Modernizing the Welding School at Northrop Grumman Newport News: Improving Business Performance through Training

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ABSTRACT

Since February 2001, the Welding School has been aggressively modernizing its training process, procedures, programs, and course content based upon the insertion of learning technologies, changes in welding procedures, and application of adult learning theory. It completed its modernization in December 2002 and has been operating under the new model since institutionalizing the modernized processes and procedures.

Modernization Initiatives and Accomplishments:

- **a.** Developed a detailed Total Cost of Ownership Model both "Current State" and "Future State"
- **b.** Updated and converted 90% of the Instructor Led Practical Training curriculum to Computer Assisted Instruction (Shielded Metal Arc Welding, Gas Metal Arc Welding, Gas Tungsten Arc Welding, Burning, and Stud Welding).
- **c.** Developed 100% of the Instructor Led Classroom Training to Computer Based Training (Fire Watch, Fire Warden, Safety Evacuation Chair, Torch Safety, Visual Testing, Welding School Orientation, and Welding School Leader Training Course and Pre-Heat / Interpass).
- **d.** Installed, implemented, and maintained a Learning Management System within the NGNN internal infrastructure.
- **e.** Developed, validated, implemented a refined Assessment and Test Plan, data capture process, and analytical support program to ensure that the Return on Investment (ROI) prediction made in April 2001 was measured both empirically and anecdotally.
- **f.** Developed the Modernized Welding School Training Model which features a Welding Basic Training to evaluate trainees early in the Welding experience and then group them by learning styles and speeds to better match instructors to trainees providing a more efficient training model.
- **g.** Developed a Welding School Staff Development Program focused on roles, responsibilities, and organizational changes to implement the modernized training model.

Results:

- **a.** **Decreased** cost by 16% per initial entry trainee.
- **b.** **Maintained** the quality level of the training the Welding School Graduates. Graduate X-ray test pass rate of 85% in 2000-01 compared to 83% in 2002.
- **c.** **Decreased** the safety incident rate by nearly half. 2000-01 rate was 1.53% compared to 0.80% in 2002.
- **d.** **Increased** available direct labor hours to the projects by 15,700 hours due to faster matriculation through the Welding School.
- **e.** **Increased** initial entry trainee throughput by 3.6 times. 153 welders in 2001 compared to 555 welders in 2002 (plus 500 Lease Welders Qualification Tests).

ABOUT THE AUTHORS

Robert P. Leber has been with Newport News Shipbuilding since 1982, in positions such as Manager of Production Planning and Control, Director of Facilities, Director of Ship Repair, Manager of Human Resources, and Director of DOE Programs. For the past five years, Bob has served as the Shipyard's Manager of Training Programs, and as such is responsible for the Company's skills training programs for all of its salaried technical staff, and production and maintenance personnel. Bob has two bachelor's two master's degrees, including an Engineering degree from the United States Merchant Marine Academy, a Liberal Arts degree from the University of Evansville, a Master of Business Administration from the College of William and Mary, and a Master of Arts in Education and Human Development from George Washington University. Bob is currently working on his Doctor of Strategic Leadership at Regent University.

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Introduction

In February 2001, Northrop Grumman Newport News (NGNN) the builder of nuclear powered aircraft carriers and submarines selected the Welding School to begin a training modernization program. Since then it has been aggressively modernizing the Welding School's training process, procedures, programs, and course content based upon the insertion of learning technologies, changes in welding procedures, and application of adult learning theory. It completed the modernization in December of 2002 and has been operating under the modernized model since. This paper discusses the methodologies used to modernize the training program, as well as the metrics development, data capture, and analytical model used to measure the outcomes. It also looks at important findings and future considerations regarding other components of NGNN's training programs.

The Northrop Grumman Newport News Welding School is the acknowledged world leader in training welders for the shipbuilding and repair industry. The School has operated for over 100 years and until 2001 provided extremely effective training to 200 welders per year from the various Trades and the Apprentice School.

