REPORT TO THE PRESIDENT

CAPTURING A DOMESTIC COMPETITIVE ADVANTAGE IN ADVANCED MANUFACTURING

Report of the Advanced Manufacturing Partnership Steering Committee

Annex 3:

Education and Workforce Development Workstream Report

Executive Office of the President

President's Council of Advisors on Science and Technology

JULY 2012

PREFACE

In June 2011, the President established the Advanced Manufacturing Partnership (AMP), which is led by a Steering Committee that operates within the framework of the President's Council of Advisors on Science and Technology. In July 2012, the AMP Steering Committee delivered its report to PCAST, entitled *Capturing Domestic Competitive Advantage in Advanced Manufacturing*. PCAST adopted this report and submitted it to the President. The Steering Committee's report draws on preliminary reports prepared by several "workstreams." These workstream reports have been made available as on-line annexes to the Steering Committee report.

Report of the Advanced Manufacturing Partnership Steering Committee Annex 3:

Education and Workforce Development Workstream Report

EXECUTIVE SUMMARY

For the United States to remain a competitive force on the world stage, talented employees who have a high level of technical skill are needed to revitalize, sustain, and improve U.S. manufacturing. Unfortunately, the image of manufacturing and the public perception that it can provide long-term, desirable careers have been tarnished. This negative image is driving the most talented, technically skilled students away from manufacturing to other career paths and creating a deficiency in the quantity and quality of the current and future workforce. To attract a robust and highly skilled workforce, the image of manufacturing must change from offering low job security and dull, dirty, and dangerous work to being exciting, engaging, essential, and environmentally sustainable. The same cohesive message from the government, educational institutions, and private industry is needed to change this perception.

An equally important need is for some modification to traditional teaching methods used to train the manufacturing workforce at all levels of education. Success in advanced manufacturing and entrepreneurship will require a workforce with fundamental science, technology, engineering, and math (STEM) skills and broad problem-solving skills, decision-making skills, and people skills that do not emerge from a conventional K–12 education. We encourage adoption of Project-Based Learning (PBL) methods in upper K–12 and in community college programs in manufacturing, with some projects selected for their relevance to manufacturing-relevant skills, such as supply-chain management, design for manufacturability, estimation of tolerances and requirements, economics, and team-management. To stimulate these new educational initiatives, educational partnerships between industry, academia, and local and regional governments must be established. A successful rebirth of manufacturing will be ensured only by addressing the underlying structural challenges.

CHARGE TO THE WORKSTREAM

The Education and Workforce Development (E&WD) Workstream's task was to identify tangible actions that support the availability of a robust supply of talented individuals to provide human capital to advanced manufacturing companies in the United States today and in the future.

The discussions about advanced manufacturing have raised awareness that efforts aimed at creating jobs and opportunities must be matched by initiatives to expand and improve the capabilities of the workforce. Industry participants have consistently raised concerns about the "largest gap" in our educational system—it does not produce people with the technical knowledge, basic business skills, people skills, and problem solving abilities necessary to succeed in a modern manufacturing facility. The Advanced Manufacturing Partnership Steering Committee (AMP SC) must begin efforts to fill this gap if all other aspects of advanced manufacturing are to take root in the United States. We decided to focus much of our initial attention on initiatives that can impact manufacturing education at the community college level because we believe the greatest near-term impact on the workforce can happen at this level.

PROCESS FOLLOWED

The E&WD Workstream comprised individuals from six industrial companies, four universities, five Federal agencies, and one community college. The participation of each proved valuable in providing a wide perspective on workforce needs. Weekly teleconferences were held to foster continuity and ongoing dialog. Guest speakers participated in many teleconferences and expanded the knowledge of the workstream. Many of the guest speakers volunteered to work with the AMP to assist with the implementation of recommendations. This interaction proved to be an important part of the process. When the input of a guest speaker was needed beyond what was provided during a teleconference, additional conferences were held.

The topic of education is very broad and presented challenges for the workstream. Early meetings were filled with valuable discussion and provided members a good background on the topic. However, because of the breadth of the topic, getting traction was difficult.

The first action of the workstream was to draft and send a survey to a group of industrial firms soliciting their response to five questions. These responses were used to focus the workstream discussion on community colleges, which was identified as the area that could have the largest impact on closing the workforce's widest educational gap. Survey results are shown in the Supporting Materials section of this report.

After three months of working on the work-life and work-skills gaps of employees entering the workforce for the first time, the workstream expanded the topics of study. Six subgroups were formed, nicknamed workcreeks. Each workcreek focused on one topic of interest to the E&WD Workstream. The areas of focus were Enhancing the Image of Manufacturing, Veterans, Federal Programs, Manufacturing Programs at Research Universities, Standards and Certification, and Attributes of Successful Partnerships. Workcreek leaders were assigned, and the workcreek managed its work independently and reported its findings during a weekly teleconference. This division of labor proved essential and allowed significant progress in a short period of time.

Members read and shared reports from groups such as the National Association of Manufacturing (NAM), the President's Export Council (PEC), Jobs Council, the Manufacturers Alliance for Productivity and Innovation (MAPI), the Information Technology and Innovation

Foundation (ITIF), and the U.S. Chamber of Commerce (USCC) and discussed related articles published in trade journal and alumni magazines.

Co-chairs and workstream members attended the four outreach meetings and participated in the E&WD breakout sessions. The discussion and feedback from the attendees confirmed much of our work and gave us confidence that we were on the right track. In each outreach meeting, the attendees also brought new ideas, which became important findings and helped form and harden our recommendations.

In the final weeks before the submittal of the workstream report, each workcreek leader produced an extensive report with his/her findings and recommendations. Each report was a standalone product that could have been submitted as a final report. The next step was to gather the members for a day-long work session. The task was to edit and finalize workcreek reports and begin the processes of consolidating the work into a final report with integrated, powerful, and actionable findings.

In summary, participation was excellent and was vital to the performance of this workstream. The findings are important, and the recommendations are extensive. If the recommendations are adopted, they will have a significant, immediate, and long-lasting positive impact on U.S. advanced manufacturing.

KEY FINDINGS

Summary

Even with unemployment near 9%, advanced manufacturing positions are available in a wide range of industries. These employment opportunities would provide rewarding careers (e.g., in businesses whose products improve energy efficiency and sustain the environment).

Over the past decades, manufacturing jobs have changed. These jobs now require highly skilled workers instead of laborers. The largest gap between manufacturing's needs and new employee skills exists for technicians and equipment operators. This gap has left many workers unqualified for available positions. Community colleges provide some of the missing education, but a significant gap remains. Most of the gap can be found at the secondary level, where many students are not prepared to join the manufacturing workforce. Workers lack general work-place skills such as problem solving, social interaction, and teamwork. Basic communication skills of reading, writing, and mathematics are also inadequate. As a result, businesses often must train employees in areas of STEM before they can make needed contributions. An accreditation system that focuses on the skill needs of the workforce is needed.

