Engaging SME Medical Device Manufacturing Industry in Massachusetts with MassMEP

A Major Qualifying Project (MQP) Report submitted to the Faculty of
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I. Executive Summary

MassMEP is part of the nationwide Manufacturing Extension Partnership through the National Institute of Standards and Technology (NIST), serving as a consultant to SME manufacturers in the state. The established organization offers a reputable mix of services, providing clients with expert knowledge and training. Currently, MassMEP has clients across a variety of industries including, but not limited to, precision machinery, food and beverage, and more. The organization is now seeking to obtain clients in the medical device industry. The WPI student team has been tasked with developing a marketing strategy for MassMEP to utilize in the effort of providing potential customers with information on how the organization can provide them with beneficial services.

I.I Industry & Target Audiences

The medical device manufacturing industry is increasingly expanding in regards to revenue and employment. Centered on the development of medical instruments and equipment, this industry is the provider of many life-saving technologies such as diabetic monitors, hearing aids, and many more. As the industry experiences incremental growth, there are a few large corporations that have acquired large portions of the market share. In Massachusetts there are approximately 300 medical device manufacturing companies with 80% consisting of less than 50 employees (Grant Thornton LLP, 2019). MassMEP services small to medium (SME) size manufacturers and therefore the target audience for the product is SME medical device manufacturers ranging in size from 30-200 employees within Massachusetts.

I.II Product

The team has worked to formulate a competitive and specific *Operational Excellence for Medical Device Manufacturers* module, derived from current MassMEP service offerings, to be marketed to medical device manufacturing clients. This module serves to highlight the services offered by MassMEP that are relevant and can be beneficial to these organizations. The highlighted services include lean manufacturing training; quality management, specifically ISO 13485 and ISO 14971 training; and cybersecurity assessment & application programming. MassMEP is able to offer these variant services through an outsourced organization of experts that are connected with the client through MassMEP. This Operational Excellence Module is tailored to address and meet the needs of medical device manufacturers.

I.III Campaign Objectives

The primary objective of this campaign is to provide potential clients from the target audience with the assurance that MassMEP has the knowledge, experience, and understanding of the industry to provide beneficial services and training. In order to achieve this objective, the team recommends the following:

- Educate the target customer on the benefits of the Operational Excellence services to generate interest.
- Convey MassMEP as a reputable manufacturing consultant that is able to provide effective and specialized services.
- Bridge the gap in technical language between MassMEP and prospective clients.
- Generate action in clients to attend informational events conducted by MassMEP

I.IV Media Plan

The team recommends that MassMEP follow a six month campaign timeline divided into three stages. The purpose of the three stages is to follow potential customers through the marketing funnel, the final stage concluding in an event hosted or partnered by MassMEP. The three stages are as followed:

1. Driving awareness to MassMEP's offerings within the local medical device manufacturing community.
2. Generating interest in the services offered by MassMEP.
3. Building enthusiasm for MassMEP services that cause action among potential customers.

The primary distribution channels for this campaign will be email, social media, and MassMEP's website. Specifically, content will be distributed through the company's existent channels with a strong focus on LinkedIn and Facebook. MassMEP's website will then serve to provide potential customers with more information on the content viewed in the social media posts. The team has developed engaging visuals and information to be utilized in the campaign. These consist of infographics, informational videos, email templates, a landing page, event guidelines, and a list of medical device manufacturing companies in Massachusetts. These materials can be found in the Appendix.

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1. Introduction

Over the past five years the medical device manufacturing industry has seen a steady increase in revenue attributed to a variety of factors including an increasing aging population and longer life spans (Curran, 2019). The industry displays many advantages and successes present day that ensure that it will continue to expand and remain profitable in the future. Given this information, MassMEP aims to attract a larger clientele in this industry and address any technical gaps and concerns potential clients may have through implementation of a marketing strategy, including new product development and a communications plan.

This project was conducted in two phases, research and composition. The team spent the first half of the project conducting research primarily on the medical device manufacturing industry as well as related industries such as biotechnology and pharmaceuticals. This research was funneled from the global, national, and local industry. Once there was a well-rounded understanding of medical device manufacturing and major players in the market, the focus was funneled to major players in Massachusetts, specifically SME manufacturers that fit the client size and need that MassMEP can service. The second phase of the project was to create the marketing strategy and supplemental materials. This was done by assessing MassMEP's current offerings and capacity, the needs of local medical device manufacturers, and any impediments that may be encountered when approaching this industry.