Due to the significant increase in the production schedule over the next 10 years, the Welding School will be required to train from 1,000 to 1,500 welders per year. There has not been this magnitude of training requirement since the early 1980's. Therefore the School must plan and modify its current operations to be able to meet this demand. In December 2000, a request to add instructors to the Welding School staff was returned because those same instructors would be pulled from the production trades that needed such seasoned leaders to meet demanding production schedules. The other alternatives were to increase the time trainees spent in school or decrease the quality of the training to maintain completion rates. Both of these options were discounted immediately. The final alternative was to use this business need as a catalyst to explore opportunities to use existing technologies and the latest in learning research to develop a plan to meet the future demand in the most efficient fashion, while retaining the excellent quality of training for the production trades.

In January 2001, the Welding School has teamed with experts in the eLearning industry to conduct a bottom-up review of the School in its current mode of operation, and identify opportunities for improvement. During 2001, the team identified, designed, tested, and executed new training methods to prepare for the projected training surge and gain a positive first year Return-on-Investment. The new methods were developed and tested through a pilot program featuring each of the following five synchronized and integrated interventions:

1. Develop Single Source Program of Instruction
2. Convert current Instructor Led Training to Web Based Training
3. Develop alternative Training Strategies and Revised Welding School POI
4. Implement Key Skills Pre-assessments
5. Synchronize automated training administration tools

Culture and Change Agents: "You can not use computers to train welders!" This quote was from one of the Welding School Instructors during one of the early working group sessions. The instructional staff of the Welding School, with an average of 20 years instructional experience was the key stakeholder in the program and was one of the most difficult challenges because they saw this as a threat to their jobs and their program. Dr. Jim Wallace, the Director of Education and Training, and senior management made it clear from the very beginning that they needed to better understand the potential for new learning technologies, but the absolute business need was for them to increase their throughput capacity without increasing the staff. Their choice was to either support change or work much harder trying to maintain the exponentially growing trainee workload due to significant hiring increases in 2002. Mr. Bob Leber, the Manager for Training at NGNN, was and is the champion for the program. His vision,

budget authority, and focus on the outcomes gave life and meaning throughout the implementation process. One of the key success decisions made up front was the realization that this project was a complex Program Management challenge that was simply overwhelming for the incumbent staff of the Welding School. The requirement that we would have to conduct this modernization without disrupting current school operations was a major challenge that could only be overcome by outsourcing the Program Management services and focusing them full time on the project. That dedicated Program Management and the core vision that we would prove the case in compelling business terms first and then use that success to justify the budget and generate a bow wave for future applications were truly the heroic efforts of the Champion--NGNN Manager of Training. The motto was, "start small and grow to big" and it worked. Now those same instructors are our biggest advocates and they say, "You can use computers to train welders faster and better!" and our production clients know we are saving them significant overhead dollars and meeting their skills needs.

The Training Modernization Process

The Welding School modernization team started the review processes on February 19, 2001, using a phased, systems engineering approach to determine if an e-based approach would be applicable and if a positive Return on Investment could be achieved within the 1st year. The Program Management Team worked out of the Welding School and conducted over 50 hours of interviews with both internal Welding School stakeholders and external stakeholders, including personnel from Human Resources, Fire Department, IT Support Staff, Trades Representatives, and recent retirees from the Welding School staff. Also, an extensive data search was conducted along with a technology discovery process.

An overview of the major activities of the modernization program follows:

Phase One: Analysis and Understanding (February 19 to March 19, 2001)

- Analyzed total Welding Trades Life Cycle from "end to end"
- Reviewed and de-composed current Welding School Training Model
- Built Total Cost of Ownership Model
- Identified and de-composed core elements and key drivers of New Welder "Time to Competency"
- Gathered data and interviewed internal and external stake-holders
- Developed initial Return on Investment Model
- Identified 6 potential opportunities to:
  - Provide highly qualified Welding Instructors maximum time with Students—key time to certification driver
  - Convert instructor-led presentations to media-based training
  - Reduce classroom time and convert to practical booth time for instructors and students
  - Use on-loan instructors more effectively and efficiently