This team has focused on initiatives that can expand the workforce in the near term.

Findings of greatest importance are as follows:

1. Advanced manufacturing is not confined to emerging technologies. It comprises efficient, productive, tightly controlled processes across a wide spectrum of globally competitive U.S. manufacturers. We define advanced manufacturing as industries where the co-location of manufacturing and design leads to innovation.

2. The quality of the U.S. workforce is not the primary reason manufacturing companies locate facilities outside the United States; however, work-force quality is a concern to industry and a top consideration when making a decision about where a new facility will be located.
3. The largest new-hire skills gaps are for operators and technicians of automated equipment and processes and for trade skills such as welders and electronic technicians. The skills gap spans work-life and job skills.
4. Service members exiting the military possess many of the needed technical and work-life skills.
5. Community colleges grew after World War II to train the returning GIs to join workforce. This founding principle can serve today's need to train returning veterans to meet the needs of advanced manufacturing.
6. The loss of manufacturing jobs over the past 25 years and the negative image of manufacturing careers have driven talented people away from manufacturing careers. Fewer manufacturing jobs result in fewer students being interested in manufacturing, which, in turn, results fewer manufacturing-based courses and degrees being offered by educational institutions. All of these trends are working against the needs of industry and must be reversed.
7. Educational programs that base curricula on project-based experiences seem to be the best at producing graduates who have the skills desired by employers in advanced manufacturing.

Image of Manufacturing

Manufacturing careers are viewed with disdain and skepticism. Reductions in force (RIFs) and offshoring are regularly reported by the media. Repetitive reporting has created an image that manufacturing jobs do not offer job security. Manufacturing jobs within a facility can decline as productivity improves and U.S. businesses outsource or open facilities outside the United States. This trend is likely to continue as companies work to be competitive in the global marketplace. Conversely, one of the highest concentrations of community and individual wealth creation is manufacturing.

The conventional wisdom about manufacturing evokes images of the past and leads one to believe that jobs in this sector are dirty, noisy, repetitive, and dangerous and that manufacturing operations are harmful to the environment.

Manufacturing and "factory work" are denigrated by influential members of society, across all sectors, as a job (not a career) that should be avoided or surpassed through better education.

Jobs for unskilled labor are declining, but jobs for skilled operators and technicians are increasing at a rate that exceeds the availability of qualified candidates. These highly-skilled, creative and innovative professionals are essential to a corporation's long-term competitiveness. In a recent survey conducted by Deloitte and the Manufacturing Institute,

manufacturing is nationally viewed as core to our economic prosperity and preferred as an industry for creating local employment. Related to available skills to support manufacturing growth, 82% of manufacturers reported moderate-to-serious gaps in the availability of skilled manufacturing candidates. In addition, 74% of manufacturers report that this skills gap has negatively impacted their company's ability to expand operations. This skills gap has resulted in 5% of all manufacturing jobs going unfilled—even in the face of our current unemployment levels. The focus needs to be on developing a strong pipeline of prepared manufacturing candidates as a key enabler to advancing manufacturing in the United States.

Veterans

Veterans demonstrate many of the work-place skills that are in great demand in advanced manufacturing. These skills include maturity, discipline, the ability to work effectively in a group, and leadership. In addition, many veterans have undertaken extensive technical training that has resulted in skills that could easily translate to manufacturing positions, such as technicians, operators of complex equipment, or craftsmen. Yet, the veteran population is experiencing a higher rate of unemployment than their civilian counterparts. In examining statistics for 2011, the Bureau of Labor Statistics (BLS) found that the unemployment rate for veterans who served in the military at any time since September 2001 (called Gulf War-era II veterans) was 12.1%. The jobless rate for veterans of all eras combined was 8.3%, compared with 8.7% for non-veterans.[1]

In a recent survey conducted by the Manufacturing Institute, 67% of respondents reported a moderate-to-severe shortage of available, qualified workers, and 56% anticipated the shortage to grow worse in the next 3 to 5 years. In addition, the survey found that 5% of current jobs at respondent manufacturers are unfilled due to a lack of qualified candidates.[2] The manufacturing sector recognizes that veterans could provide a robust employee pool, as exemplified in the Manufacturing Institute's new Pipeline Initiative to "connect transitioning military men and women to manufacturing employment through 'high-tech' regional and local career expos."[3]

As a result, we recommend actions to:

- Facilitate the matching of skilled veterans with manufacturers, including clear translation of military training and certifications to civilian training and certifications;
- Expand the recognition across the manufacturing sector of the unique skill sets offered by veterans; and
- Ensure that veterans are aware of opportunities for careers in manufacturing (an outcome tightly coupled with improving the image of advanced manufacturing).

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[1] BLS Economic News Release: Employment Situation of Veteranc-2011, March 20, 2012, http://www.bls.gov/news.release/vet.nr0.htm

[2] http://www.themanufacturinginstitute.org/Research/Skills-Gap-in-Manufacturing/2011-Skills-Gap-Report/2011-Skills-Gap-Report.aspx.

[3] http://www.themanufacturinginstitute.org/Education-Workforce/Military-and-Veterans/Military-and-Veterans.aspx.

Project-Based Learning

Many educational "experiments" are underway in which all or parts of a curriculum are designed around project-based instruction. "New Tech High Schools" have their entire curriculum based on student teams executing industry-specified project challenges. Community colleges often rely on project-based experiences in some classes to provide skills. Some colleges (e.g., The Claremont Colleges in California) base entire years of their curriculum on team projects. Bachelors of Science in Mechanical Engineering (BSME) and other graduate programs at all top universities include team projects in "Capstone Design" courses or other focused single-term or multi-term courses. The emergence of these methods at all levels has created an awareness that these experiences lead to the development of important skills such as decision-making and leadership skills, which go beyond the STEM core. Participants from the industrial sector have emphasized the unique value of these experiences in the education of their best employees.

Manufacturers who go into the classrooms provide real-world projects and research opportunities. They support the adoption of project-based learning (PBL) and the revitalization of job shadowing, internships, and apprenticeships. These manufacturer-led partnerships and initiatives have been successful at the local and regional levels in producing graduates who have skills that manufacturers value. The best practices and key attributes of these successful partnerships should be captured and propagated.

Governmental entities can encourage these partnerships by funding progressive benchmark initiatives and defunding legacy status quo programs.

Community Colleges

Community colleges grew after World War II to train the returning GIs to join workforce. This founding principle can serve today's need to train returning veterans to meet the needs of advanced manufacturing. The approximately 1,500 community colleges located across the United States should develop location-specific curricula to meet the needs of local and regional manufacturers.