From the gathered information, our team assembled a marketing campaign focused on a specific version of MassMEP's Operational Excellence module that is tailored specifically for the medical device manufacturing industry. This portfolio includes key information on the industry, important terminology, a list of potential clients, product packages, and supplemental marketing materials. The product package is a module composed of current services offered by MassMEP that are most applicable to companies in the target industry. The key services are ISO certification training and lean process improvement. Through the implementation of this marketing strategy, the desired outcome is for MassMEP to acquire more clients in this industry.

2. Background

2.1 Medical Device Manufacturing Industry

Similar to biotech and biomanufacturing, but in many ways vastly different, medical device manufacturing is another prominent manufacturing discipline in the US, and Massachusetts. The industry is defined as being the development of implants, instruments and equipment for therapeutics, diagnostics, research and care (SME, 2019). This includes devices like artificial implants, diabetes monitors, hearing aids, tubes and syringes, and electronic measuring devices.

In 2018, the industry saw a steady increase in both revenue and employment. Total revenue across the industry in 2018 equaled about $41.3 billion, with overall profit of margins of about 5.3%. This figure reflects the importance of increasing efficiency of these companies in order to increase profit. Due to industry regulations and control on prices due to the nature of hospital sales, as of 2018 the industry has an overall average profit margin of 2% (Curran, 2019). Industry growth is projected to grow from 0.1% to 2.3%. Several factors are positively increasing this, including increased healthcare being sought and offered. Globalization of manufacturing is negatively influencing the industry domestically, as international development is beginning to rise. Demand overall has been steady and will continue to see incremental growth. Of the estimated 5,800 businesses across the U.S., the market share is primarily dominated by several large corporations, with the rest of the competitive landscape being made up of companies that employ 50 or less (Proven Process, 2018). The primary large corporations in the industry are: Medtronic PLC, General Electric, Abbott Laboratories, Danaher Corporation, and Johnson & Johnson.

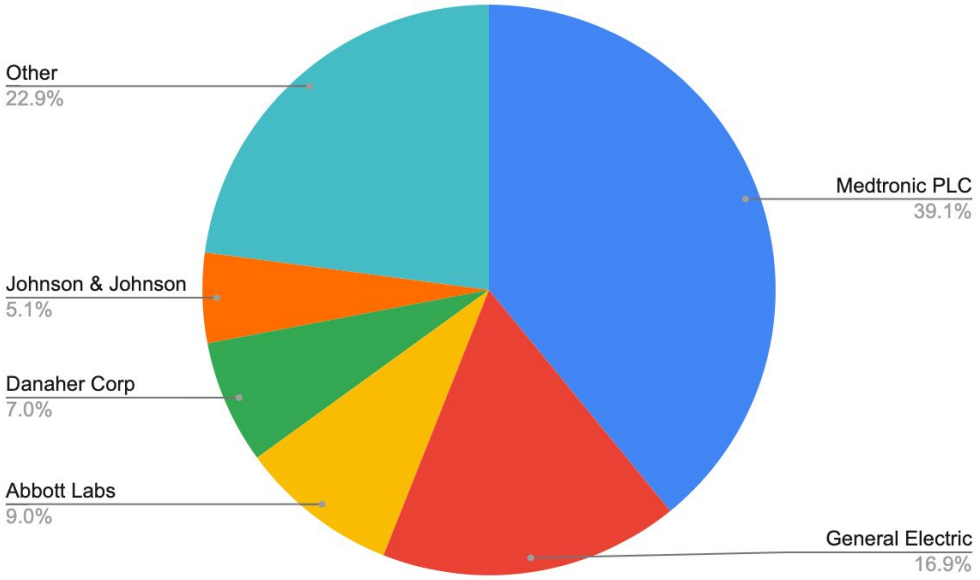

Figure 1. Market Share of Medical Devices Manufacturing Industry (Curran, 2019).