Phase Two: Definition and Design (March 20 to April 19, 2001)

- Received senior management guidance to continue to define and design pilot projects for all 5 potential intervention opportunities
- Developed detailed and specific plan of action and milestones for all six pilot interventions.
- Developed Total Resource Requirements to execute all 6 pilot interventions
- Refined Return on Investment Model
- Analyzed master synchronization and integration plan of action and milestones for all 6 pilots
- Gained consensus among all stakeholders, internal and external
- Designed interventions to affect ROI model to ensure positive ROI:
  - Gain benefit from reduced training time associated with media-based training, which is typically 1/3 reduction
  - Capture instructional techniques of experienced instructor
  - Make materials available to area Vocation Schools
  - Reduce reliance on on-loan instructors
  - Prepare Welding School to meet surge in hourly welding hiring in 2003-05 time frame

Findings and Proposed Action Plan

The accepted recommendation based upon results of Phases I and II is to conduct a single synchronized and integrated Pilot Project to be operational by December 2002. The strategic goal was to open the Modernized Welding School in full operation in January, 2003. The Pilot should include the following six segments:

1. Develop Single Source Program of Instruction

Hypothesis: If courseware is standardized, training objective lesson steps will mirror what is being taught, instructor institutional knowledge will be captured, and "on loan" instructors will train to welding school standards resulting in a more efficient instructional process.

Action: Standardize Shielded Metal Arc Welding (SMAW)/Gas Metal Arc Welding (GMAW) Program of Instruction. Consolidate and update current sourcebooks.

Benefit: Provide Instructional Standardization to reduce content variation and ensure at-risk students are adequately supported. Provide body of content for reuse as Instructor Led Training presentations, Learner Based Instruction / Reference, and for situational export.

Impact: Improve Safety. Optimize Instructor Contact Time. Allow greater access to critical information. Reduce Rework. Reduce Attrition. Reduce Total Time To Train.

2. Convert current Instructor-Led Training to Web-based Training

Hypothesis: If current ILT content is converted to Learner Based Training (Computer Based Training and Computer Assisted Instruction) Welding School efficiency will improve by independent student ability to reinforce skills, by affording instructors more student booth contact time, and the ability to export the content to other users outside of the Welder School. Result will be reduced time to certification within the Welding School.

Action: CAI for Instructor presentations. CBT for Learner Based Activity. Electronic Trainee Guides for Learning Center. Objective driven Student Pocket Handbook for ready reference.

Benefit: Provides Learner-Based delivery of training just in time. Maximizes learner access to critical information without overt instructor support. May be distributed to distant learners. Provides reinforcement of critical concepts and knowledge factors. Provides ability to dynamically assess learner progress. Provides immediate feedback to learner.

Impact: Improve Safety. Optimize Instructor Contact Time. Improve welding project performance. Reduce Rework. Reduce Attrition. Reduces time away from value added work. Reduce Total Time To Train.

3. Develop Alternative Training Strategies and Revised Welding School POI

Hypothesis: If welding school attendance is better aligned with the actual operational requirements the Welding School will produce more efficient welders qualified on the actual jobs they will perform. (Just in Time, not Just in Case). Result will reduce course length for new students and better align training with career progression. Additionally, significant reductions in time to train will be gained from procedural adjustments made as school transitions from paper based to electronic based record keeping.

Action: Develop Revised Welding School Program of Instruction and Training Procedures document based upon integration of planned interventions. Develop alternative Training Strategies/Models depending upon welding school surge requirements. (High, Medium, Low) Low is current model.

Benefit: Enables instructors to optimize use of available resources. Considers perish ability and degradation of skills for those qualifications not used in several months. Provides flow throttle points for surge periods. Identifies non-X18 (non-welder) training as a component of total time to train and instructor utilization.

Impact: Improve Safety. Optimize Instructor Contact Time. Reduce Rework. Reduce Attrition. Reduce Total Time To Train. Improve welding production performance.