A successful implementation model currently exists with the National Science Foundation (NSF) Advanced Technological Education (ATE) Program. This program emphasizes the role of community colleges as the main providers of technician education in the United States. ATE centers and projects at community colleges, in partnership with universities, secondary schools, business and industry, and government agencies, design and carry out model work-force development initiatives.

Technology funding managed by the NSF, the Department of Defense (DOD), the Department of Energy (DOE), the Department of Commerce (DOC), and other agencies includes investments in technologies for advanced manufacturing. While this funding is significant, it is overwhelmingly delivered to universities, national labs, and industry and has almost no impact on the community colleges' educational programs that are critical for training the next-generation advanced manufacturing workforce.

Colleges and Universities

A survey of the six universities showed that none has a named undergraduate degree in manufacturing; however, several have at least one comprehensive program at the graduate level.

Many baccalaureate-level engineering degree programs in 4-year colleges and universities have very little in the way of manufacturing science and technology content in their curricula. The lack of exposure to the engineering and systems aspects of manufacturing is a key factor in the low level of interest that program graduates have in pursuing a career and/or further studies in advanced manufacturing.

Major research universities must play a key role in defining the fundamental elements of the discipline of advanced manufacturing and in producing the next generation of educators and industrial leaders. In so doing, these institutions will not only add to the profession, but will also greatly improve the image of manufacturing as a challenging and rewarding career.

This effort should be aimed at programs and degrees that give the student a comprehensive view of manufacturing and that provide a technological and an operational perspective to the student in a professional engineering context.[4] If one starts with the premise that U.S. manufacturing excellence includes the need for graduates from such degree programs,[5] a review of current programs reveals that we are not addressing these needs nationally. What emerges is a picture of local programs that rise and fall with local enthusiasm and industry interest and that are, on the whole, isolated and independent. Likewise, universities have not learned where manufacturing best fits in academia. It does not fit well into normal boundaries of degree programs, departments, or even schools and, as a result is often marginalized. Also, typical research university interactions with industry are with R&D and not manufacturing organizations.

Certifications and Accreditations

An efficient market for employees who have needed knowledge and skills depends on reliable and appropriate credentials and/or certifications. To succeed, any new assessments, accreditations, and credentials require a critical mass of national recognition and acceptance and adoption by industry, education, and government. Such certifications work when they

- Involve quality assessments, accurately gauging worker skills;
- Include an accreditation regimen that ensures program quality and alignment with the changing needs of industry; and
- Result in nationally portable, industry-recognized support, preferential consideration, and job search mobility.

[4] The term “professional” implies an emphasis on non-research degree programs as a priority but not at the exclusion of strengthened advanced engineering research.
[5] There is increasing evidence of this need in many industries.

Public/Private Partnerships

Traditional approaches to technical education are mismatched to the needs of advanced manufacturing and have contributed to unfilled jobs at a time of high unemployment. Regional programs and partnerships successfully close the skills gap.

There are many examples of successful industry-academia-government partnerships that have improved the education system, but no two partnerships alike, even in the same region with similar partners.

Fundamentally, the partnerships that have had best outcomes have been built on six important pillars: (1) partners have a passion for learning and a vision for the future, (2) partners embrace the case for change, (3) convening organizations share their expertise, (4) collaboration, committed involvement, and sense of community combine for success, (5) the partners' specific roles are clear, and (6) stakeholders remain flexible to meet manufacturers' needs.

When industry partners work with academia, all parties benefit. Manufacturers that engage at the K–12 level affect students across society, regardless of the career path they choose. These partnerships help ensure that students are provided with relevant teaching that will enable them to contribute to society and provide for themselves upon graduation.

RECOMMENDATIONS

Summary

These findings require a call to action from government, academia, and industry. Our recommendations include the following:

1. The image of manufacturing needs a complete restoration, removing false impressions based upon partial truths and realities of the past. The Advanced Manufacturing NPO should launch a nationwide Ad Council[6] campaign to restore the image of manufacturing careers, with outreach support from existing associations such as the Society of Manufacturing Engineers (SME), the National Association of Manufacturers (NAM, and the Institute of Industrial Engineering (IIE).
2. Veterans possess many of the missing skills that are crucial to advanced manufacturing. Veterans must be aware of career opportunities in manufacturing, and industry must be aware that veterans can provide solutions to many existing employment problems. This solution is truly elegant. Veterans win, business wins, and our nation is made stronger. We recommend providing tuition aid for returning veterans who enroll in manufacturing

[6] The Ad Council is a private, non-profit organization that marshals volunteer talent from the advertising and communications industries, the facilities of the media, and the resources of the business and non-profit communities to deliver critical messages to the American public. The council produces, distributes, and promotes public service campaigns in support of key issue areas.

related programs in community colleges and universities (e.g., through the post 9-11 GI Bill) and cost sharing by manufacturing companies interested in hiring and retraining veterans. We support tax credits for employers that hire and train veterans (e.g., those provided in the Vows To Hire Heroes Act). Community colleges near military bases where returning veterans are likely to locate after return should receive special assistance to create and support programs to retrain veterans. A "GI Bill" for retraining and employing veterans should be initiated to carry and support all of these initiatives.

3. Community colleges already enroll many of the people who should train for advanced manufacturing. They have partnerships, infrastructure, and teaching methods that focus on regional needs. The Nation needs to invest in improvements in community colleges and promote engagement among community colleges, and industry, universities, national labs, and K–12 programs. Modest changes to agency solicitations to encourage partnering with community colleges could instantly create stronger regional community college partnerships with the industry, universities and national labs that routinely seek agency R&D funding.
4. Certifications and accreditations for skills in advanced manufacturing are needed. These educational certificates should be portable from institution to institution (enabling mobility between regions) and from colleges to jobs and back. Nationwide associations, such as NAM and the MI, should initiate and coordinate a register of certifications that are available in all regions and that can be "stacked" one after another to assemble complete programs of training in advanced manufacturing.
5. The importance of manufacturing-related content in university education needs to be highlighted. The Accreditation Board for Engineering and Technology (ABET) can serve in this role by imposing modest changes to the "attributes and objectives" of accredited undergraduate programs in engineering and by encouraging the insertion and use of manufacturing-inspired challenges in the undergraduate curriculum.
6. Federal agencies are already sponsors of advanced manufacturing in many technology programs. Modest changes to the review and selection criteria of government agency programs could lead to a much greater impact on the development and commercialization of technologies for advanced manufacturing and on the creation of opportunities for attracting and training new members of the advanced manufacturing workforce.
7. The creation of graduate degree programs in advanced manufacturing (e.g., through the NSF Integrative Graduate Education and Research Traineeship (IGERT) program and national MS and PhD Fellowships in advanced manufacturing) should be encouraged.