2.1.1 Industry Segments

The industry is segmented primarily by the target use of products and services, with Cardiovascular devices making up the largest segment in the industry (Curran, 2019). The other segments as defined by IBISWorld are: Neuromodulation and Spinal Devices, Diabetes Devices, Irradiation Devices, Patient Recovery and Noninvasive Devices, and Other Devices. Diabetes devices are a rapidly growing section, focusing on the development of Continuous glucose monitoring technology, and insulin pumps. While Diabetes is the most rapidly growing segment, growth across all segments continues to grow steadily (Curran, 2019).

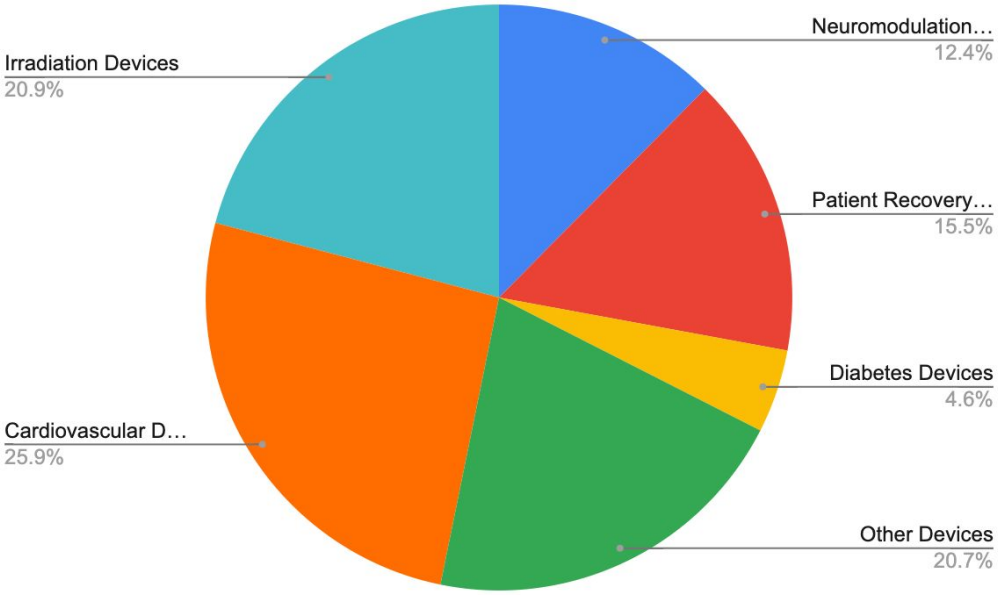

Figure 2. Segmentation in Medical Device Manufacturing Industry (Curran, 2019).

Demand in these segments is determined primarily by the market segmentation, with hospitals and exports making up a majority of markets for these manufacturers. Hospitals make up 36.6% of the market for medical device manufacturers in the United States as of 2018, with exports making up the second largest amount at 28.6% of the market (Curran, 2019). As a result of the advanced state of the industry in the United States, exports to other countries remain high, but are forecasted to dip in the coming years, due to increasing growth in the global market.

2.1.2 Growth Factors

Several growth factors impact the medical device manufacturing industry in the United States. Particularly, regulations, technology advancements, aging populations, and globalization.

Regulations in the industry create uncertainty related to industry costs and revenue as taxes, policies, and healthcare legislation can dramatically impact business decisions and operations. However, as the healthcare industry in the United States is constantly expanding, the demand for medical devices is expected to increase. As a result, profit margins are also expected to rise on average to 2.2% in the next 5 years (Curran, 2019).

Technology advancements within the medical device industry and manufacturing as a whole have enabled growth and innovation. In particular, developments have led to cost cutting and increased quality in the development and research of new products. Technologies in biotechnology and additive manufacturing particularly have a direct impact on new product development in medical device manufacturing (Curran, 2019).

Demographic changes in the coming years however will also positively impact the industry as a whole, as populations in the United State begin to age. In particular, the increasing number of adults aged 65 and older is a large driver in demand for medical devices. This number is estimated to increase by about 3% continuously through 2025 (Curran, 2019), and will continue to be the largest size of this subpopulation group.

