important for all parties to recognize that, while BIW 2011 is critical to BIW's future, mistakes will be made and are unavoidable. Major enterprise-level change requires employees to think innovatively which requires a certain amount of risk taking. Managers must be careful not to punish employees for failing as long as the employees were honest and acting responsibly. Jim Kilts clearly articulated to his employees his policy on mistakes as he described his vision of Gillette's future and the difficult changes required to get there: "Don't make dumb mistakes. Don't punish smart mistakes. Don't make smart mistakes twice. An omission mistake is just as bad or worse than a commission mistake."⁶⁸

Employee-management communication must be a two-way process, and employee feedback will be essential to assessing morale, discovering local innovations and understanding the needs of the workforce. BIW currently has no sustainable company-level process in place to address employee comments, which are generally treated on a case-by-case basis. A process needs to be developed that will allow employees to provide feedback and suggestions to management and receive feedback from management in a timely manner. Employee involvement can be problematic because not all suggestions are actionable or in the enterprise's best interest, but other suggestions provide very innovative solutions to difficult problems. However, the feedback mechanism needs to make all employees and their suggestions feel valued. Regardless of the solution, feedback must be provided to employees if management expects the employees to remain active participants in the process.

Assessment

Table 20 assesses the value, cost, schedule and risk of measures and feedback and is followed by a brief explanation of each assessment. Milestones were previously assessed in *Guidance, Structure and Process*.

Table 20: Measures and Feedback Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe		X	
Involved Employees		X	
Cost		X	
Resistance			X

- Required Timeframe – Measures and feedback should be contemplated early in the process, but implementation needn't precede the start of the initiatives they are intended to track.
- Involved Employees – Even if currently available data are used, there will be some burden associated with tracking the metrics and administering the feedback process.
- Cost – Existing systems will probably have to be modified to successfully measure and track progress of the initiative. Also, supporting infrastructure for the feedback process will have to be developed; this may require capital expenditure depending on the feedback mechanisms chosen.
- Resistance – Initial resistance to measures will be high because people have a natural aversion to being measured or graded and the addition of more metrics and reports will not be valued initially. Resistance to feedback is likely to be fairly high due to employee fears of retaliation, even if anonymity is assured, and because of similar, unsuccessful efforts of the past. Demonstrating the usefulness and value of the new systems will be important in overcoming resistance.

Rewards and Recognition

The final slice of the change wheel, Rewards and Recognition, is no less important than the other attributes of a successful change program and is one of the most difficult to implement consistently and effectively across an enterprise. Employees are people, each with varying needs for acknowledgement of their contributions to the success of the enterprise. In turn, employee behavior and performance is influenced by the way in which they are rewarded. Appropriate rewards and recognition are likely to vary widely across a diverse organization like BIW because of the prevailing culture, the different needs and attitudes within each area of the organization, and differences between the union and salaried populations. However, BIW 2011 is largely dependent on the actions of individual employees, so appropriately rewarding and recognizing their achievements is important to the success of the initiative.

The initial response to providing rewards and recognition is generally monetary, but, as the results of the Kovach study on employee motivation, shown previously in Table 15,

illustrate, money is neither the only nor the most valued motivator of employees. Gerstner's list of motivating factors is similar to that of Kovach, but is somewhat more pragmatic.

- Money
- Advancement
- Recognition
- Fear or anger
- Learning
- Opportunity to make an impact
- Threat of extinction
- Inspired by a compelling vision of the future⁶⁹

“Fear or anger” is instinctually not the best motivator of employees, but it is a powerful force and, unfortunately, it is far too common a practice in a manufacturing environment. This diversity of motivators is again illustrative of the difficulty of consistently applying rewards and recognition across an organization.

Rosabeth Moss Kanter states that “Compensation is a right; recognition is a gift.”⁷⁰ However, the perceived fairness and consistency by which the compensation and merit increase process is conducted strongly influences the amount of fulfillment an employee receives. Performance evaluation and its role in compensation are further discussed in the *Policy, Procedures and System Alignment* section. Merit increases are important and provide annual recognition of an employee's performance in addition to enhancing compensation, but do not recognize positive performance as it occurs over the course of the year.

There are many different approaches to rewarding and recognizing employees, such as a simple “thank you,” special recognition of individuals at staff meetings or by executives, formal rewards and recognition programs that provide material rewards to employees, profit-sharing, instant recognition bonuses, or group lunches and company cookouts to celebrate performance. As can be seen, rewards and recognition can take many forms, can range in size from department level to enterprise-level recognition, are largely dependent on the style of the leader and must be appropriate to the constituency to be recognized. Whatever the form, rewarding and recognizing employees in an appropriate

manner is important and can't be dismissed as being too difficult because each portion of the enterprise is different. Enterprise-level change, like BIW 2011, increases uncertainty and stress levels in employees as old, comfortable mental models are uprooted and changed. Rewarding and recognizing even small victories is reassuring to employees as it provides a level of stability.

Catherine Meek, President of Meek and Associates, a compensation consulting firm, provides the following guidance and consideration regarding rewards and recognition initiatives, both at a company and area level.⁷¹

- Reflect the company's values and business strategy
- Know your employees
- Understand what is meaningful to each individual
- Don't approach recognition as one-size-fits-all
- Involve employees in the development and execution
- Match the reward to the achievement
- Encompass variety
- Involve cash and non-cash rewards
- Be timely and specific
- Ensure that emphasis on someone's achievement does not diminish the importance of other colleagues' achievements
- Allow, to the greatest extent possible, employee control over work
- Allow, to the greatest extent possible, flexible scheduling
- Provide on-going feedback to employees
- Change rewards frequently

Appropriately motivating employees will be critical to the success of BIW 2011, but will also be a substantial challenge. Rewards and recognition need to be consistently applied across diverse constituencies. BIW has attempted various forms of reward and recognition programs ranging in scope from profit sharing to cookouts, and the results have similarly varied from abject failure to extremely successful. BIW 2011 will require a system of rewards and recognition that suitably reward and influence behavior across the company.

Assessment

Table 21 assesses the value, cost, schedule and risk of rewards and recognition and is followed by a brief explanation of each assessment.

Table 21: Rewards and Recognition Assessment

	Low / Near-term	Medium / Medium-term	High / Long-term
Required Timeframe			X
Involved Employees			X
Cost		X	
Resistance	X		

- Required Timeframe – Consistently rewarding and recognizing the efforts of employees are attributes of a good leader, but a more formal rewards and recognition program is a longer-term action for BIW 2011. It is important, but is not as high a priority as other actions.
- Involved Employees – Rewards and recognition are most effective when they are appropriate to the constituency being recognized. Consequently, any rewards and recognition program is likely to be decentralized and tailored to each department or division across the company.
- Cost – Rewards and recognition programs can vary widely in their cost, but costs mount quickly when trying to meaningfully reward the individual efforts of a large population. Any programs are likely to be administered and budgeted by individual divisions.
- Resistance – Resistance to a program is expected to be low, but employees are likely to be skeptical of the sustainability of any initiative until it is proven.

Summary Assessment

The preceding sections have described the highest-level plan for BIW 2011. Some activity has already occurred on the foundational elements, but there is still significant work to be done in the coming months and years to make BIW 2011 a reality. This section will summarize the assessments of each subsection by assessment criteria to develop a preliminary implementation schedule, estimate initial personnel and financial resource requirements and assess the risks and relative anticipated difficulty of implementing each slice of the change wheel. These elements represent a preliminary business plan that will be refined to support schedule, budget and resource allocations as BIW 2011 is further defined. It must be remembered that the change wheel will be traversed several times during the implementation of complex, enterprise-level change and the preceding discussion has generally been targeted toward the initial stages of BIW 2011, not the entire implementation.

Required Timeframe

The Required Timeframe assessment criteria classify actions as being required in the near-term, medium-term or long-term to support successful implementation of change. Near-term actions are those that should be addressed over the next six months. Medium-term actions are required within the next six to eighteen months. Long-term actions don't come into focus for at least eighteen months.

The tabulation of the Required Timeframe assessments found in Table 22 yields a reasonable distribution of effort. The actions are biased toward the near-term, but many of these items are already in process, are not of substantial duration and have low resource requirements. Items that are deferred to the medium and long-term will take much longer to execute and generally have higher resource requirements even though there are fewer items in each timeframe.

Table 22: Tabulation of Required Timeframe Assessments

	Near-term	Medium-term	Long-term
Shared Vision and Common Themes	X		
Symbols and Signals	X		
Guidance, Structure and Process	X		
Education, Training and Action Tools		X	
Champions and Sponsors	X		
Quick Wins and Local Innovations		X	
Communications and Best Practice Exchange	X		
Policy, Procedures and System Alignment			X
Measures and Feedback		X	
Rewards and Recognition			X

Figure 53 shows the rough prioritization of the effort in graphical format on the change wheel.

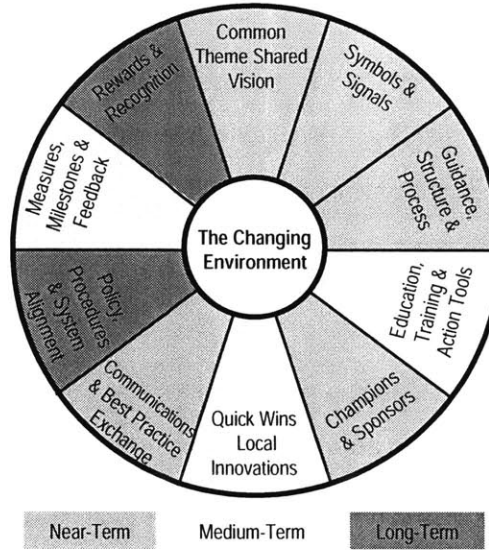


Figure 53: BIW 2011 Change Wheel Time Phasing

Table 23 has been rearranged by required timeframe to place the elements in rough chronological order. This ordering of elements will be used in the following discussions instead of the order of the change wheel.

Table 23: Tabulation of Required Timeframe Assessments in Relative Chronological Order

	Near-term	Medium-term	Long-term
Shared Vision and Common Themes	X		
Symbols and Signals	X		
Guidance, Structure and Process	X		
Champions and Sponsors	X		
Communications and Best Practice Exchange	X		
Education, Training and Action Tools		X	
Quick Wins and Local Innovations		X	
Measures and Feedback		X	
Policy, Procedures and System Alignment			X
Rewards and Recognition			X

Involved Employees

The Involved Employee assessment criteria categorize the expected number of employees actively involved in implementation as: localized to a workgroup or department (low), requiring a whole division (medium) or requiring active involvement of nearly everyone in the company (high). The assessment of involved employees only considers the number of employees involved in the implementation of the element - not the number of employees affected by the implementation.

The tabulation of the involved employees assessments found in Table 24 shows generally increasing resource requirements over time starting with localized activity that eventually evolves to the entire company. These staffing requirements are not necessarily additive to current levels as some elements do not require a full-time staff while other functions will supplement or replace current practices.

Table 24: Tabulation of Involved Employees Assessments

	Low	Medium	High
Shared Vision and Common Themes	X		
Symbols and Signals	X		
Guidance, Structure and Process		X	
Champions and Sponsors	X		
Communications and Best Practice Exchange	X		
Education, Training and Action Tools		X	
Quick Wins and Local Innovations		X	
Measures and Feedback		X	
Policy, Procedures and System Alignment			X
Rewards and Recognition			X

Cost

The Cost assessment criteria estimate the expected costs associated with implementation of the element as: normal work product with few additional costs (low), within the limits of departmental discretionary budgets (medium) or capital investment required (high).