The education and work-life skills gaps are problems faced by large and small manufacturers throughout our country. Left unaddressed, these problems will continue. The good news is the solutions are known, discrete, and solvable with a sustained long-term approach. The following subsections support each of these recommendations with more detailed discussion.

Image of Manufacturing

Engage the Ad Council to develop and launch a multi-year (3-year minimum) Public Service Announcement (PSA) awareness campaign to improve the image of manufacturing. The Advanced Manufacturing NPO would lead the campaign under the guidance of the industrial members of the Ad Council's Board of Directors.

- Peers have a significant—perhaps the most significant—effect on teenage students. Focus the PSA campaign on high school and community college students. A peripheral benefit would be that parents' and educators' image of manufacturing would also improve.
- The PSA campaign is projected to have an out-of-pocket cost of $800,000 to $1,000,000 annually. This could be funded by the DOC's Advanced Manufacturing NPO and through industry and professional society foundations.
- Pro bono costs for creative development and media placement range for $25 to $30 million for a typical PSA campaign.
- Consider modeling the program on Army of One, Got Milk, or Essential 2 advertisements
- Consider a message that speaks to patriotism, creativity, innovation, potential, and the critical link that manufacturing will play in America's future.
- Manufacturing careers need to be elevated so they are viewed as professions and not just as jobs.
- A subset of the messages should be regional in nature, highlighting individual sectors that are important regionally (Robotics in Automation Alley [Michigan]), aerospace (South Carolina), advanced electronics (California). These messages could affect students of all ages.

Veterans

Design and develop an educational advanced manufacturing module that emphasizes opportunities, challenges, and benefits of manufacturing to individuals and society. This module would include the types of businesses, examples of processes and equipment, and the skills of people who work in that environment.

- This module should be inserted into DOD's Transition Assistance Program (TAP) at the highest organizational level to mitigate the local variability in administration of the program but should also be available before and after transition.
- The module would be funded, directed, and managed by the DOD.
- The Ad Council would take the advanced manufacturing TAP module and revise it for civilian use. The module would be made available free to professional societies such as SME, NAM and IIE and to educational institutions. The military and civilian modules

would be produced as standalone presentations that would not require the presenters to have any knowledge of advanced manufacturing.

Veterans have many of the work-life and jobs skills in high demand but missing in the general workforce. The Department of Labor (DOL) and the DOD should also focus on the design and development of job-seeking tools that facilitate the translation of military occupational codes (e.g., U.S. Army Military Occupational Specialties (MOS)) to civilian occupational credentials (e.g., MI's Manufacturing Skills Certification System). DOL and DOD should consider endorsing the MI's Pipeline program as the go-to point for veterans interested in manufacturing and for manufacturers interested in veterans. DOL and DOD should also encourage manufacturers to commit to using such tools and local and regional outreach (e.g., job fairs and partnership with State Veterans Affairs departments) to reach veterans in post-transition.

Community Colleges

Community colleges grew after World War II to train the returning GIs to join workforce. This founding principle can serve today's need to train returning veterans to meet the needs of advanced manufacturing.

- The approximately 1,500 community colleges located across the United States should develop location-specific curricula to meet the needs of local and regional manufacturers.
- The Advanced Manufacturing NPO should arrange a meeting of community colleges in Washington D.C. The American Association of Community Colleges (AACC) represents over 1,100 community colleges across the United States and would be a likely source to help coordinate the meeting. The purpose of this meeting would be to explain the need, solicit long-term support, and roll out the advanced manufacturing module for civilian use. Presentation would also be given by participants in this workstream.
- Community college curricula and credentials should be developed and standardized to meet the needs of manufacturing.

Universities

High schools, community colleges and universities must work together to educate our workforce to meet the needs of advanced manufacturing environments. Universities should take the lead in linking and coordinating the "education supply chain." The system should be a pull system that reaches out to regional industries and connects their needs with educational institutions. This effort could become part of the role of Manufacturing Innovation Institutes (MII).

- Engineers with varying educations are required for advanced manufacturing environments. Manufacturing engineering courses needs to continue to be part of or be added to Bachelor of Science engineering programs, as recommended elsewhere in this Annex.

- Research universities should establish new Masters-level professional degrees in Manufacturing Leadership. The major research universities have a special responsibility to establish what advanced manufacturing means and why it is so vitally important. These degree programs should be comprehensive in their integration of technologies (e.g., robotics and advanced automation) with methods (e.g., supply-chain management). Once established, the major universities must collaborate to establish a new educational model and uniform standards that can propagate nationally to an aligned set of education and training programs at the secondary, certificate, sub-baccalaureate, and baccalaureate levels.
- Industry associations, professional societies and educational organizations such as the IIE, SME, NAM, American Chemistry Council (ACC), and the USCC should form a coalition that will
    - Establish a path forward toward a national framework of standards, accreditations, and certifications at each level of the manufacturing workforce
    - Work directly with high schools and community colleges within their communities to stress the importance of using the advanced manufacturing module.

The Federal Government's help is needed to attract students and faculty to new manufacturing degree programs (e.g., through the introduction of National Manufacturing Fellowships, Veterans Leadership in Manufacturing Fellowships, funded "Traineeships," and curriculum/program development funds). For example, programs that would extend the NSF IGERT program to focus on MS-level manufacturing degrees or the inclusion of advanced manufacturing in the Department of Education's Graduate Assistance in Areas of National Need (GAANN) program would spur university activity. Potential action items include:

- Create "Presidential Fellowships and Scholarships" to encourage U.S. students interested in manufacturing careers to pursue professional degrees in this area.
- Modify the Department of Education's GAANN program to have a focused solicitation on manufacturing fellowships/scholarships at the university and community college levels. Structure this modified program to encourage collaboration between industry, community colleges, and universities or have separate scholarship programs aimed at the different educational levels.

Accreditations and Certifications

Ensure this path forward incorporates two key functions (accreditation and certification) and results in two key outcomes (common education and training standards) to satisfy current and emerging competencies and portable certifications for individuals. Leverage and/or expand existing models that have proven successful.

- **Accreditation.** ABET validates applied science, computing, engineering, and technology education programs by using an agreed-upon set of criteria to assess the quality of degreed programs at the associate, bachelors, and graduate levels for engineering and engineer technology.[7]
- **Certification.** The Manufacturing Institute (MI) uses the DOL Advanced Manufacturing Competency Manufacturing framework[8] to align existing credentials to a national certification system and uses this framework to assess future and incumbent workers' knowledge and skills. The MI has also established an extensive coalition of partnering organizations that provide certifications for most of the competencies outlined in the DOL model. Current partners include ACT, the Manufacturing Standards Skills Council (MSSC), the American Welding Society (AWS), the National Institute for Metalworking Skills (NIMS), and the SME.