Another impactful growth factor is globalization. As the global outlook of the industry increases, the demand for medical devices exported from the United States will decrease. With a total market share for exported medical devices in the industry equalling 28.6% in 2018, growth in other market segments is expected to make up for any decrease in exports (Curran, 2019). In particular, European markets are advancing steadily to meet the standards of the United States' medical device industries, and in some cases surpass it. Asian markets are also seeing rapid growth in advancements in medical device manufacturing, and depending less and less on expertise from United States based companies and research (Curran, 2019).

2.1.3 Current Industry Performance

As a whole, the medical device manufacturing industry has been performing well and is expected to continue to do so. Revenue in 2019 is estimated to grow by over 2%, reaching a total market revenue of $41 billion (Curran, 2019). As a result of the economy growing, production of medical devices is going to continue to grow as an industry. In the future however, revenue growth is expected to level out and become stagnant, due to increasing demand for healthcare products with the expectation of lower device costs (Curran, 2019). To continue the trend, companies must begin considering how they can reduce expenses in their processes.

2.1.4 Products, Services, and Technologies

Many different types of products and technologies make up the medical device manufacturing industry. Because of the vastly different variation, a lot of companies focus on specialized products. Some types of these products include: Orthopedics, artificial bone and joint implants, dilators, surgical robots, endoscopic devices, ultrasound technology, pacemakers, defibrillators, stents, glucose monitors, drills, dental instruments, catheters, syringes, needles, IV equipment and blood monitors (SME, 2019).

Technologies that are important to the industry are usually based on common manufacturing processes. Orthopedics and implants typically require more traditional machining approaches and use technologies such as metal injection molding (SME, 2019). Imaging technologies, electrical engineering, chip manufacturing, assembly and sensor production are all widely used across various types of products. Material science is also a common practice in this industry. In addition to these technologies, manufacturing processes require a highly controlled

level of quality in the development of medical devices, and assembly lines are complex (SME, 2019).

Companies that are developing new products are often in a pilot manufacturing stage, in which they need to develop the process to move onto full-scale production for their devices. Because of the complexity of these manufacturing lines, a lot of the smaller companies in the United States and Massachusetts often invest a lot of time and resources into this stage (Curran, 2019). Full scale production usually is reached more quickly by the larger companies in the industry, as a result of their funding availability and experience setting up production lines.

2.1.5 Cost Structure Benchmark

In the medical device industry, costs for a company are high when compared to other industries. Similar to biotechnology, costs are heavy up front, in the development and research of the products, and development of an assembly line. Research and Development costs in the industry take up about 12% of revenue overall (Curran, 2019). Notably, wages take up a higher percentage than the average of all other industries, equaling around 20.4% of revenue for medical device manufacturing, while it equals 11.6% for all other industries on average (Curran, 2019). This is due to the highly skilled nature of the development and production of these products. The following table shows a breakdown of medical device manufacturing industry costs versus the average costs for all industries:

	Medical Device Manufacturing Industry Costs in MA	U.S. Sector Costs, All Industries
Profit	5.3%	7.2%
Wages	22.2%	11.8%
Purchases	35.5%	55.6%
Depreciation	1.4%	2.5%
Marketing	0.5%	0.5%
Rent & Utilities	1.3%	2.3%
Other	33.8%	19.7%

Table 1. Medical Device Manufacturing Industry Revenue Breakdown vs. Average Industry Revenue Breakdown (Curran, 2019)

2.1.6 Major Players and Main Activities in Massachusetts

Massachusetts is home to about 8.3% of the total medical device manufacturing industry, giving Massachusetts the third highest percentage, behind California and Minnesota (Grant Thornton LLP, 2019). This is a result of the skilled workforce, and strong educational and technological foundation in the state, created by funding opportunities, research institutions, and schools and institutions (Curran, 2019). Of the five largest companies in the medical device manufacturing market, all of them operate in the state of Massachusetts in some capacity, although often in smaller independent offices. These companies are: Medtronic PLC, GE Healthcare, Abbott, Danaher, and Johnson & Johnson.

The Massachusetts Medical Device Industry Council (MassMEDIC) has over 300 members from the medical device manufacturing industry, with over 790 companies affiliated with the industry in some way (including suppliers, council, legal representation and more) (MassMEDIC, 2019). These companies together make up for 23% of the state's total exports, which is the highest for the industry across all states in the nation (Grant Thornton LLP, 2019).