4. Implement Key Skills Pre-assessments

Hypothesis: Better screening will reduce attrition and identify early on potential at risk students who may need different training approaches.

Action: Identify, test and implement Pre-hire Assessment Screening Tools for:
Hand-Eye Coordination, Vision Depth Perception, Manual Dexterity, "The Welding Experience" Video.

Benefit: Identifies ideal candidates for Vocational Welding. Conversely, identifies at-risk employees. Enables prescriptive remediation to be in effect earlier

in process. Creates entry baseline for comparing demographic-based results and tailoring support in future curricula variations.

Impact: Improve Safety. Optimize Instructor Contact Time, Reduce Rework, Reduce Attrition, Reduce Total Time To Train

5. Refine Instructor Training Program

Hypothesis: If permanent instructors receive regularly scheduled professional development training and procedural review this will reinforce standardized best practices and provide a peer forum for on-loan instructors to become familiar with the same standards, resulting in more efficient instructional processes and safety procedures.

Action: Ensure that as new tools and processes emerge, the Instructor Training Program is updated and Lessons Learned captured for current Instructors and "On-Loan" Instructors.

Benefit: Provide instructionally sound, organized, semi-automated instructor delivery of information. Provides reinforcement of critical concepts and knowledge factors. Provides ability to dynamically assess learner progress. Creates a uniform training methodology that can be more readily evaluated and improved. Enables instructor's effectiveness in motivation and reaching individuals within a group.

Impact: Improve Safety. Optimize Instructor Contact Time, Reduce Rework, Reduce Attrition, Reduce Total Time To Train, Reduces time away from value added work.

6. Synchronize automated training administration tools.

Hypothesis: Automated record keeping will increase efficiency by reducing: frequency of documents changing hands, chances of error and loss, and increasing instructor/student contact time.

Action: Implementation of basic automated training administration/record keeping tools to capture both student performance data and the ability to better manage training production requirements with production trade skill needs. Transition Welding School from a Paper Based Record Keeping Systems to an automated Learning Management Center.

Benefit: Maximizes learner access to critical information without overt instructor support.
Captures distributed learning events to quantify and qualify individual and group performance. Provides reinforcement of critical concepts and knowledge factors. Provides the ability to dynamically assess learner progress and provide immediate feedback to learner.

Impact: Impact: Improve Safety. Optimize Instructor Contact Time, Improve welding project performance Reduce Rework, Reduce Attrition, Reduces time away from value added work, Reduce Total Time To Train

Phase Three: Creation and Development (April 2001 - September, 2002)

Program Management and Professional Services:

1. Synchronize and Integrate ~~six~~ 6 separate projects with internal and external stakeholders
2. Develop Concept for Revised Training Model and Program of Instruction
3. Develop Concept, Criteria, and Plan of Action with Milestones for Pre-Assessment Tools
4. Develop support materials and evaluation methodology for Pre-Assessment Tools
5. Develop Concept, Criteria, and Plan of Action with Milestones for Revised Instructor Training Course
6. Implement Strategic Communications Plan

Automated Support Tool Installation and Customization:

1. Define Data Structure for "mediazation" of current Welding School related content
2. Tag content and map to data structure, .html meta-data tags assigned
3. Integrate with existing Training and HR Support Tools
4. Install Student Management Systems functions to ensure ROI data is captured electronically
5. Develop and Test Installation
6. Document and Deliver

Content and Courseware Development:

1. Develop Common Graphical User Interface and Templates
2. Develop, test, and field over 50 hours of Computer Based Training and Computer Assisted Instruction

Phase Four: Pilot Implementation and Roll Out (June - December 2001)

Program Management and Professional Services:

1. Continue Synchronization and Integration 5 separate projects with internal and external stakeholders
2. Document detailed Revised Training Model and Program of Instruction
3. Implement Plan of Action with Milestones for Pre-Assessment Tools
4. Implement Plan of Action with Milestones for Revised Instructor Training Course
5. Continue Implementation of Strategic Communications Plan with internal and external stakeholders

Automated Support Tool Fielding:

1. Integrate with Courseware (as developed)
2. Install Student Management Systems functions and capture ROI data electronically
3. Adjust Documentation
4. Train Users (Instructors, Admin Staff and IT staff)

Content and Courseware Development

1. Develop Content Management System and Digital Media Library
2. Develop, test, and field Fire Warden and Fire Watch as the prototype courses.