The cost assessments tabulated in Table 25 show that most of the elements associated with BIW 2011 will require some investment, but at generally modest levels. However, capital investment will be required beginning in the near-term to support the modification and replacement of some information systems. Discrete estimates of anticipated costs need to be developed to support overhead and capital budgeting cycles.

Table 25: Tabulation of Cost Assessments

	Low	Medium	High
Shared Vision and Common Themes	X		
Symbols and Signals	X		
Guidance, Structure and Process			X
Champions and Sponsors		X	
Communications and Best Practice Exchange		X	
Education, Training and Action Tools		X	
Quick Wins and Local Innovations			X
Measures and Feedback		X	
Policy, Procedures and System Alignment			X
Rewards and Recognition		X	

Resistance

The Resistance criteria assess the likely resistance of the organization to the implementation of the element as low, medium or high based on prevailing culture, past practices or similar initiatives in other organizations. There are other sources and types of risk, but resistance tends to be one of the most prevalent in change initiatives affecting culture and can destroy the effort if not properly addressed and mitigated.

Resistance to change is likely to be relatively high for the duration of BIW 2011’s implementation, as seen in Table 26. This is not uncommon when approaching enterprise-level change in a hierarchical organization with a senior and largely unionized workforce like BIW. Anticipating high levels of resistance and finding the actual levels to be lower can only be beneficial. Underestimating and under planning likely resistance could lead to failure of the initiative. The resistance to some elements will require significant effort over a short duration to mitigate while other elements will require a lower-level sustained effort for an extended period of time. The methods for overcoming resistance will vary by element, but clear communication and sustained and consistent actions over time will be important.

Table 26: Tabulation of Resistance Assessments

	Low	Medium	High
Shared Vision and Common Themes		X	
Symbols and Signals			X
Guidance, Structure and Process			X
Champions and Sponsors		X	
Communications and Best Practice Exchange			X
Education, Training and Action Tools	X		
Quick Wins and Local Innovations			X
Measures and Feedback			X
Policy, Procedures and System Alignment			X
Rewards and Recognition	X		

Key Findings and Implications for Future Research

Change is hard. There is considerable literature surrounding change that provides theories, frameworks and methodologies, but they are all necessarily broad. There is no one integrated approach for successfully implementing enterprise-level change from conception through implementation. Large-scale change must be tailored to the requirements of the individual organization and executed in a manner that is acceptable to the prevailing culture, even if the culture itself is an objective of the change. Successfully changing the processes and culture of an enterprise takes time, significant planning, technical and business acumen and must employ elements of organizational behavior and processes, project management, and system design, to name a few. BIW's change effort, BIW 2011, will be a substantial, complex endeavor requiring visible corporate commitment and a rigorous, systematic approach to design, integration and planning before any implementation begins.

Continuing to communicate and build the case for change while further expanding each element of BIW 2011 into discrete, actionable, lower-level transition plans that remain integrated at the enterprise-level are the next required steps. However, concurrently developing a critical mass of empowered Outsider-Insiders at all levels of the organization will also be imperative. The BIW 2011 plan will be of no use if there is not a network of committed change agents poised to embrace and implement the plan through distributed leadership and to identify appropriate opportunities to pull in new ideas.

Change planners need to be mindful of BIW's history and the long memory of its entrenched, senior workforce. Prior change initiatives have come and gone and this collective experience will prejudice BIW 2011 as another "initiative of the week." Successfully overcoming this resistance will require: unrelenting communication; strong, overt leadership; a balanced, culturally acceptable approach; an analytic, integrated, systematic process; and patience and perseverance to overcome the inevitable difficult middles.

Managing change is traditionally viewed as a “soft” skill. This is only partially true as there is an equivalent requirement for systems-thinking and analytic rigor to appropriately and holistically address the complexities of enterprise-level change. In fact, failure to balance the “soft” aspects of change with analysis and strategic design generally leads to incompletely formed initiatives that do not produce the desired results or fail upon implementation. The extant literature alludes to this observation, but a complete development was found to be lacking. This thesis employed a rigorous, analytic approach wherever possible, but deeper development of the analytic and systems aspects of change requires further scholarly research. Specifically, a methodology for modeling the cultural dynamics of the contemplated changes would allow change planners to simulate the response of the organization and investigate strategies to mitigate resistance.

Change is a three-dimensional game of chess requiring management focus at all levels of the organization. Providing data and status relating to the critical aspects of the change implementation can quickly become complicated and confusing. This thesis employed some non-traditional approaches to aggregating and displaying these data, but further development of a system to display them in a manner that is simple and useful to a variety of constituencies is needed. The display must address the major elements of the change and be easy to use while not imposing a significant administrative burden.

This thesis has explored the exogenous and endogenous elements affecting BIW and applied the principles of change management and systems-thinking to design an integrated, systematic plan for approaching enterprise-level change. Internally, substantial effort still remains to define the details of BIW 2011, but the process and frameworks are in place and culturally, the time is right. Change is never easy, but developing a balanced plan for implementation that employs the best theoretical and practical knowledge available from a multiplicity of sources will allow change planners to make informed decisions and guide BIW into the next decade.

Appendix A – Defense Shipbuilders: 1965 - 2004

SHIP TYPE	1965	1975	1985	2004
SURFACE COMBATANTS	<ul style="list-style-type: none"> • Avondale Industries • Bath Iron Works • Bethlehem San Francisco • Defoe Shipbuilding • Lockheed Shipbuilding • Newport News Shipbuilding • New York Shipbuilding • Todd San Pedro • Todd Seattle • Mare Island NSY • Puget Sound NSY 	<ul style="list-style-type: none"> • Avondale Industries • Bath Iron Works • Ingalls Shipbuilding • Newport News Shipbuilding • Todd San Pedro • Todd Seattle 	<ul style="list-style-type: none"> • Bath Iron Works • Ingalls Shipbuilding • Todd San Pedro • Todd Seattle 	<ul style="list-style-type: none"> • Bath Iron Works • Ingalls Shipbuilding
AIRCRAFT CARRIERS	<ul style="list-style-type: none"> • Newport News Shipbuilding 	<ul style="list-style-type: none"> • Newport News Shipbuilding 	<ul style="list-style-type: none"> • Newport News Shipbuilding 	<ul style="list-style-type: none"> • Newport News Shipbuilding
SUBMARINES	<ul style="list-style-type: none"> • G.D. Electric Boat • G.D. Quincy • Ingalls Shipbuilding • Newport News Shipbuilding • New York Shipbuilding • Mare Island NSY • Portsmouth NSY 	<ul style="list-style-type: none"> • G.D. Electric Boat • Ingalls Shipbuilding • Newport News Shipbuilding 	<ul style="list-style-type: none"> • G.D. Electric Boat • Newport News Shipbuilding 	<ul style="list-style-type: none"> • G.D. Electric Boat • Newport News Shipbuilding
AMPHIBIOUS WARFARE	<ul style="list-style-type: none"> • G.D. Quincy • Ingalls Shipbuilding • Lockheed Shipbuilding • National Steel & Shipbuilding • Newport News Shipbuilding • Philadelphia NSY • Brooklyn NSY 	<ul style="list-style-type: none"> • G.D. Quincy • Ingalls Shipbuilding 	<ul style="list-style-type: none"> • Avondale Industries • Ingalls Shipbuilding • Lockheed Shipbuilding 	<ul style="list-style-type: none"> • Avondale Industries • Ingalls Shipbuilding
AUXILIARIES	<ul style="list-style-type: none"> • Alabama Shipbuilding • Bethlehem Sparrows Point • G.D. Quincy • Ingalls Shipbuilding • Lockheed Shipbuilding • National Steel & Shipbuilding • New York Shipbuilding • Brooklyn NSY • Puget Sound NSY 	<ul style="list-style-type: none"> • Alabama Shipbuilding • Avondale Industries • G.D. Quincy • Lockheed Shipbuilding • National Steel & Shipbuilding 	<ul style="list-style-type: none"> • Avondale Industries • National Steel & Shipbuilding • Peterson Builders 	<ul style="list-style-type: none"> • Avondale Industries • National Steel & Shipbuilding
NUMBER OF SHIPYARDS	20	11	10	6

Appendix B – Shipbuilding Process Flow Dictionary

A dictionary was created as a companion to the process flow diagram to reduce ambiguity and the risk of misinterpretation. This appendix defines each element of the process flow and describes the primary linkages to the surrounding elements in the following format. Italicized red elements and linkages associate to the core shipbuilding process flow while black items further define the system.

Defined Element (block on the diagram)

Defined Element – definition of the element

Linkages

Linked Element 1 – definition of the specific interaction (the solid or dashed lines on the diagram) between the *Defined Element* and *Linked Element 1*

Linked Element 2 – definition of the specific interaction (the solid or dashed lines on the diagram) between the *Defined Element* and *Linked Element 2*

Ship

Ship - The physical product

Linkages

Labor Effort - Labor effort expended to construct the product

Material - Components combine to produce final product

Facility - Facility supports construction of the final product

Navy Customer & Current Programs - Completed product is delivered to the customer.

Labor Effort

Labor Effort - Labor effort is similar to horsepower - generic human work

Linkages

Ship - Labor effort expended to construct the product

Material - Labor expended to transform material in construction of final product

Facility - Facility supports labor effort in construction of the final product.

Planning - Labor effort is expended according to a plan

Quality - Quality influences quantity of labor effort required. Higher quality reduces required labor effort.

Productivity - Productivity directly affects quantity of labor effort required. Higher productivity requires less labor effort

Material

Material - Physical components required in the construction of the product

Linkages

Ship - Components combine to produce final product

Labor Effort - Labor expended to transform material in construction of final product

Facility - Facility supports material in construction of the final product

Planning - Material must be staged and delivered according to a plan

Inventory & Transportation - Material is stored after its arrival before it is required.

Material is then transported to the job site.

Safety - Handling and condition of material affects safety

Quality - Material defects affect quality

Productivity - Size, design, packaging and other attributes affect the productivity during the construction process

Facility

Facility - Property, plant and equipment supporting construction of the product

Linkages

Ship - Facility supports construction of the final product

Labor Effort - Facility supports labor effort in construction of the final product.

Material - Facility supports material in construction of the final product

Planning - Capacity of the facility must be balanced through a plan

Engineering & Design - Changes to the facility are engineered and effects on the product and construction process are incorporated

Finance - Changes, upgrades and new constructions to any aspect of the facility are phased with available funding

Capital Projects - Subset of facility for acquisition of new property, buildings or major equipment

Property/Buildings - Subset of facility representing the physical footprint of the facility

Equipment - Subset of facility representing major pieces of equipment and hardware

Maintenance - Subset of facility responsible for maintaining other subsets of the facility

Safety - The condition and configuration of the facility affects safety

Productivity - Appropriate facilities positively impact productivity while poor facilities negatively impact productivity

Morale - Working conditions embodied by the facility impact the morale of employees

Planning

Planning - Performs all coordinating functions among entities and functions. Includes all different types of plans.

Linkages

Labor Effort - Labor effort is expended according to a plan

Material - Material must be staged and delivered according to a plan

Facility - Capacity of the facility must be balanced through a plan

Engineering & Design - The design and engineering data are packaged and scheduled by planning and become work orders for production

Procurement - Procurement purchases material according to the required in plant date

Strategic Plan - The strategic plan contemplates the utilization and capacity of the enterprise using planning data.