CONCLUSION

While it is impossible to separate the education system into discrete pieces, the AMP E&WD workstream believes that the most impactful recommendations for improvement are at the high school and community college levels, followed by undergraduate education. Industry has identified content-mastery and soft-skills deficiencies that could be impacted by changing the way students are taught through the use of project-based learning, which has proven its unique capacity to prepare young people for a 21st century workplace. The content-mastery and soft-skills deficiencies can be remedied through this approach when coupled with a marked improvement in teaching skills.

To further secure and develop our talent pipeline, we believe the following must be accomplished through public/private partnerships .

- Create an aggressive, integrated "Image of Manufacturing" public service announcement campaign that would raise awareness and correct misperceptions of manufacturing in the United States;
- Provide support for veterans who possess the skills to fill technical manufacturing jobs, starting with the addition of a training module on advanced manufacturing to TAP materials;
- Build a certification and accreditation program to create national standards for advanced manufacturing;
- Enhance the role of research universities in defining the discipline of advanced manufacturing;
- Invest in community colleges and project-based curricula to build advanced manufacturing skills.

[7] http://www.abet.org/index.aspx.
[8] http://www.careeronestop.org/competencymodel/.

- Create a coordinated interagency initiative under the direction of the Advanced Manufacturing NPO to expand existing programs that enable students, faculty, and post-doctoral researchers to interact directly with manufacturers through the establishment of a high-profile public/private national internship and fellowship project; and
- Leverage programs such as the NSF ATE to develop advanced manufacturing education programs.

SUPPORTING MATERIALS
Education and Workforce Development Workstream

Enhancing the Image of Manufacturing

For the United States to remain a competitive force on the world stage, talented employees who have a high level of technical skill are needed to revitalize, sustain, and improve U.S. manufacturing. Unfortunately, the image of manufacturing and the public perception that it can provide a long-term, desirable career have been tarnished. This negative image is driving the most talented technically skilled students away from manufacturing to other career paths and is creating a deficiency in the quantity and the quality of the current and future workforce. To attract a robust and highly skilled workforce, the image of manufacturing must change from low job security, dull, dirty, and dangerous to exciting, engaging, essential, and environmentally sustainable. The same cohesive message from government-supported programs, educational institutions, and private industry is needed to change this perception.

Key Findings

- Manufacturing is viewed as lacking job security. RIFs and offshoring are regularly reported by all arms of the media. Repetitive reporting has created an image that manufacturing jobs do not offer job security. Manufacturing jobs within a facility can decline as productivity improves and U.S. businesses outsource or open facilities outside the United States. This trend is likely to continue as companies work to be competitive in the global marketplace. Conversely, one of the highest concentrations of community and individual wealth creation is manufacturing.
- The conventional wisdom about manufacturing evokes images of the past and leads one to believe that jobs in this sector are dirty, noisy, repetitive, and dangerous and that manufacturing operations are harmful to the environment.
- Manufacturing and "factory work" is denigrated by influential members of society, across all sectors, as a job (not a career) that should be avoided or surpassed through better education.
- Jobs for unskilled labor are declining but jobs for skilled operators and technicians are increasing at a rate exceeding the availability of qualified candidates. These highly-skilled, high wage, creative and innovative professionals are essential to a corporation's long term competitiveness.

Recommendations

- Design an "Advancing Manufacturing" campaign to transform the image of manufacturing through the Ad Council similar to An Army of One, Got Milk, or Essential2.
- Appeal to the public's sense of patriotism and the critical link that manufacturing will play in America's future.

- Consider a message that speaks to creativity, innovation, personal potential, and public service.
- A subset of the messages should be regional in nature, highlighting individual sectors that are important regionally (Robotics in Automation Alley (Michigan), aerospace (South Carolina), advanced electronics (California). These messages could impact students of all ages.
- Determine if the Advanced Manufacturing NPO will manage the initiative.
- Collaborate with professional organizations such as IIE, SME, NAM, AACC, and USCC to work directly with high schools and community colleges to spread the messages of the importance of manufacturing.
    - Large trade associations should provide "conversation starting" materials.
    - Professional organizations could commit to send 10% of their membership into classrooms to start the conversation about manufacturing.

Veterans

Veterans demonstrate many of the workplace skills that are in great demand in advanced manufacturing. These skills include maturity, discipline, the ability to work effectively in a group, and leadership. In addition, many veterans have undertaken extensive technical training that has resulted in skills that could easily translate to manufacturing positions, such as technicians, operators of complex equipment, or craftsmen.

Yet, the veteran population is experiencing a higher rate of unemployment than their civilian counterparts. In 2011, the Bureau of Labor Statistics (BLS) found that the unemployment rate for veterans who served in the military at any time since September 2001 (called Gulf War-era II veterans) was 12.1%. The jobless rate for veterans of all eras combined was 8.3%, compared with 8.7% for non-veterans.[9].

At the same time, a recent survey conducted by the MI, 67% of respondents reported a moderate-to-severe shortage of available, qualified workers, and 56% anticipated the shortage to grow worse in the next 3 to 5 years. In addition, the survey found that 5% of current jobs at respondent manufacturers are unfilled due to a lack of qualified candidates.[10] The manufacturing sector recognizes that veterans could provide a robust employee pool, as exemplified in the MI's new Pipeline Initiative to "connect transitioning military men and women to manufacturing employment through 'high-tech' regional and local career expos."[11]

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[9] BLS Economic News Release: Employment Situation of Veteranc-2011, March 20, 2012, http://www.bls.gov/news.release/vet.nr0.htm

[10] http://www.themanufacturinginstitute.org/Research/Skills-Gap-in-Manufacturing/2011-Skills-Gap-Report/2011-Skills-Gap-Report.aspx.

[11] http://www.themanufacturinginstitute.org/Education-Workforce/Military-and-Veterans/Military-and-Veterans.aspx.

As a result, achieving the following is desirable:

- Facilitate the matching of skilled veterans with manufacturers, including clear translation of military training and certifications to civilian training and certifications;
- Expand the recognition across the manufacturing sector of the unique skill set offered by veterans; and
- Ensure that veterans are aware of opportunities for careers in manufacturing (an outcome tightly coupled with improving the image of advanced manufacturing).

Recommendations: Near term

- Design and develop an educational advanced manufacturing module that emphasizes opportunities, challenges, and benefits of manufacturing to individuals and society. This module would include the types of businesses, examples of processes and equipment, and the skills of people who work in that environment. This module should be inserted into DOD's Transition Assistance Program (TAP) at the highest organizational level to mitigate the local variability in administration of the program but should also be available before and after transition.
- After transition, design and develop job-seeking tools that facilitate the translation of military occupational codes (e.g., U.S. Army MOS) to civilian occupational credentials (e.g., MI's Manufacturing Skills Certification System). Consider endorsing the MI's Pipeline program as the go-to point for veterans interested in manufacturing and for manufacturers interested in veterans.