Phase Five: Pilot Execution, Data Capture and Analysis (January - December 2002)

Program Management and Professional Services:

1. Conduct detailed ROI analysis based upon data generated from AST
2. Continue Synchronization and Integration 5 separate projects with internal and external stakeholders
3. Build alternative Training Model for various levels of student throughput
4. Evaluate and conduct short cycle product improvement for Pre-Assessment Tools
5. Evaluate and conduct short cycle product improvement for Revised Instructor Training Course
6. Continue Implementation of Strategic Communications Plan with internal and external stakeholders

Content and Courseware Development

1. Develop Level 1 VT, Torch and Preheat Courses
2. Test and field within AST

Return on Investment Summary

First Year Return on Investment is positive.

The ROI does not include any savings attributed to reduced attrition in first year of employment.

The following are additionally tangible benefits not included in the ROI:

1. Increases Available Instructor Direct Contact Time with Students in Welding Booth– the critical event to decreasing time to competency.

2. Reinforces critical Safety Requirements in school and on production lines.

3. NNS Welding School showcases innovative training methods while maintaining status as "Best Welding School in the World."

4. Potentially serves as training prototype for other areas of NGNN.

5. Production clients on the waterfront retain more expertise as reliance on "On-Loan" instructors decreases.

6. Install prototype Automated Training Support Tool package for entire NGNN.

7. Immediate impact through Web Distribution of NGNN Welder Program of Instruction to area Technical and Vocational Schools.

Analytical Model: One of the key success factors was the development and implementation of an analytical model in Phase 2 and 3 which became the touch stone of the entire program. In October 2001, an Enhancements Review Board was established to track milestones and to ensure that our analytical model was

being followed. Here are the core elements of our analytical model.

Hypothesis: Increasing instructor to student contact time in the practical area will decrease student time to train (cost), maintain safety standards and provide quality graduates to production.

Metrics: To prove the hypothesis measurable metrics were derived from the Total Cost of Ownership model.

a. Student Practical Labor Cost
b. Practical Instructor Labor Cost
c. Materials Cost
d. Student Classroom Labor Costs
e. Classroom Instructor Labor Cost
f. Administrative and Miscellaneous Cost

Empirical Data Elements: Each metric was then broken down to actual measurable data elements and procedures and methods were established or refined to capture this data as related to the student in the modernized training programs.

a. Student Practical Time to Task
b. Practical Instructor Time to Task
c. Monthly Materials Costs
d. Student Classroom Time to Train
e. Classroom Instructor Time to Train
f. Administrative and Management Time to support per student

Anecdotal Data Elements: During the data capture process, a systematic process to gain anecdotal data from all the key stakeholders was developed and implemented. Anecdotal data was captured through the personal interviews with:

a. Students (During training and at graduation)
b. Instructors
c. Senior Instructors
d. Welding School Management Staff
e. Welding School Administrator
f. Production Foremen
g. X18, X10 Leadership
h. Welding Engineering Staff

Implementation Results:

On January 15, 2003 the Modernized Welding School opened and the modernized policies and procedures were implemented. Process adjustment, data capture and analysis continue on a regular basis through the creation of a Welding School Monthly Program Review, which replaced the Enhancements Review Board. The result is a Welding School that has positioned itself to meet the business needs of Northrop Grumman Newport News for the next decade.

a. Increased throughput capacity
b. Reduced cost of training
c. Maintains current and relevant welding instructional content
d. Improved support to Production

- Serves as training modernization prototype for other areas of NGNN.
- Waterfront retains more expertise as reliance on "On-Loan" instructors decreases.
- Installed prototype Automated Training Support Tool (LMS) capability for NGNN.
- Immediate impact through Curriculum Distribution of NGNN Welder Program of Instruction to area Technical Schools.