Program Management - Planning data are used to manage program cost and schedule.

Business Development - Business development assesses new programs against the utilization, capacity and competence of the enterprise via planning data.

Finance - Cost and schedule data are provided to finance for reporting, progressing and billing. Budgets are allocated and adjudicated

Inventory & Transportation - Material is scheduled for delivery against required in plant dates.

Safety - Safety is impacted by the sequencing of jobs during the construction process

Quality - Logical job sequencing improves quality by reducing rework inherent in inappropriately scheduled jobs

Productivity - Appropriate scheduling of jobs and material availability enables higher productivity and production efficiency.

Navy Customer & Current Programs - Construction schedules need to support the availability of funds and customer prescribed milestones

Leadership - Good planning leadership ensures an integrated and efficient planning function

Engineering & Design

Engineering & Design - Provides engineering and design product via planning process in the form of bill of materials, work paper, etc.

Linkages

Facility - Changes to the facility are engineered and effects on the product and construction process are incorporated

Planning - The design and engineering data are packaged and scheduled by planning and become work orders for production

Procurement - Material is procured using specifications developed by engineering. These organizations are tightly linked

Strategic Plan - The strategic plan contemplates the competencies and capacity of engineering and design for future programs

Program Management - Program costs and schedule are managed against scope

Business Development - Business development assesses new programs against the utilization, capacity and competence of engineering and design.

Work Practices & Processes - Engineers set safe and efficient work practices and processes for production

Safety - Design safety is analytically assessed.

Navy Customer & Current Programs - The customer's technical community collaborates with and assesses internal engineering activity

Leadership - Engineering and design leadership promotes innovation and good engineering practices and customer support

Procurement

Procurement - Negotiates purchase and timing of material for construction

Linkages

Planning - Procurement purchases material according to the required in plant date

Engineering & Design - Material is procured using specifications developed by engineering. These organizations are tightly linked

Program Management - Program costs and schedule are managed against scope

Services - Procurement secures services for construction support in the form of general support and vendor technical support

Suppliers - Procurement contracts with vendors for all material required in the construction process

Inventory & Transportation - Material delivery is scheduled and vendor interface issues are addressed for issues such as quality and timing

Leadership - Procurement leadership maximizes value per dollar spent and promotes good customer support

Strategic Plan

Strategic Plan - Coordinates and aligns internal and external actions with a view toward the future.

Linkages

Planning - The strategic plan contemplates the utilization and capacity of the enterprise using planning data.

Engineering & Design - The strategic plan contemplates the competencies and capacity of engineering and design for future programs

Program Management - Program data regarding cost, schedule, customer orientation and future business outlook are contemplated in the strategic plan

Business Development - Business development pursues new business previously identified in the strategic plan or informs the strategic plan of new opportunities

Finance - Out-year financial projections are based on the strategic plan and the strategic plan is mindful of financial performance

Employee / Labor Relations - The status of labor relations influences the strategic priorities

Communications - The purpose of the strategic plan is to communicate priorities. Communication informs the strategic plan.

Corporate - The company's strategic plan falls within the corporation's strategic objectives

Navy Customer & Current Programs - The strategic plan needs to listen to the voice of the customer and anticipate future programs and work load.

New Programs - The strategic plan should be aware of future program opportunities

Congress - Congress controls U.S. Navy funding and can often be influenced by the enterprise's delegation. Also the strategic plan needs to be influenced by Congress' funding priorities.

Leadership - The strategic plan sets the path to lead toward the future

Program Management

Program Management - Responsible for cost, schedule, customer interaction and program execution.

Linkages

Planning - Planning data are used to manage program cost and schedule.

Engineering & Design - Program costs and schedule are managed against scope

Procurement - Program costs and schedule are managed against scope

Strategic Plan - Program data regarding cost, schedule, customer orientation and future business outlook are contemplated in the strategic plan

Business Development - Business development draws data, expertise and experience from current programs and gauges the enterprise's capacity and utilization

Finance - Program management is responsible for the program's cost and schedule performance

Work Practices & Processes - Program management adjudicates process and manufacturing specification issues with the customer

Quality - Program management adjudicates quality issues with the customer

Corporate - Program management keeps corporate apprised of major developments within programs

Navy Customer & Current Programs - Program management is the primary line of communication to the customer for existing and new work

Leadership - Program management leads individual programs toward success

Business Development

Business Development - Pursues and captures new work

Linkages

Planning - Business development assesses new programs against the utilization, capacity and competence of the enterprise via planning data.

Engineering & Design - Business development assesses new programs against the utilization, capacity and competence of engineering and design.

Strategic Plan - Business development pursues new business previously identified in the strategic plan or informs the strategic plan of new opportunities

Program Management - Business development draws data, expertise and experience from current programs and gauges the enterprise's capacity and utilization

Finance - Business development requires overhead funds to pursue new work. New work must clear financial hurdle rates to be considered good opportunities

New Programs - Business development pursues new external programs via multiple venues and develops them into actual programs within the enterprise

Leadership - Business development leads new work into the company

Finance

Finance - Responsible for all financial functions including treasury, accounting, rates and overhead.

Linkages

Facility - Changes, upgrades and new constructions to any aspect of the facility are phased with available funding

Planning - Cost and schedule data are provided to finance for reporting, progressing and billing. Budgets are allocated and adjudicated

Strategic Plan - Out-year financial projections are based on the strategic plan and the strategic plan is mindful of financial performance

Program Management - Program management is responsible for the program's cost and schedule performance

Business Development - Business development requires overhead funds to pursue new work. New work must clear financial hurdle rates to be considered good opportunities

Corporate - The primary connection of the enterprise to the corporate parent is financial.

Finance provides cash payments to the parent and regularly submits cost and schedule performance and projections

Navy Customer & Current Programs - Finance receives periodic cash payments from the customer and regularly provides cost and schedule performance and projections

Leadership - Finance leads the company toward a profitable outcome

Services

Services - Services or support provided within the system by external organizations.

Linkages

Procurement - Procurement secures services for construction support in the form of general support and vendor technical support

Inventory & Transportation - Inventory and transportation are the conduit by which services physically engage the enterprise

Suppliers

Suppliers - Vendors of material for construction

Linkages

Procurement - Procurement contracts with vendors for all material required in the construction process

Inventory & Transportation - Inventory and transportation are the conduit by which material provided by suppliers physically engage the enterprise

Inventory & Transportation

Inventory & Transportation - Receives, stores and transports material to the appropriate site for construction of the product

Linkages

Material - Material is stored after its arrival before it is required. Material is then transported to the job site.

Planning - Material is scheduled for delivery against required in plant dates.

Procurement - Material delivery is scheduled and vendor interface issues are addressed for issues such as quality and timing

Services - Inventory and transportation are the conduit by which services physically engage the enterprise

Suppliers - Inventory and transportation are the conduit by which material provided by suppliers physically engage the enterprise

Navy Customer & Current Programs - The U.S. provides some military-specific equipment, such as armament and radars, to the enterprise acting as a supplier in this capacity.

Leadership - Inventory and transportation leads physical construction through timely material support

Capital Projects

Capital Projects - Construction of new facilities, reconstruction/renewal of existing facilities or significant equipment purchases

Linkages

Facility - Subset of facility for acquisition of new property, buildings or major equipment

Property/Buildings - Capital projects generally involve modification or construction of new buildings or facilities

Equipment - Capital projects may involve the acquisition or refurbishment of major pieces of equipment

Maintenance - Capital projects may include major refurbishment or upgrades

Property/Buildings

Property/Buildings - All land and buildings comprising the physical plant

Linkages

Facility - Subset of facility representing the physical footprint of the facility

Capital Projects - Capital projects generally involve modification or construction of new buildings or facilities

Equipment - Equipment is supported by and resides in buildings or on property

Maintenance - Property and buildings require periodic maintenance and refurbishment

Equipment

Equipment - All major equipment items employed in the construction or in the support of the product.

Linkages

Facility - Subset of facility representing major pieces of equipment and hardware

Capital Projects - Capital projects may involve the acquisition or refurbishment of major pieces of equipment

Property/Buildings - Equipment is supported by and resides in buildings or on property

Maintenance - Equipment requires periodic maintenance and refurbishment

Maintenance

Maintenance - Any activity prolonging the useful life of any portion of the facility

Linkages

Facility - Subset of facility responsible for maintaining other subsets of the facility

Capital Projects - Capital projects may include major refurbishment or upgrades

Property/Buildings - Property and buildings require periodic maintenance and refurbishment

Equipment - Equipment requires periodic maintenance and refurbishment

Work Practices & Processes

Work Practices & Processes - Formal and informal practices and processes defining how manufacturing work is performed.

Linkages

Engineering & Design - Engineers set safe and efficient work practices and processes for production

Program Management - Program management adjudicates process and manufacturing specification issues with the customer

Safety - Work practices and processes must be designed to be safe when properly executed

Quality - Work practices and processes must be designed to provide an appropriate level of quality when properly executed

Productivity - Work practices and processes must be designed to maximize productivity when properly executed

Morale - Work practices and processes must be designed to promote good morale within the work force whenever possible.

Training - The work force needs to be trained in the appropriate execution of work practices and processes

Leadership - Leaders understand, promote and enforce practices and processes. Leaders help develop or influence the practices and processes within their area of expertise.

Employee / Labor Relations

Employee / Labor Relations - Represents and characterizes the relationship between employees and management at any layer within the organization.

Linkages

Strategic Plan - The status of labor relations influences the strategic priorities

Productivity - Good labor relations increase work force productivity

Communications - Communication is an important conduit for good labor relations

Morale - Good labor relations increase work force productivity

Leadership - Leadership is a tenant of promoting good labor relations

Safety

Safety - Represents the enterprise's environment and approach toward safety and its attendant effects

Linkages

Material - Handling and condition of material affects safety

Facility - The condition and configuration of the facility affects safety

Planning - Safety is impacted by the sequencing of jobs during the construction process

Engineering & Design - Design safety is analytically assessed.

Work Practices & Processes - Work practices and processes must be designed to be safe when properly executed

Quality - Neither safety nor quality can be sacrificed in the pursuit of the other. They must both be contemplated.

Productivity - Productivity is optimized without sacrificing safety

Communications - Good communications enhance safety performance

Morale - A safe working environment enhances morale

Work Force - Fundamentally, the behavior of the work force determines safety performance

Training - The work force needs to be trained in safe behaviors and use of protective equipment

OSHA - Safety practices must conform to rules as defined by OSHA

Leadership - Good leaders promote safe actions and learn from the past.

Quality

Quality - Represents the enterprise's and individual's approach, attitudes, quantification and effects of quality

Linkages

Labor Effort - Quality influences quantity of labor effort required. Higher quality reduces required labor effort.

Material - Material defects affect quality

Planning - Logical job sequencing improves quality by reducing rework inherent in inappropriately scheduled jobs

Program Management - Program management adjudicates quality issues with the customer

Work Practices & Processes - Work practices and processes must be designed to provide an appropriate level of quality when properly executed

Safety - Neither safety nor quality can be sacrificed in the pursuit of the other. They must both be contemplated.

Communications - Good communications enhance quality and reduce rework and quality issues as they are more broadly known and understood

Morale - The work force takes pride in producing a quality product. Increased quality promotes good morale. Quality problems, such as rework, are bad for morale since no one likes to have to do the same job twice.