Recommendation: Longer term

- Identify key characteristics of existing successful models within industry, trade associations, and veterans organizations that are already focused on Veterans (e.g., Intel's Veterans/Clubhouse Initiative, Northrop Grumman's Operation Impact, The United Association (UA) Union of the Plumbers, Fitters, Welders, and Heating, Ventilation, and Air Conditioning (HVAC) Service Techs Veterans In Piping (UA VIP) program). Successful programs should include a manufacturing-specific focus, information on the image/career potential of advanced manufacturing, available tools to easily translate Military Occupational Classifications (MOCs)/MOSs to civilian certification, and local and regional outreach (e.g., Job Fairs and partnership with State Veterans Affairs departments to reach veterans in post-transition).

Review of Federal Programs

Efficient use of resources in support of initiatives for education in advanced manufacturing must be a priority. Opportunities exist today to leverage changes in current Federal programs that directly and immediately impact the development of the workforce for advanced manufacturing. There are three primary areas of opportunity to promote engagements between universities, community colleges, industry, and national labs that stimulate the use of manufacturing-inspired challenges and provide opportunities for project-based educational programs.

Key Findings

- **The NSF ATE.** A successful implementation model currently exists with the ATE. This program emphasizes the role of community colleges as the main providers of technician education in the United States. ATE centers and projects at community colleges—in partnership with universities, secondary schools, business and industry, and government agencies—design and carry out model workforce development initiatives.
- **Manufacturing content in Bachelor-of-Science-level education.** Many baccalaureate-level engineering degree programs in 4-year colleges and universities have very little in the way of manufacturing science and technology content in their curricula. The lack of exposure to the engineering and systems aspects of manufacturing is a key factor in the low level of interest that program graduates have in pursuing a career and/or further studies in advanced manufacturing.
- **Community college partnerships.** Technology funding managed by NSF, DOD, DOE, DOC, and other agencies includes investments in technologies for advanced manufacturing. While this funding is significant, it is overwhelmingly delivered to universities, national labs, and industry and has almost no impact on the community colleges' educational programs that are critical for training the next-generation advanced manufacturing workforce.

Recommendations

- Expand ATE programs to include broader dissemination of successful projects and centers. Consideration should be given in new center and project proposals consistent with AMP SC recommendations.
- Coordinate development of MIIs in partnership with ATE Centers to leverage and expand existing activities and infrastructure.
- Create opportunities for specific, meaningful, and economically driven engagement between industry, the Advanced Manufacturing NPO, and the ATE program.
- To create broad impact on engineering education and manufacturing workforce development, a two-fold approach is suggested:
    - Create an industry pull for fresh engineering graduates, along with the requisite level of manufacturing knowledge and training.
    - Update the criteria specified by the ABET to require manufacturing content in engineering curricula.
- Change scoring mechanisms, algorithms, and other aspects of Federal solicitations for technologies supporting advanced manufacturing so that they will specifically encourage partnerships with community colleges.

Manufacturing Programs at Research Universities

Major research universities must play a key role in defining the fundamental elements of the discipline of advanced manufacturing and in producing the next generation of educators

and industrial leaders. In so doing, these institutions will not only add to the profession, but will also greatly improve the image of manufacturing as a challenging and rewarding career.

This effort is aimed at programs and degrees that give the student a comprehensive view of manufacturing and that provide a technological and an operational perspective to the student in a professional engineering context [12]

Key Findings

- If one starts with the premise that U.S. manufacturing excellence includes the need for graduates from such degree programs,[13] a review of current programs reveals that universities are not addressing these needs nationally. What emerges is a picture of local programs that rise and fall with local enthusiasm and industry interest and that are, on the whole, isolated and independent. Likewise, universities have not learned where manufacturing best fits in academia. It does not fit well into normal boundaries of degree programs, departments, or even schools and, as a result is often marginalized. Also, typical research university interactions with industry are with R&D organizations and not manufacturing organizations.

Recommendations

- Research universities should establish new Masters-level professional degrees in Manufacturing Leadership. The major research universities have a special responsibility to establish what advanced manufacturing means and why it is so vitally important. These degree programs should be comprehensive in their integration of technologies (e.g., robotics and advanced automation) with methods (e.g., supply-chain management). Once established, the major universities must collaborate to establish a new educational model and uniform standards that can propagate nationally to an aligned set of education and training programs at the secondary, certificate, sub-baccalaureate, and baccalaureate levels.
- The Federal Government's help is needed to attract students and faculty to new manufacturing degree programs (e.g., through the introduction of National Manufacturing Fellowships, Veterans Leadership in Manufacturing Fellowships, funded "Traineeships," and curriculum/program development funds). For example, programs that would extend the NSF IGERT program to focus on MS-level manufacturing degree development or the inclusion of advanced manufacturing in the Department of Education's GAANN program would spur university activity.
- A coalition of companies must participate in the aforementioned recommendations by providing funds, people, and advice. For example, industrial partners should work with university coalitions to facilitate the transition of graduates into manufacturing leadership positions. Mid-degree internship programs that expose students to careers in

[12] The term "professional" implies an emphasis on non-research degree programs as a priority, but not at the exclusion of strengthened advanced engineering research.
[13] There is increasing evidence of this need in many industries.

Manufacturing Leadership should be provided. Industrial representatives should serve as mentors and role models to students entering and emerging from these new programs. Industry should participate in the development of curriculum modules and in providing and supporting infrastructure at universities.

Accreditations and Certifications

Manufacturing jobs have changed. These jobs now require highly skilled workers instead of laborers. The largest gap between manufacturing's needs and new employee skills exists in technicians and equipment operators. This gap has left many workers unqualified for available positions. Community colleges provide some of the missing education, but a significant gap remains. Most of the gap can be found at the secondary level, where many students are not prepared to join the manufacturing workforce. Workers lack general work-place skills such as problem solving, social interaction, and teamwork. Basic communication skills of reading, writing, and mathematics are also inadequate. As a result, businesses often must train employees in areas of STEM before they can make needed contributions. An accreditation system that focuses on the skill needs of the workforce is needed.

Key Findings

An efficient market for employees who have needed knowledge and skills depends on reliable and appropriate credentials and/or certifications. To succeed, any new assessments, accreditations, and credentials require a critical mass of national recognition and acceptance and adoption by industry, education, and government. Such certifications work when they

- Involve quality assessments, accurately gauging worker skills;
- Include an accreditation regimen that ensures program quality and alignment with the changing needs of industry; and
- Result in nationally portable, industry-recognized support, preferential consideration, and job search mobility.