2002 Results:

a. Decreased cost by 16% per initial entry trainee.

b. Maintained the quality level of the training the Welding School Graduates. Graduate X-ray test pass rate of 85% in 2000-01 compared to 83% in 2002.

c. Decreased the safety incident rate by nearly half. 2000-01 rate was 1.53% compared to 0.80% in 2002.

d. **Increased** available direct labor hours to the projects by 15,700 hours due to faster matriculation through the Welding School.

e. Increased initial entry trainee throughput by 3.6 times. 153 welders in 2001 compared to 555 welders in 2002 (plus 500 Lease Welders Qualification Tests).

2002 Welding School Findings and Path Forward:

In January 2003, the Modernization Team prepared a comprehensive report detailing the activities and accomplishments of the Welding School Modernization along with a recommended path forward for each finding. All of the recommendations were approved and are being implemented today. Additionally, a monthly Welding School Program Review has been established to maintain the momentum of the modernization and to realize its full business potential.

Maximizing Instructor/Trainee Interaction Reduces Time to Train and Increases Quality. Migration from Instructor-centric to Trainee-centric instructional model allows instructors to focus their efforts on the trainee rather than on repetitive instructions; thereby allowing for empowered trainees, decreased turnover and attrition, increased job satisfaction and productivity. Path Forward: Increase the number of permanent instructors. The current mix of permanent to "on-loan" instructors hinders realizing full modernization results because the "on-loan" instructors train-up time versus the total amount of time spent in the school is not efficient.

Fully Implement the Modernized Training Method. Early trainee welding ability evaluation allows more cost effective training in the Welding School and better postgraduate placement in the Trades. Path Forward: The Welding School will fully implement the modernized training strategy to include a Welding Basic Training and grouping of trainees by learning style and instructor techniques. We will continue to refine the instructional model to gain more efficiency through implementing short-term revisions based upon lessons learned and manage the modernization through the establishment of a monthly Welding School Program Review.

The Welding School Trains Foremen. Currently, Welding School "On Loan" instructors are taught and then practice NGNN leader skills under the direct supervision of an experienced Welding School Instructor. This On the Job training gives them the skills necessary to move into supervisory positions upon returning to the Yard after their tenure as instructors. Path Forward: Implement and conduct short term enhancements on the Welding School Leader Training Program to train both permanent and "On Loan" instructors. We will share the course and its results with the Production Trade Management to ensure the course represents the core Foreman Skills required.

Transition to Welding Support Center of Excellence. The Welding School will begin the transition from a "brick and mortar" Welding School to a "production focused" Welding Support Center of Excellence in 2003 to even better meet production needs. Instant access of the Computer Based Welding expertise as close to the Waterfront as possible, allows for effective and efficient resolution of welding issues affecting production. To facilitate this transition, the Welding School will send teams directly to the Waterfront to support the continuing education and training of welders on the job. Path Forward: Conduct detailed planning, prepare implementation guides, and support the Trades to ensure these practices support production needs. Our focus will be to ensure the Welding School is Receptive, Responsive, and Adaptable to our foreman.

Development of Skills Pre-Assessment Tools. The ability to pre-assess trainee attitudes and aptitudes towards welding during the pre-hiring process could significantly increase the effective trainee placement in the appropriate learning path or trade. Path Forward: Continue work with Human Resources and Old Dominion University to test instruments and/or methods to assess trainee attitudes and aptitudes towards welding.

Expand the New Horizon Regional Education Center (Technical High School) Project to Other Welding Institutions. Leverage the success at New Horizon's by deliberately expanding the now proven techniques to other Welding training programs.
Path Forward: Expand the New Horizon's model to at least two other Welding training programs in 2003. Mature the New Horizon's Program to hire New Horizon's graduates at NGNN. Closely linked the expansion with NGNN's recruiting programs.