Work Force - Quality is most heavily influenced by the skill and proficiency of the work force

Training - The work force needs to be trained appropriately to produce high quality products

Leadership - Good leaders are mindful of quality requirements and promote good quality

Productivity

Productivity - Represents the enterprise's and individual's approach, attitudes, quantification and effects of productivity. Productivity is a measure of relative labor efficiency.

Linkages

Labor Effort - Productivity directly affects quantity of labor effort required. Higher productivity requires less labor effort

Material - Size, design, packaging and other attributes affect the productivity during the construction process

Facility - Appropriate facilities positively impact productivity while poor facilities negatively impact productivity

Planning - Appropriate scheduling of jobs and material availability enables higher productivity and production efficiency.

Work Practices & Processes - Work practices and processes must be designed to maximize productivity when properly executed

Employee / Labor Relations - Good labor relations increase work force productivity

Safety - Productivity is optimized without sacrificing safety

Communications - Good communications enhance productivity as information is consistently communicated and best practices are shared

Morale - Happy people are generally more productive than unhappy people

Work Force - The skill, proficiency and experience of the work force heavily influences productivity

Training - The work force needs to be trained appropriately to maximize productivity

Leadership - Good leadership promotes employee productivity by removing barriers, promoting good performance and inspiring people to succeed

Communications

Communications - Interaction among entities of all types at all levels. Is not solely limited to traditional functions of communications department. All blocks on diagram should connect to communications but only primary interactions are shown for emphasis.

Linkages

Strategic Plan - The purpose of the strategic plan is to communicate priorities. Communication informs the strategic plan.

Employee / Labor Relations - Communication is an important conduit for good labor relations

Safety - Good communications enhance safety performance

Quality - Good communications enhance quality and reduce rework and quality issues as they are more broadly known and understood

Productivity - Good communications enhance productivity as information is consistently communicated and best practices are shared

Morale - Morale is positively affected by the consistent, credible and timely information

Work Force - Communications of all types and at all levels are dependent on the individuals acting within the enterprise

Training - Training practices are communicated to the enterprise. Good Communication can be a form of training.

Navy Customer & Current Programs - The enterprise needs clear communication with the customer at all levels to be responsive and to establish and maintain good relationships

Leadership - Communication in all directions is imperative to good leadership

Morale

Morale - Primary representation of motivation and behavior or work force influenced by the totality of their environment.

Linkages

Facility - Working conditions embodied by the facility impact the morale of employees

Work Practices & Processes - Work practices and processes must be designed to promote good morale within the work force whenever possible.

Employee / Labor Relations - Good labor relations increase work force productivity

Safety - A safe working environment enhances morale

Quality - The work force takes pride in producing a quality product. Increased quality promotes good morale. Quality problems, such as rework, are bad for morale since no one likes to have to do the same job twice.

Productivity - Happy people are generally more productive than unhappy people

Communications - Morale is positively affected by the consistent, credible and timely information

Work Force - Individuals acting within the enterprise define the morale both at the enterprise and area level

Training - Adequate and appropriate training will improve the morale of an employee

Leadership - Good leaders inspire as well as lead people which increases morale.

Work Force

Work Force - Representation of individuals who, in totality, comprise the work force

Linkages

Safety - Fundamentally, the behavior of the work force determines safety performance

Quality - Quality is most heavily influenced by the skill and proficiency of the work force

Productivity - The skill, proficiency and experience of the work force heavily influences productivity

Communications - Communications of all types and at all levels are dependent on the individuals acting within the enterprise

Morale - Individuals acting within the enterprise define the morale both at the enterprise and area level

Age - The age of an employee affects physical ability and career motivation

Experience - The experience of an employee will directly impact their productive capacity. Learning by doing

Skill Set - The skill set of the employee needs to be appropriate to the job requirements of the trade

Proficiency - The relative proficiency of an employee will directly impact their productive capacity

Age

Age - Demographic contributing to physical job performance.

Linkages

Work Force - The age of an employee affects physical ability and career motivation

Experience

Experience - Attribute contributing to job performance. The amount of time a worker has worked in a trade.

Linkages

Work Force - The experience of an employee will directly impact their productive capacity. Learning by doing

Skill Set

Skill Set - Attribute contributing to job performance. The trade in which the worker has skills.

Linkages

Work Force - The skill set of the employee needs to be appropriate to the job requirements of the trade

Proficiency

Proficiency - Attribute contributing to job performance. The skill with which the worker plies a trade.

Linkages

Work Force - The relative proficiency of an employee will directly impact their productive capacity

Training

Training - Formal instruction in work-related skills, policies or practices.

Linkages

Work Practices & Processes - The work force needs to be trained in the appropriate execution of work practices and processes

Safety - The work force needs to be trained in safe behaviors and use of protective equipment

Quality - The work force needs to be trained appropriately to produce high quality products

Productivity - The work force needs to be trained appropriately to maximize productivity

Communications - Training practices are communicated to the enterprise. Good Communication can be a form of training.

Morale - Adequate and appropriate training will improve the morale of an employee

Leadership - Leaders require training to enhance their skills. Leaders promote adequate training for their employees.

Corporate

Corporate - Parent entity with a financial and strategic interest in the enterprise

Linkages

Strategic Plan - The company's strategic plan falls within the corporation's strategic objectives

Program Management - Program management keeps corporate apprised of major developments within programs

Finance - The primary connection of the enterprise to the corporate parent is financial. Finance provides cash payments to the parent and regularly submits cost and schedule performance and projections

Leadership - Corporate leads all the business units toward maximizing shareholder value

Navy Customer & Current Programs

Navy Customer & Current Programs - Represents the U.S. Navy for current work and provides entry for some future work.

Linkages

Ship - Completed product is delivered to the customer.

Planning - Construction schedules need to support the availability of funds and customer prescribed milestones

Engineering & Design - The customer's technical community collaborates with and assesses internal engineering activity

Strategic Plan - The strategic plan needs to listen to the voice of the customer and anticipate future programs and work load.

Program Management - Program management is the primary line of communication to the customer for existing and new work

Finance - Finance receives periodic cash payments from the customer and regularly provides cost and schedule performance and projections

Inventory & Transportation - The U.S. provides some military-specific equipment, such as armament and radars, to the enterprise acting as a supplier in this capacity.

Communications - The enterprise needs clear communication with the customer at all levels to be responsive and to establish and maintain good relationships

Congress - Congress controls and authorizes all U.S. Navy funds and provides oversight during program execution.

New Programs

New Programs - External opportunities entering the system. May be U.S. Navy or external entities.

Linkages

Strategic Plan - The strategic plan should be aware of future program opportunities

Business Development - Business development pursues new external programs via multiple venues and develops them into actual programs within the enterprise

Congress - Congress controls and authorizes all U.S. Navy funds and must approve any new programs before any funding is provided.

Congress

Congress - Represents the interests of the taxpayers, set national priorities and provides funds for all U.S. Navy programs.

Linkages

Strategic Plan - Congress controls U.S. Navy funding and can often be influenced by the enterprise's delegation. Also the strategic plan needs to be influenced by Congress' funding priorities.

Navy Customer & Current Programs - Congress controls and authorizes all U.S. Navy funds and provides oversight during program execution.

New Programs - Congress controls and authorizes all U.S. Navy funds and must approve any new programs before any funding is provided.

OSHA

OSHA - Occupational Safety and Health Administration is responsible for establishing rules regarding work place safety and enforcement.

Linkages

Safety - Safety practices must conform to rules as defined by OSHA

Leadership

Leadership - Enabling, managing and inspiring a group to a successful conclusion.

Linkages

Planning - Good planning leadership ensures an integrated and efficient planning function

Engineering & Design - Engineering and design leadership promotes innovation and good engineering practices and customer support

Procurement - Procurement leadership maximizes value per dollar spent and promotes good customer support

Strategic Plan - The strategic plan sets the path to lead toward the future

Program Management - Program management leads individual programs toward success

Business Development - Business development leads new work into the company

Finance - Finance leads the company toward a profitable outcome

Inventory & Transportation - Inventory and transportation leads physical construction through timely material support

Work Practices & Processes - Leaders understand, promote and enforce practices and processes. Leaders help develop or influence the practices and processes within their area of expertise.

Employee / Labor Relations - Leadership is a tenant of promoting good labor relations

Safety - Good leaders promote safe actions and learn from the past.

Quality - Good leaders are mindful of quality requirements and promote good quality

Productivity - Good leadership promotes employee productivity by removing barriers, promoting good performance and inspiring people to succeed

Communications - Communication in all directions is imperative to good leadership

Morale - Good leaders inspire as well as lead people which increases morale.

Training - Leaders require training to enhance their skills. Leaders promote adequate training for their employees.

Corporate - Corporate leads all the business units toward maximizing shareholder value