Recommendations

- Create a coalition of industry associations, professional societies, and educational organizations to establish a path forward toward a national framework of standards, accreditations, and certifications at each level of the manufacturing workforce.
- Ensure this path forward incorporates two key functions (accreditation and certification) and results in two key outcomes (common education and training standards) to satisfy current and emerging competencies and portable certifications for individuals.
- Leverage and/or expand existing models that have proven successful. Two such programs include

- *Accreditation.* ABET validates applied science, computing, engineering, and technology education programs by using an agreed-upon set of criteria to assess the quality of degreed programs at the associate, bachelors, and graduate levels for engineering and engineer technology.[14]
- *Certification.* The MI uses the DOL Advanced Manufacturing Competency Manufacturing framework[15] to align existing credentials to a national certification system and uses this framework to assess future and incumbent workers' knowledge and skills. The MI has also established an extensive coalition of partnering organizations that provide certifications for most of the competencies outlined in the DOL model. Current partners include ACT, MSSC, AWS, NIMS, and SME.

- Skill requirements and credentials require continuous updating to accommodate the changing needs of workers and the manufacturing sector.
- Identify gaps and opportunities in these existing models (or others) and include additional organizations where appropriate.

Attributes of Successful Partnerships

There are many examples of successful industry-academia-government partnerships that have improved the education system, but no two partnerships are exactly alike, even in the same region with similar partners.

Fundamentally, the partnerships that have had best outcomes have been built on six important pillars: (1) partners have a passion for learning and a vision for the future, (2) partners embrace the case for change, (3) convening organizations share their expertise, (4) collaboration, committed involvement, and sense of community combine for success, (5) the partners' specific roles are clear, and (6) stakeholders remain flexible to meet manufacturers' needs.

Key Findings

- When industry partners with academia, all parties benefit. Manufacturers that engage at the K–12 level affect students across society, regardless of the career path they choose.
- These partnerships help ensure that students are provided relevant teaching that will enable them to contribute to society and provide for themselves upon graduation.
- Manufacturers who go into the classrooms provide real-world projects and research opportunities, the adoption of project-based learning, and the revitalization of job shadows, internships, and apprenticeships.

[14] http://www.abet.org/index.aspx.
[15] http://www.careeronestop.org/competencymodel/.

- Governmental entities encourage partnerships by funding progressive benchmark initiatives and defunding legacy status quo programs.

Recommendations

- Create "Presidential Fellowships and Scholarships" to encourage U.S. students interested in manufacturing careers to pursue professional degrees in this area.
- Modify the Department of Education's GAANN program to have a focused solicitation on manufacturing fellowships/scholarships at the university and community college levels. Structure this modified program to encourage collaboration between industry, community colleges, and universities or have separate scholarship programs aimed at the different educational levels.
- Create a national network of manufacturing educators by integrating educational programs among NSF, the Department of Education, and the DOL to share best practices, curricula, and resources.
- Establish a program at NSF that funds the acquisition or development of shared equipment for research and/or education purposes.

Survey of Industrial Firms (with response summary) – Used as Data to Support Initial Prioritization

1. *What elements of education and/or skills are you seeing now in your candidates that are beneficial to your business?*

- Math, science, engineering emphasis, with computer literacy, advanced math, basic science/tech/engineering—especially for advanced technician positions that directly support manufacturing operations.
- Advanced computer skills, more advanced degrees and professional certifications, more candidates with formal post-secondary education, and good general writing, reading, communication, and mathematic skills
- Public high school graduates. Weak math skills and no applicable manufacturing skills, except perhaps for entry level material handling and/or stockroom kitting.
- University Graduates. Meet the minimum skills required for entry-level, general machining job descriptions.
    - Technical. No difficulty in finding well-educated candidates for Manufacturing Engineer, Industrial Engineer, or Materials Engineer roles. Use the Pratt & Whitney Manufacturing Engineer Development (MED) Rotational Program to link academic training with practical floor experience.
    - Non-technical. No difficulty in finding candidates for Supply Management, Finance, and Materials Management roles. At the United technologies Corporation (UTC), the Financial Leadership Program (FLP) rotation program is attracting and developing good talent. In 2010, we initiated rotational programs

in Supply Management and Materials Management to bridge the academic to practical experience gap for these disciples, similar to MED. The key for future competitiveness in the United States will be the adoption of life learning and education from the shop floor and up.

- For our professional needs, engineering skills are well taught. For our hourly needs, we wage a constant battle to identify candidates with good math/reading/technical skills.
- For PhD, strong Chemical Engineering and Materials Science and Engineering skills. For Techs, strong hands-on project and equipment know-how.

2. *At what educational level do you notice the largest gap or deficiency in skills in new hires (high school, community college, or university)?*

- High School: 43% of those who responded
- Community colleges: 67% of those who responded
- Universities: 29% of those who responded
    - With the exception of computer literacy, high school candidates tend to possess few skills. This fact, coupled with generally poor social skills, problem-solving ability, and poor work ethic, make this educational level the one that has the largest deficiency in skills.

3. *What are the most significant elements (education or skill sets) missing in your job candidates?*

- Education: 43% of those who responded
- Skill Sets: 78% of those who responded
    - Practical application and integration of the courses of study. We end up training people how to solve real problems and do work.
    - Vocational, problem solving, and social skills and work ethic, leadership, and business acumen are the more significant missing elements.
    - Critical thinking, math, and electronics abilities are often deficient.
    - For basic math and writing skills, and hands-on project experience, the greatest skill deficiency is found in advanced level technicians/manufacturing operators.

4. *Have you located a manufacturing plant(s) outside the United States due, in part or in full, to lack of talented employees? If yes, what skill was missing?*

- Yes: 29% of those who responded
- No: 71% of those who responded
    - U.S. corporate tax policies relative to other countries is a much greater factor.
    - Skills missing: basic math and project disciplines; apprentice training.
    - See below in general comments.

5. *Are there programs or degrees in local schools (high schools, community colleges, or universities) you believe have "best practice" education programs that meet the needs of advanced manufacturing plants? If yes, please summarize and provide the institutions name and a contact person.*

- Yes: 67% of those who responded
- No: 43% of those who responded
    - "Tech Prep" programs. Combination hands-on and academic programs. Project-based learning; apprentice learning teams.