Familiarize the Production Foremen on new Training Methods. One of the unintended consequences of the modernization program is that first line supervisors who receive these graduates will not be familiar with the modernized training methods used to train new Welders. Path Forward: Work with the Production Trades to develop a Foreman Welding School familiarization program. The purpose would be a brief foreman on how we have changed the Welding School Training Program, familiarize them with the Computer Based Training and Computer Assisted Instruction so that they will be better informed as to how the new graduates are being trained. Also, this will be an opportunity to introduce how these new training tools can help them to train in the production areas.

Capture NGNN Welding School Graduate Performance Results.

The original strategic goal of the project was to produce graduates of the welding school that increased the amount of weld, reduce re-work, and improve safety in the production areas without increasing the training burden on production foreman. Path Forward: To ensure we have met the strategic goals of the modernization program stated above, a deliberate effort will be made to capture and analyze data related to production welding goals. During 2003 a quarterly report will be produced demonstrating the business impact of the Welding School modernization program to the business results of NGNN.

2002 NGNN Conclusions and Path Forward:

The NGNN Training Programs Department will continue to pursue the above mentioned activities, while addressing the following additional needs required to expand the modernization program outside of the Welding School.

a. Implement an NGNN Learning Management System/ Learning Content Management System. Support the current Automated Support Tool (i.e., Learning Vista) as an NGIIS Production System, continue to develop and deploy courseware until an NGNN Enterprise LMS is acquired and installed.

b. Expand the Welding School modernization process to other training areas. Expand the modernization process throughout 026 Training Services department to increase the training products capacity, capability, and responsiveness.

c. Develop Five-Year Strategic Plan for Training. Based on the business needs of NGNN, develop a Five-Year Strategic Plan (i.e., 2004 – 2008) and a Short Term Courseware Development Plan (i.e., 2003) to support the modernization effort.

d. Northrop Grumman Repeatable Model. Make other areas of the corporation aware of our work and serve as a resource should they decide to conduct similar training modernization programs.

Summary: Today NGNN is moving forward on all paths to grow this great success into all areas of NGNN, NG Ship Systems, and NG as an organization. However, we are doing it based upon the confidence of experience and actual demonstrated performance.

The Welding School and all its support elements, should take great pride in the fact that since February 2001, we have completely updated the courseware, transitioned most of the courseware to computer-based training or computer-assisted instruction, and conducted a rigorous, comprehensive review of all of its operations. This is a significant accomplishment in and of itself. It is even more impressive that during all of this activity the Welding School did not miss one training requirement and provided the Production Trades with over 1,000 qualified welders in 2002 which is a five fold increase over the previous year.

Lessons Learned:

- The modernization Champion must create an environment that supports innovation and change.
- The Senior Sponsor must select a meaningful training program on the critical path. Welding skills are a core skill at NGNN.
- Do not promise too much until you know it will work. Start with a small, well defined project and grow to big as you gain confidence and the organization learns about the technology and the training model.
- Include all Stakeholders… those that can kill your program and those who influence success.
- Partner with best-in-class Training Experts who understand the business of training and return on investment.
- Establish a rigorous, dedicated Program Management process focused on the Business Case--Full time work.
- Human Learning is the bottom line… not the software or computers.
- Get on with it…at some point you have to have the confidence that the path is correct and things will change. Know that everything will change and unexpected challenges are growth opportunities.

Closing: If the mark of true modernization success is for trainees and instructors to never know it was any different then the modernization of the Welding School at Northrop Grumman Newport News is a sterling example. Those same instructors who were so skeptical three years ago are now disciples of the program and our greatest spokesman. We started with designing a solution to empower the core learning event—instructors teaching students to weld in a one-on-one coaching role. Three years later we have proved that if the instructors have more time and energy to focus on that task then they are better, the graduates are better and the system is better. The Welding School Training Administrator, Gary Roy, now says it all, ***"You can not train a person to weld using a computer but you can train them faster and better!"***