Appendix C – Shipbuilding Process Flow Diagrams

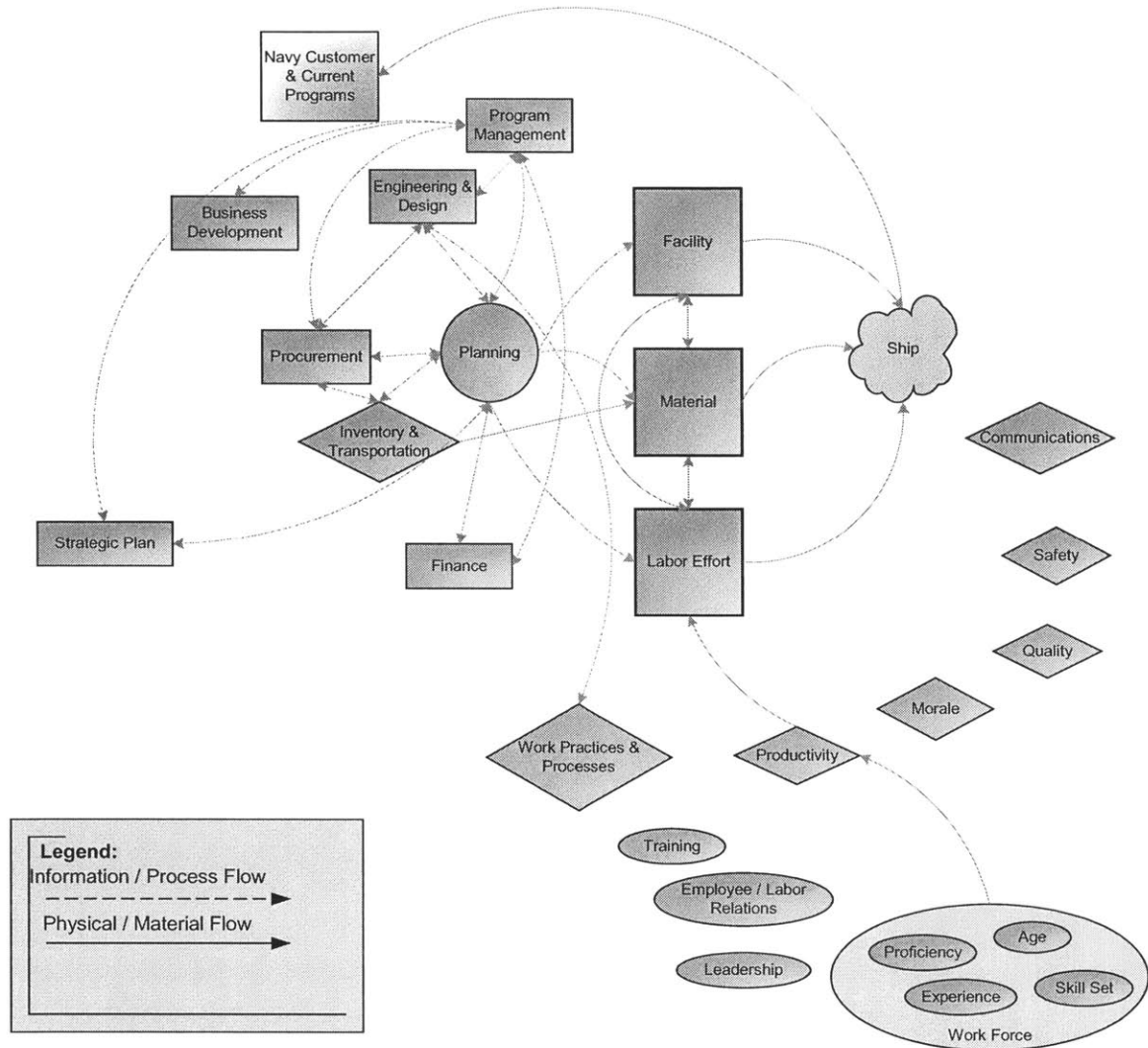


Figure 54: Core Shipbuilding Process

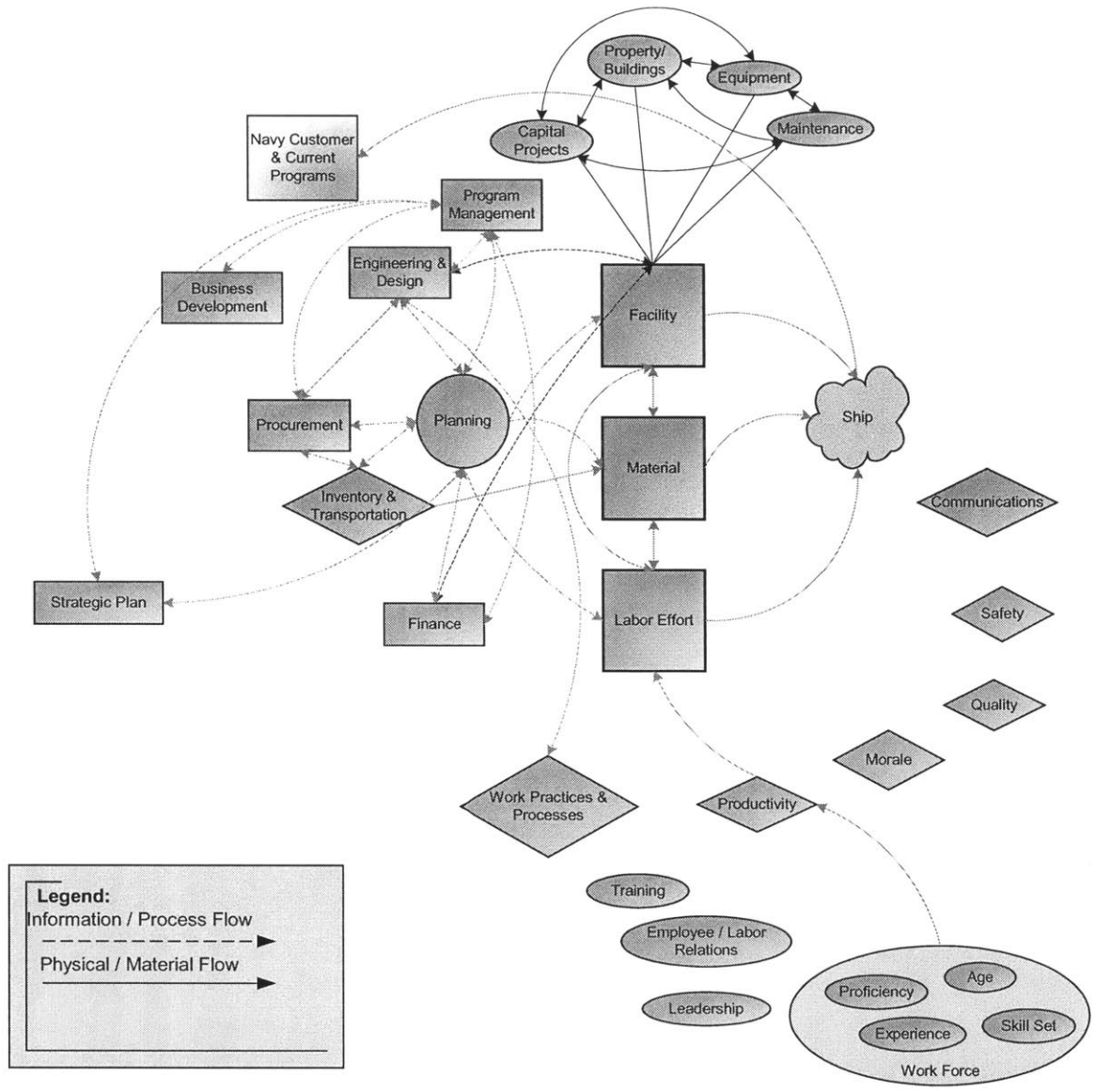


Figure 55: Facilities

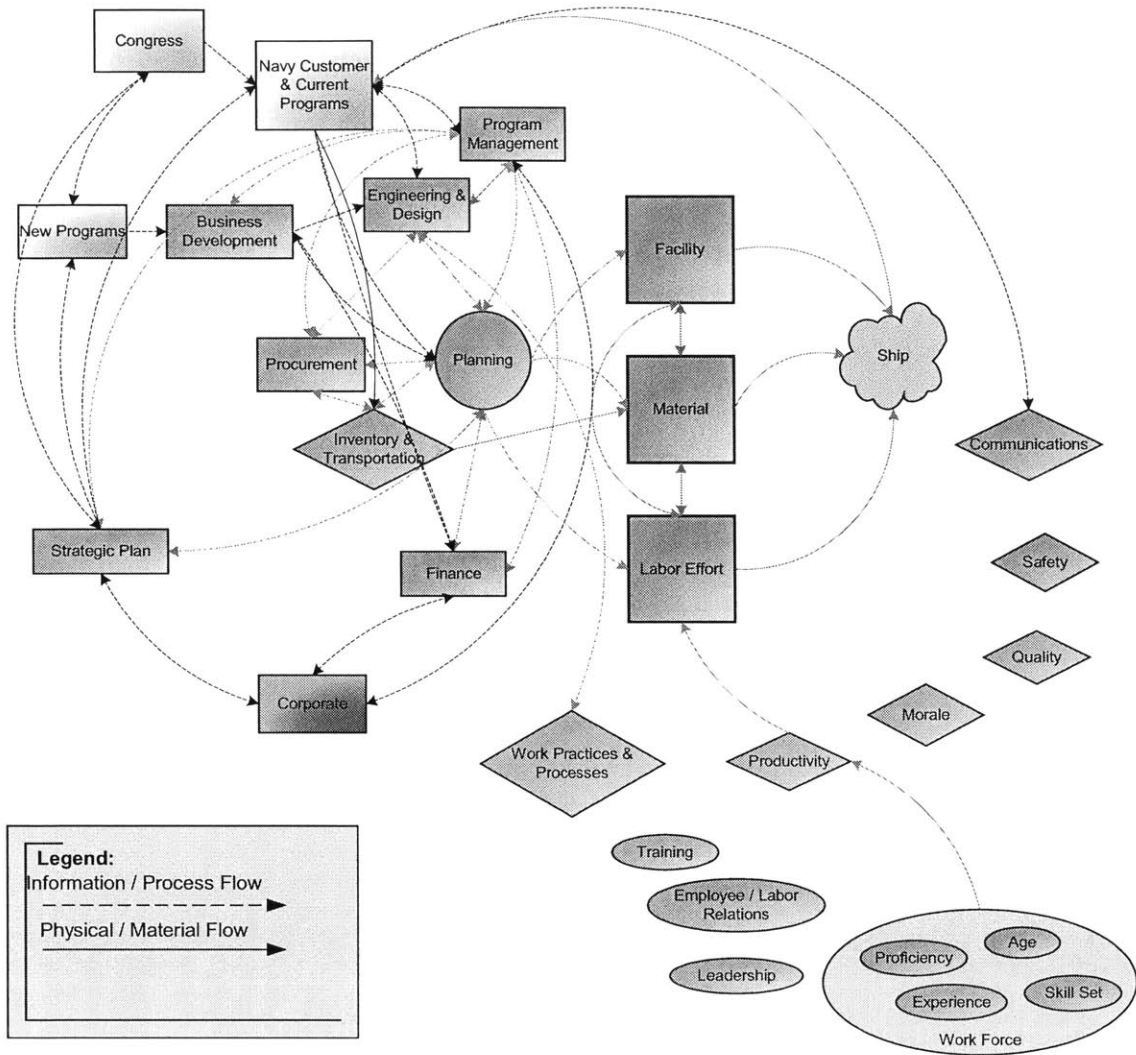


Figure 56: External and Corporate

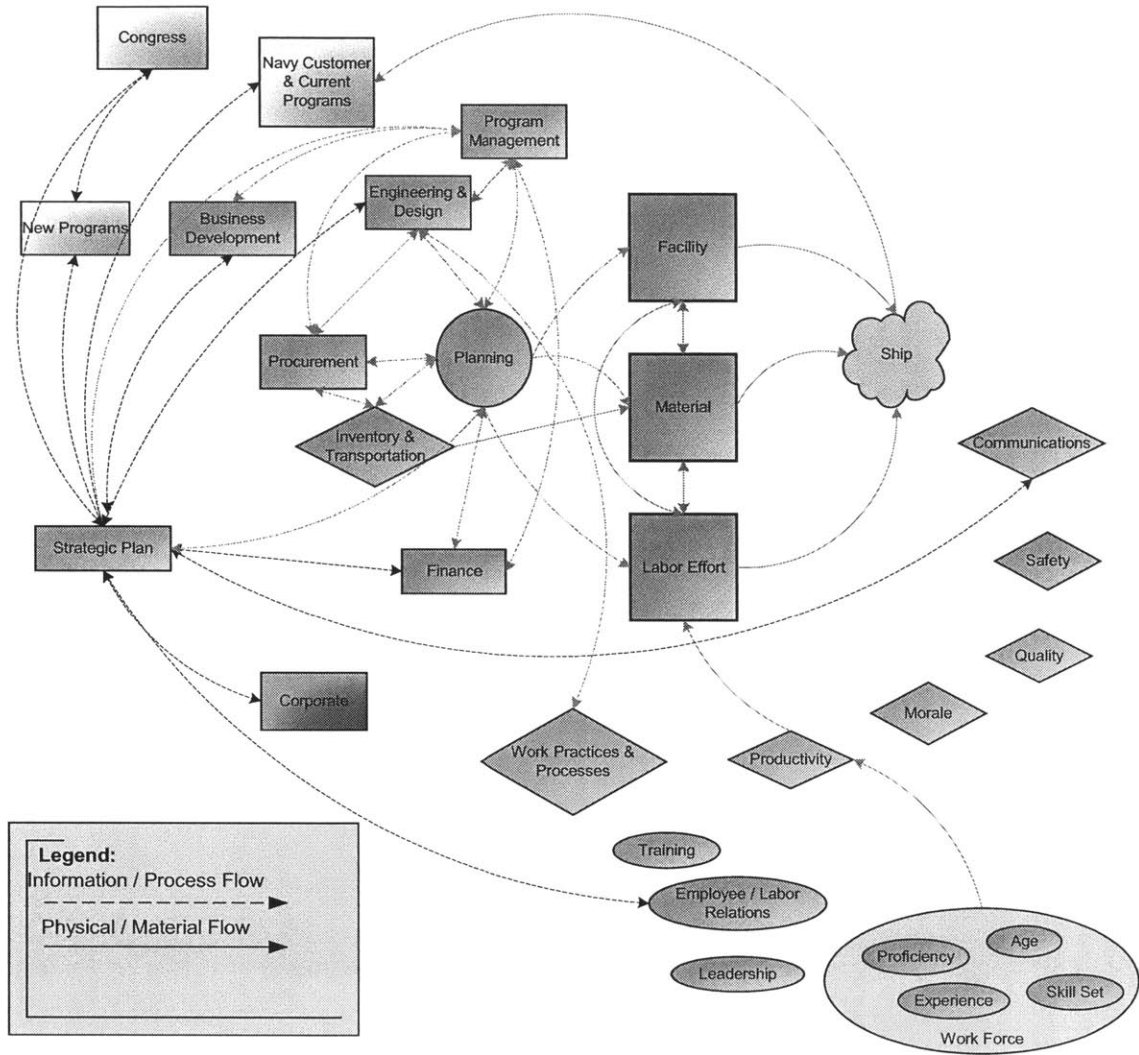


Figure 57: Strategic Plan

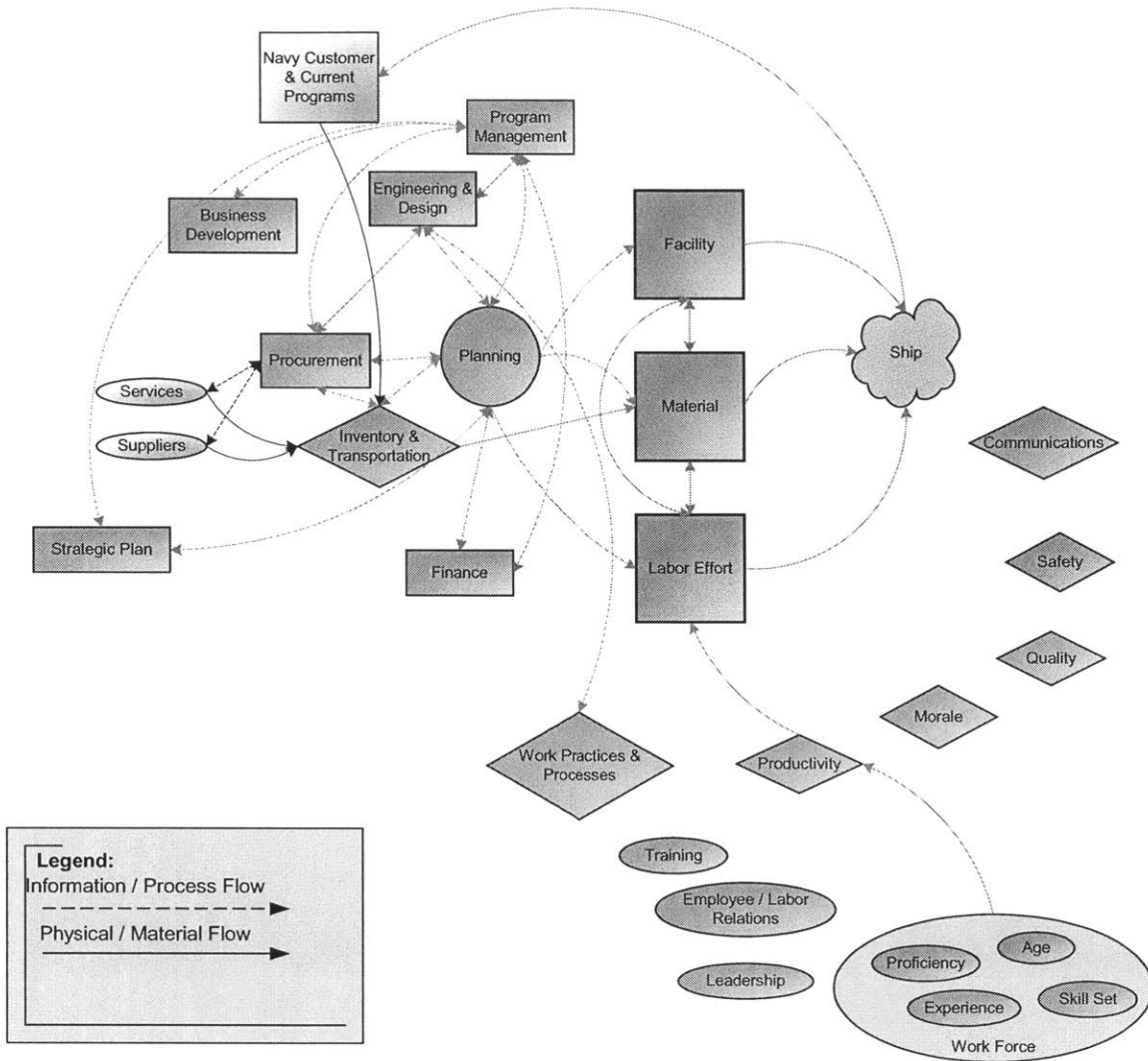


Figure 58: Procurement

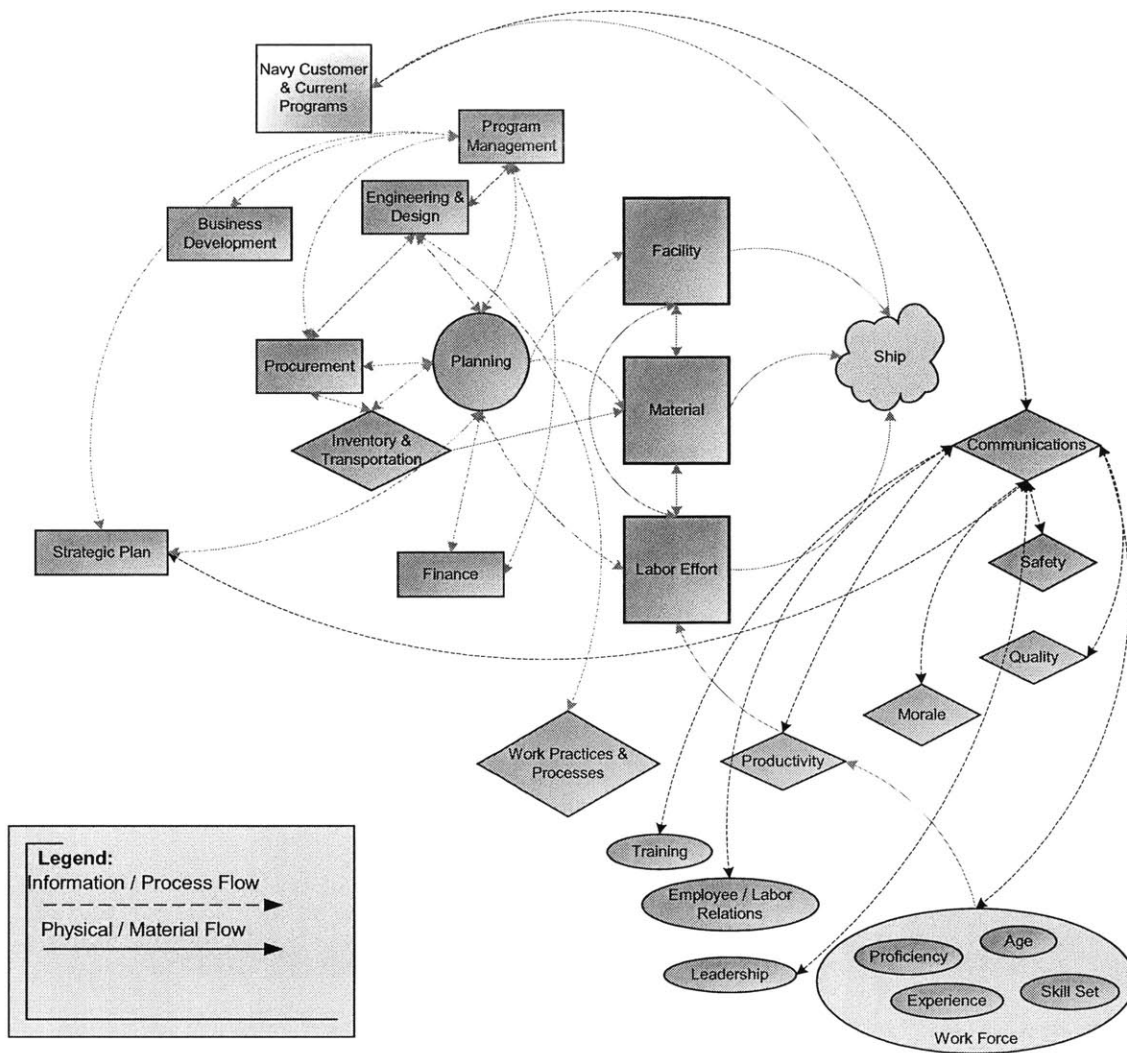


Figure 59: Communications

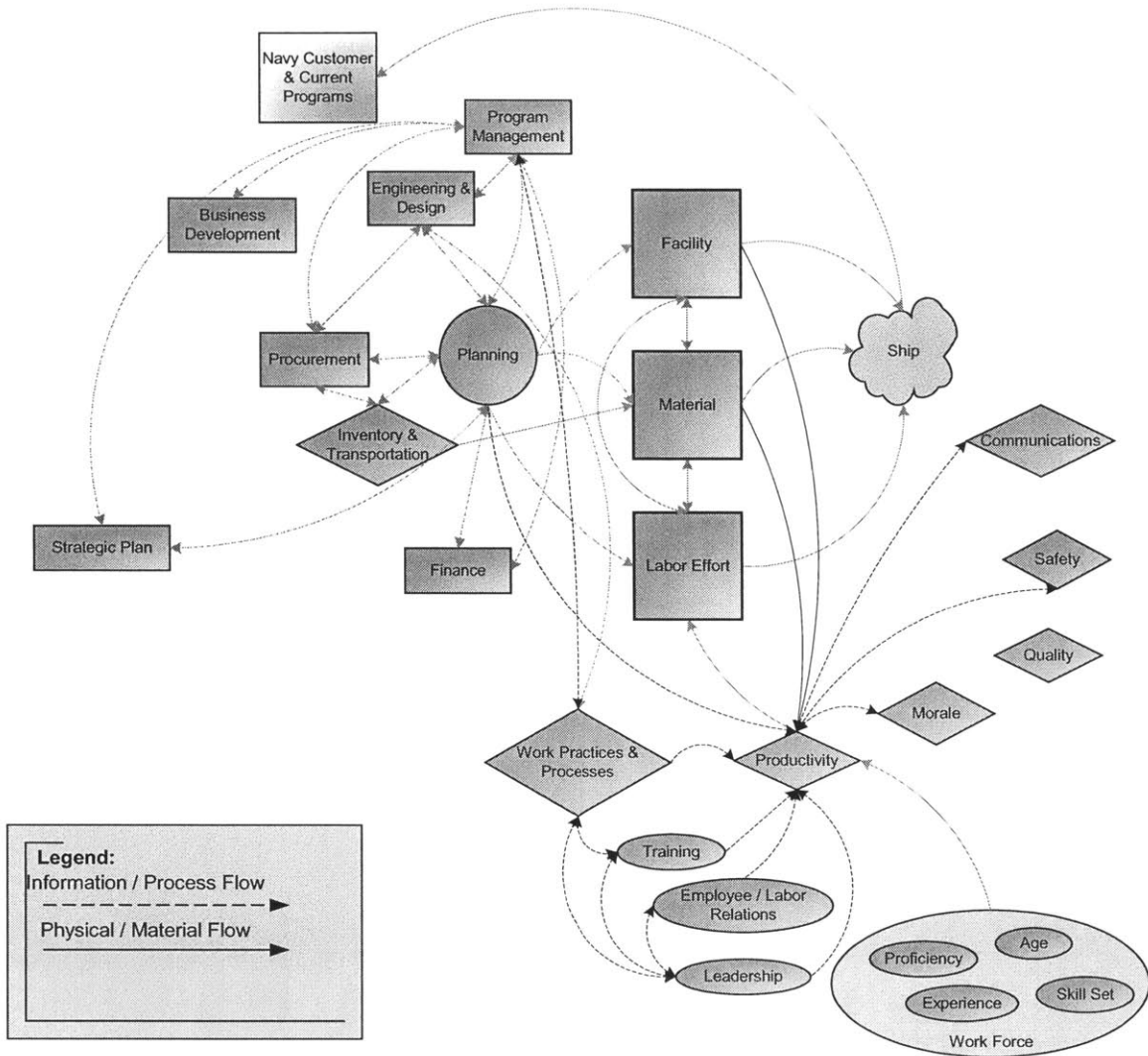


Figure 60: Productivity

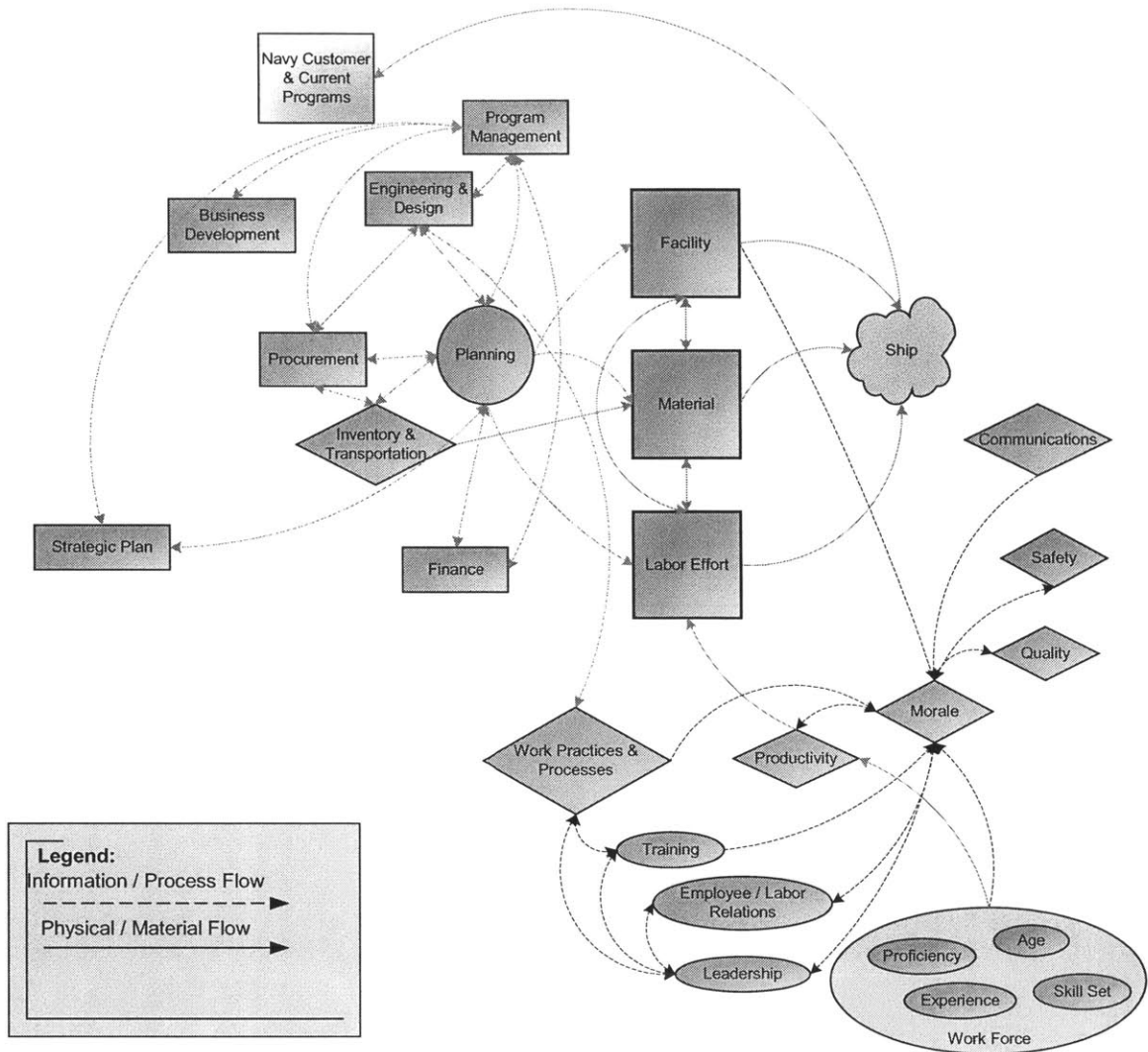


Figure 61: Morale

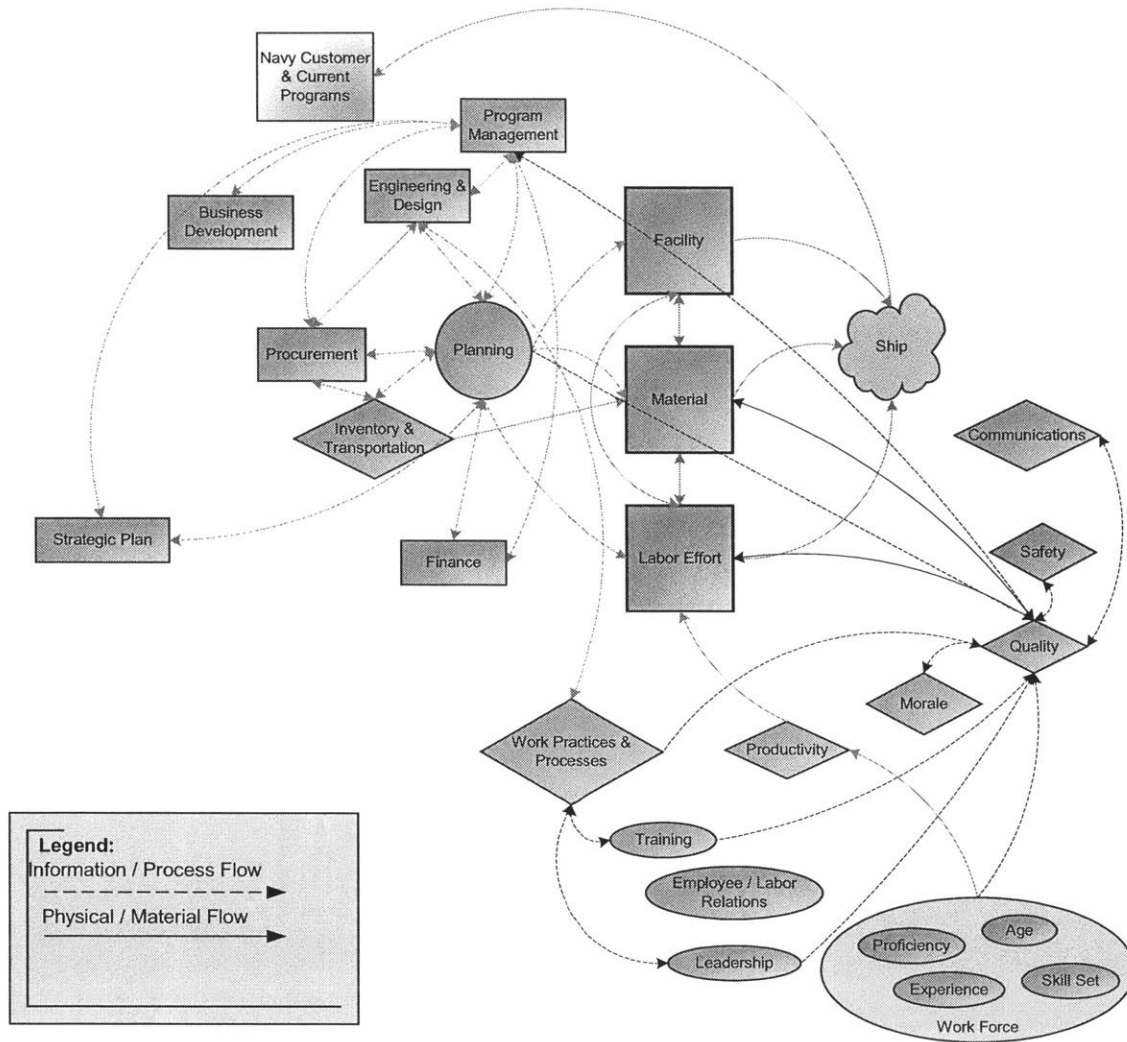


Figure 62: Quality

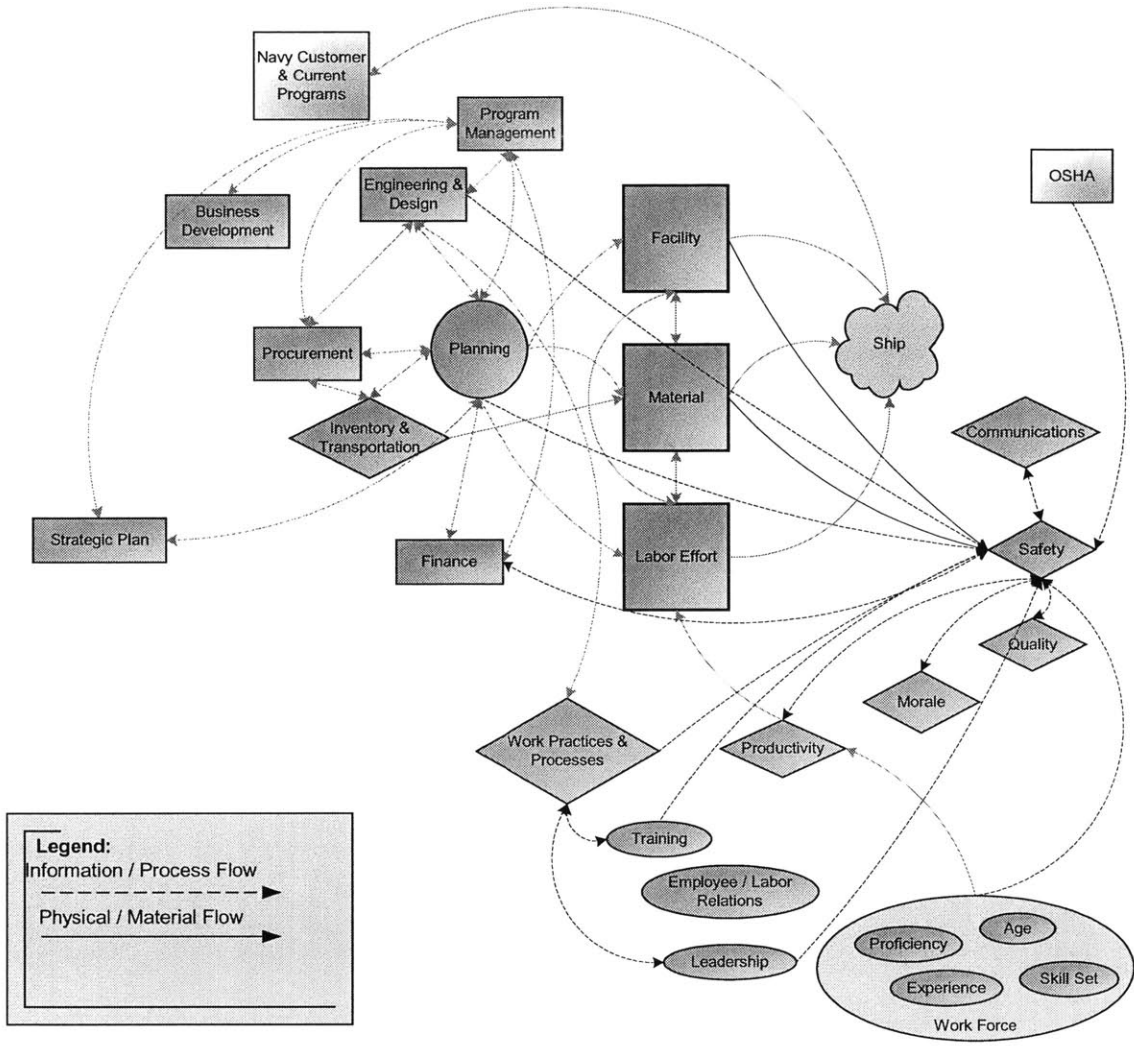


Figure 63: Safety

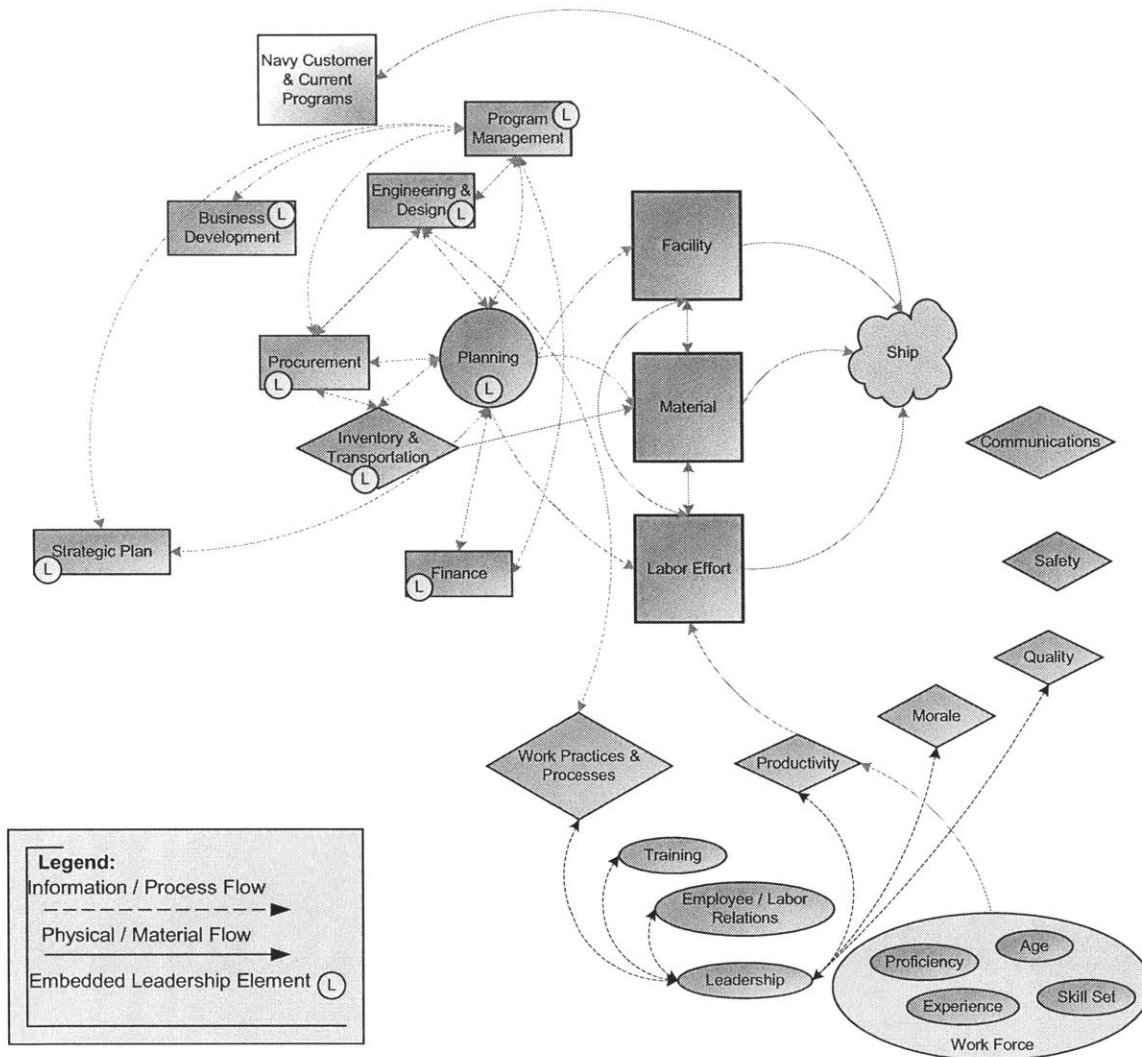


Figure 64: Leadership

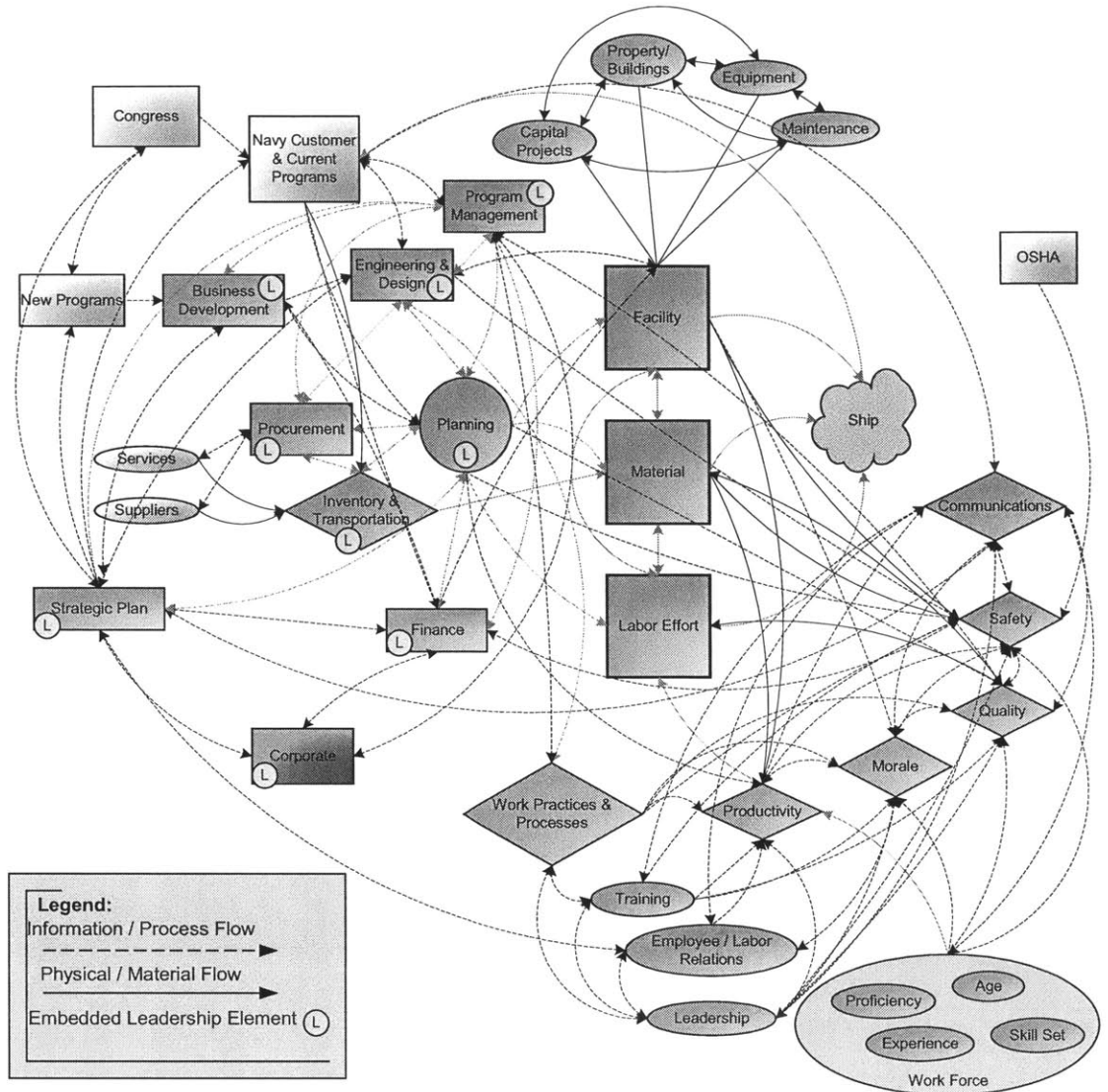


Figure 65: Complete Shipbuilding Process