Below is a list of the top 18 manufacturers in the state of Massachusetts by employee size. Because there are over 300 companies in the Massachusetts industry, over 80% of them are operations with under 50 employees in total (Grant Thornton LLP, 2019).

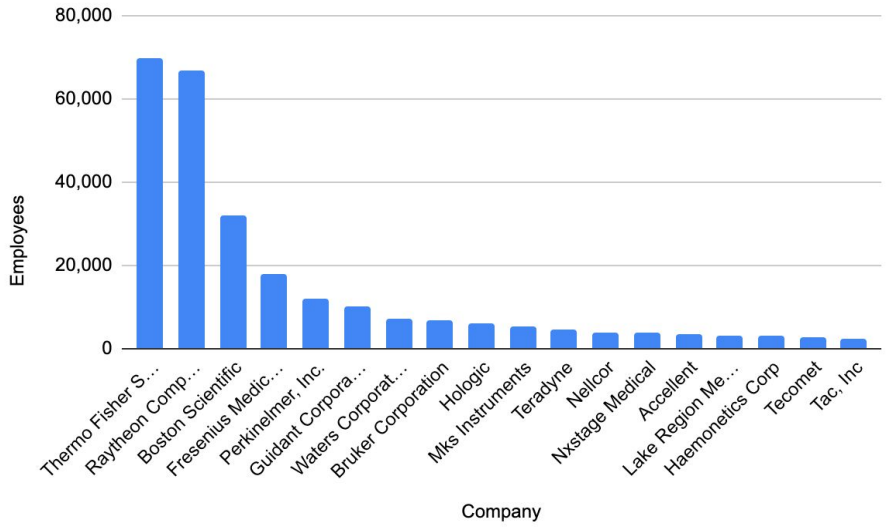

Figure 3. Top medical device manufacturing companies by size in the state of Massachusetts (Hoover, 2019)

2.2 Brand Snapshot

Founded in 1996, Massachusetts Manufacturing Extension Partnership (MassMEP) is a non-profit organization that functions under the National Institute of Standards and Technology, (NIST), specifically through the Department of Commerce of Massachusetts. The organization works with various business, academic, and government partners to assist small to medium manufacturers in improving their processes. The three main pillars under which MassMEP categorizes its services are Operational Excellence, Workforce Development, and Innovative Growth Strategies. The services offered are geared towards identifying, analyzing, and providing measurable growth opportunities to improve client organizations. The services vary from inhouse training sessions, informational meetings at MassMEP, and onsite training.

Currently, MassMEP services more than 2,000 manufacturers within Massachusetts. The company claims that their clients receive a 35 to 1 return on investment when utilizing MEP services (MassMEP, 2019). The organization is involved in many different industries and is currently assessing the viability of entering the medical device industry. As previously stated, the organization centers its services around Operational Excellence, Workforce Development, and Innovative Growth Strategies. The services offered under these pillars can be found in the table below.

Program	Services	Service Details
Operational Excellence	1. Continuous Improvement 2. Quality Management 3. Cyber Security Assessment & Application	1. Lean Manufacturing, Lean Office, Pre-Lean ESOL Training, Kaizen Rapid Improvement Training, Value Stream Mapping, Team Involvement Problem Solving, Training Within Industry, Six Sigma 2. ISO trainings (9001;14001;13485), on-site assessments, implementation services 3. Cybersecurity Evaluation Tool, Cybersecurity Assessment Training 800-171, Cybersecurity ISO 27001
Workforce Development	1. Apprenticeships 2. Tooling U-SME 3. MACWIC Credentialing Levels 1&2 4. Manufacturing your Career 5. All Made Possible(“AMP”)	1. Work-based training programs, hands-on experience for employees in a structured environment 2. Online course, content and program developed from identified gaps in client performance 3. Manufacturing certification and credentialing system 4. Connections to manufacturers in the state that can assist in gathering information regarding manufacturing careers 5. Education and workforce development program for upcoming generations
Innovative Growth	1. Enterprise Strategy & Transformation	1. Revenue Growth Plan Development Training, Sales Training, Technology Driven Market Intelligence