6. *Please add your thoughts and comments not addressed by this survey.*

- As human interaction in advanced manufacturing processes decreases, the quantity of employee base will also decrease. A critical element at our company is the ability to bring new innovations to market rapidly, and, for this, the skills are much less defined than in the past. The ability to link R&D and manufacturing will be an important element if we wish to pursue a "invented here, made here" approach.
- Educated employees are not limiting our ability to manufacture in the United States (or anywhere else for that matter). Finding the right people takes effort, but it pays off.
- Facilities across the United States have similar views of the strengths and weakness of the education system.
- Gaps by educational level
    - High school (for shop floor). Intermediate math, technical literacy, very little practical shop training with basic tools/gages/simple machines
    - Community college (typically for shop floor). Statistics (for process control), technical literacy, technical writing, limited shop training with basic tools/gages/ simple machines.
    - Military (for shop floor). Often greater technical literacy and better familiarity with basic tools and gages than community college students.
    - University. Very few degrees in manufacturing engineering. Stronger emphasis needed on practical elements of material science for machining and special processes. Difficult to secure work visas for international students to fill key manufacturing engineering roles.
- Gaps by function
    - Shop floor technicians. Intermediate math, statistics, technical literacy, technical writing, practical training with basic tools/gages/simple machines
    - Process planners and Numerical Control Machine (NCM) programmers. Very few young U.S. individuals have these skills. Community college co-op program would be helpful here.

- Technical: Need for more experienced manufacturing engineers. Stronger emphasis needed on practical elements of material science for machining and special processes. Difficult to secure work visas for international students to fill key manufacturing engineering roles. Opportunity for university-level co-op programs.
- Professional: Aging manufacturing workforce with experience in production planning/scheduling/logistics/advanced quality principles. Opportunity for university-level co-op programs. Built/expanded international factories in part due to skill gaps in the United States. A new machining factory in Singapore supported by training dollars from Singapore government. Generally stronger intermediate math, statistics, and technical literacy at the high school level in Singapore than in the United States. Acquired a factory in Poland near a technical university with 30,000 engineering students and research programs in advanced machining and fabrications. Process planners and manufacturing engineers more readily available than in the United States

- Educational programs in the United States that have worked for us:
  - Solid success recruiting factory/shop technicians from individuals leaving U.S. military.
  - Successful co-op program with Northeastern University through which we have recruited individuals with good educational background in supply-chain management.
  - Successful UTC Operation Leadership Program in which university graduates rotate through assignments to gain professional experience in shop supervision, quality, and supply chain roles
  - Many candidates have the technical skills but lack motivation. Whether characterized by poor attendance or an "it's good enough" mentality, many seem to think they are owed a job.
  - Aforementioned comments focused on vocational training. There is also a critical need to ensure that adequate chemical engineers are being trained (BS, MS & PhD) to support non-bio based businesses.

Ad Council Proposal

Extensive research and review would be conducted during the campaign's formative stage to inform the most effective communications strategy and creative concepts. This research would include a literature review, expert panel and exploratory qualitative research (either traditional focus groups or one-on-one interviews, in-home groups or interviews, or consumer ethnographies). Typically, the Ad Council travels to at least three markets for a given campaign and speaks with a broad range of consumers within the target audience.

After the campaign's creative concepts have been developed, they will be tested qualitatively or quantitatively with consumers to gauge their response to the advertising. This

will help determine if the ads will be effective in gaining the target audience's attention, conveying the main message, and persuading the audience to take action.

The campaign's success will be measured in three ways:

- **Media measurement.** The campaign's donated media support will be monitored to estimate the number of ad placements, media impressions generated, and the monetary value of each of these placements.
- **Consumer response.** All forms of consumer response will be monitored, including website traffic, brochure requests/downloads (if appropriate), email sign-ups, etc.
- **Tracking survey.** A national benchmark survey of the target audience will be conducted before the release of the campaign, followed by annual post-wave surveys. The tracking study will gauge trends over time among the target audience. Measures include awareness of the issue, recognition of the advertising, relevant attitudes and relevant behaviors.

Based on this research, the Ad Council would develop creative concepts that are appropriate for motivating the target audience. The campaign will be peer reviewed and approved at three critical stages: campaign strategy, creative concepts, and final advertising materials. This process will be conducted by the Ad Council's Campaign Review Committee (CRC), which is made up of a panel of the nation's top advertising executives who meet monthly and provide feedback for all of the Ad Council's campaigns.

The Ad Council, tapping into the vast pro bono resources of its media partners, would distribute the campaign to its unique network of 33,000 media outlets nationwide (TV, radio, print, out-of-home, and Internet). Ad Council campaigns are also distributed by our Regional Managing Directors, who are located in the country's top Direct Marketing Associations (DMAs) and cover 86% of the country's media markets.

In addition, the Ad Council's National Accounts team maintains relationships with the nation's leading media companies on a corporate and national level to secure top-level media commitments. In addition, its Media Marketing team engages the support of trade and industry associations and coordinates the distribution of each campaign, using unique communication strategies and our staple of general media contacts.

- On average, each general market Ad Council campaign garners $25 to $30 million in donated media. (More broadly, the Ad Council secures about $1.4 billion dollars in donated media for its entire docket.)
- Beyond traditional public-service advertising, the Ad Council also relies on innovative communications, using new communications tools such as bus shelters, yellow pages, taxi cab tops, in-school programming, and cinema advertising and other emerging media outlets (e.g., personal data assistants (PDAs), video email, satellite radio and interactive television).

If funding permits, the Ad Council, in partnership with a reputable public relations agency, could help to create a fully integrated Public Relations (PR) program that could extend the

reach and impact of the campaign. Possible components could include press relations (including local, national and targeted pitching, Op-Eds, letters to the editor, editorial board visits, etc.), special events, grassroots marketing, customized web packages, mat release, multimedia newswire distribution, broadcast outreach, localized bites and B-roll feeds, and satellite and radio media tour.

The Ad Council unique approach to PSA campaigns creates campaigns exclusively through the creative services of a "volunteer" advertising agency that donates its labor pro bono and through donated media. However, all Ad Council campaigns incur certain hard costs. The campaign, for a 3-year effort, could cost $2.4 to $3 million. Specifically, these funds would pay for the hard costs associated with the campaign, including conducting qualitative and quantitative research; television, radio and print production; distribution (TV, radio, newspaper, magazine, Internet, out-of-home); media monitoring; research tracking studies; website development; public relations; and media outreach.

The funding for the 3-year effort would pay for two rounds of PSAs. Approximately 18 months after the campaign has been distributed to the media and thoroughly evaluated, the Ad Council and partnering organization would create and distribute new PSAs to the media. This approach will bolster the campaign's efficacy and maximize donated media since the media will increase their support when they receive newly created work.

Since the Ad Council relies on the pro bono services of ad agencies and media companies, the organization is able to produce national PSA campaigns for a fraction of the cost of paid media campaigns. Over 40 advertising agencies donate the creative work for Ad Council campaigns, and over 33,000 media companies contribute free ad space and time.