Appendix D – Sample E-Mail from Shipway to the Workforce

E-mail sent to the entire workforce on November 4, 2004

Last week I sent a message to the BIW family about the results of our efforts to present a great ship - NITZE - to the Navy and how proud I was of each and every one of you.

Yesterday I received a thoughtfully written email from a long time employee who helped make that success possible. She was proud of our accomplishment but more importantly she asked me to think about the dynamics of our work force, and the importance of a simple "thank you".

Since I became President 18 months ago more than 180 folks have been laid off because there was no longer work for them at the yard. Some are off for a short time while for others it is much longer. Whether planners, designers, craftsmen or others who support them, each of these people leaves an imprint on this ship. Her letter reminded me that it takes us all working together to provide a ship of the quality that we continue to send down the Kennebec, and how important it is for us to say thank you to these people, as they leave, for their contributions to the Navy and their fellow workers. Because they have been part of the team that continues to build good ships - the rest of us continue to have the opportunity to be here. Some will leave this week and next, some left months ago, and unfortunately over the next several years more will also depart because of a lack of work.

I am unable to personally express my appreciation to each individual affected by reductions for their many contributions during their employment at BIW. But I ask each of you to say to your co-workers, those whom you supervise, or just those you know who are impacted by these force reductions: "Thank you for being here - you have played a significant part in helping us build great ships - you have made a difference."

Dugan Shipway
President, BIW

Endnotes

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- ³ General Dynamics 2003 Annual Report, p 21.
- ⁴ Northrop Grumman Corporation 2003 Form 10-K Filing to the Securities and Exchange Commission, p 23.
- ⁵ Id.
- ⁶ From American Shipbuilding Association data (www.americanshipbuilding.com)
- ⁷ United States Navy Ship Force Levels, Naval Historical Center.
- ⁸ Section excerpted from BIW internal documents
- ⁹ Id.
- ¹⁰ Section excerpted from GD LCS documents
- ¹¹ Section excerpted from BIW internal documents
- ¹² Schein, Edgar H. *Organizational Culture and Leadership* – 2nd Edition. Jossey-Bass, A Wiley Company. 1992. p379.
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- ¹⁵ Id.
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⁵¹ Internal BIW document

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