Strategies	2. Technology Acceleration 3. Industry 4.0 4. Marketing Strategy & Development	(TDMI) 2. Agile Manufacturing, Design for Manufacturability (DFM)/ Value Engineering (VE) Training, Technology Driven Market Intelligence (TDMI) 3. In development 4. Market Research and Positioning for Small Businesses, Branding and Design Training for Small Business, Marketing Strategy Development for Small Business, Marketing Technology Training for Small Business, Digital Marketing for Small Business, Technology Driven Market Intelligence (TDMI)

Table 2. MassMEP Services, 2019

MassMEP's brand image is that of a consulting company focused on working with smaller manufacturing companies, using a structured approach to process improvement. The work they do aligns with the shop floor component of operations. The company prides itself on being viewed as a resource expert for increasing manufacturers' top line, bottom line, and pipeline, while also striving to make a marketing push towards advanced manufacturing companies.

3. Product Review

The product that the team recommends for this campaign is a version of MassMEP's Operational Excellence module that is configured specifically for medical device manufacturing. The primary services that would be provided in this *Operational Excellence for Medical Device Manufacturers* module are Continuous Improvement offerings such as lean manufacturing training; Quality Management, specifically through training in ISO 13485 and ISO 14971 for the medical device industry; and Cybersecurity Assessment & Application through training and evaluation programs. The key differentiator of the *Operational Excellence for Medical Device Manufacturers* module is a focus on the ISO training previously mentioned, as these standards apply directly to the medical device manufacturing industry.

All ISO trainings currently offered by MassMEP are conducted by an outsourced organization of experts that are able to explain the purpose, benefits, and process of the ISO standards to clients. This includes expertise in the ISO standards relevant to the medical device industry. Because of the expertise of MassMEP and their training organizations, they have the ability to offer a configurable Operational Excellence package to meet the exact needs of medical device manufacturing clients.

Despite the focus on Operational Excellence, all of MassMEP's services can be applicable to businesses in medical device manufacturing. Through our research we determined that Operational Excellence are the services that are most applicable to a wide range of businesses in the medical device manufacturing industry. A customer using MassMEP's Operational Excellence services can also easily integrate Workforce Development and Innovative Growth Strategies offerings to a manufacturer's consulting program based on their unique situations and needs.

3.1 Product Characteristics

- Configurable to client needs.
- Addresses bottomline, topline, and pipeline issues.
- Taught by experienced industry experts.

3.2 Product Strengths and Key Benefits

Operational Excellence for Medical Device Manufacturers has several strengths for the medical device manufacturing industry, especially regarding the benefit of achieving ISO certifications. In particular, ISO 13485 training is compliant with the FDA's Quality System's Regulation, the European Medical Device Regulations (EU MDR), and the Medical Device

Single Audit Program (MDSAP). In many cases, ISO 13485 certification is a requirement for companies who want to sell their products outside of the United States (Orielstat, 2019). Because this offering from MassMEP is compliant with the above regulations, this training can make a company more marketable and provide greater access to the supply chain and markets related to medical device manufacturing, while ensuring the highest quality process and products.

While ISO has many benefits for this industry, Lean process improvement and Lean manufacturing offerings also have many applicable benefits. Lean eliminates waste as an ongoing process in pursuit of perfection, and helps identify the value of a product to the customers while improving processes (Kumar, 2019).

If a company were to work with MassMEP, they would receive valuable knowledge and training on how to improve their manufacturing process(es), increase savings and increase their competitive advantages.

- Advanced lean concepts that can be applied to both plant floor and offices.
- Process improvement that can lead to higher profit.
- Resources behind manufacturing: problem-solving and cybersecurity offerings.
- Offerings guarantee expert knowledge.

3.3 Product Weaknesses

The biggest weakness of this service is that the standards are not typically mandatory to do business domestically which serves as a demotivating factor for these manufacturers. Cost is also a big issue, as after the cost of the training the companies will need to pursue the certification which is expensive. The industry standard pricing of ISO training is around $1650 per day for a variable amount of days, depending on the size of the project (J. Saropoulos, Exolytic, Personal Communication, February 29th, 2020). This is a cost that will be increased with the addition of the Operational Excellence modules. Additionally, companies that don't have enough resources may not be able to spare the employees to be trained, or have the liquidity to pay for the training. In some cases, when larger companies have internal quality management departments, MassMEP might have a difficult time because they have more resources to address changes and improvements internally. Because of this, MassMEP typically works with companies sized from 30-200 (J. Saropoulos, Exolytic, Personal Communication, February 10th, 2020). The following SWOT analysis further evaluates the product:

Strengths	Weaknesses
● ISO Certification Training ○ Meets U.S. Food and Drug Administration, the European Medical	● ISO certification is not required for domestic business ● ISO training in itself is expensive

Device Regulations, and the Medical Device Single Audit Program regulations ● Lean Process Improvement ○ MassMEP has ample experience offering related services across a variety of industries	○ Packaged with the Operational Excellence offerings, the module cost will be relatively high ● Requires active participation ○ Companies may not be able to afford to spare employees to attend training, workshops ,etc.
Opportunities	**Threats**
● Increased profitability and marketability for client ● Higher quality processes and products for targeting manufacturers ● Increased waste elimination through Lean process improvement ● Increase in safety	● Larger companies may choose to implement their own internal process improvement module

Table 3. SWOT Analysis of Operational Excellence Module

3.4 Competitive Review

The primary competitors of MassMEP are public and privately-owned manufacturing consultants in the state of Massachusetts. MassMEP operates specifically with small to medium sized manufacturers in Massachusetts, while most other consulting firms in this sector also operate in multiple other fields outside of manufacturing. Consulting firms and companies in Massachusetts that target similar customers in medical device manufacturing range from small independent firms to larger national and multinational corporations.

Most of the consultants targeting this industry focus on offering services for biological process improvement, testing and product or process development, and validation while focusing less on the manufacturing process itself. Most of the consulting firms in this target that offer certification training and standards training primarily focus on FDA regulations, ISO 9001 and ISO 13485. This means that they are competing with the types of services that MassMEP will be offering, however we found that they are more focused on the biological and biotechnology side of the industry, which would provide MassMEP with an advantage by targeting medical device manufacturers specifically. A lot of these companies specifically are targeting large corporations with large production operations, or small research and development organizations who do not have manufacturing to the scale of MassMEP's target audience.

Below are the main consulting firms that we found that offer similar services as MassMEP, specifically to the medical device manufacturing market in Massachusetts:

Company	Locations	Services Offered
CfPIE	U.S., International	Biological, pharmaceutical and medical device trials, best practices, validation, and FDA compliance
GMED, LNE Group	U.S., International	ISO 13485, MDSAP overview courses, validation, best practices
MEDIcept	Ashland, MA	FDA and international regulations, lab support
Alira Health	U.S., International	Business process, strategy, FDA regulations
Nuventra	U.S.	Regulations and product development
Boston Industrial	Danvers, MA	Lean implementation, process improvement
Goddard Technology	Beverly, MA	cGMP, process improvement, product development
Quality Support Group	U.S., International	ISO 9001, ISO 13485, lean implementation
Boston Consulting Group	U.S., International	Lean implementation, change management, strategy and more
Public Consulting Group	Boston, MA	Business strategy and management
Quality Systems Consulting Group	Newburyport, MA	ISO 9001, ISO 13485, ISO 14001, AS9100D, ISO 19770-1, ISO 27001 or FDA cGMP

Table 4. Manufacturing Consultants Operating in Massachusetts as of January 2020.

MassMEP's reputation with other companies and success in manufacturing across the state helps build its position as a reputable consulting firm. While it doesn't have as much exposure to the medical device industry as some of its competitors, MassMEP's extensive experience and familiarity with manufacturing processes will be an advantage, as its competitors tend to focus more on research and development or business strategy. According to Jim Saropoulos, the training consultant that MassMEP utilizes, the programs offered can easily apply to companies in the medical device industry, and he has trained many companies in that space.

3.5 Target Market

According to MassMEP, their target market is small and medium-sized enterprises (SME) ranging from 30-200 employees in the organization. This campaign will focus specifically on companies this size in the medical device manufacturing industry.

3.6 Personas

In order to better understand who we are marketing to and the role they play in these companies, we synthesized our research into profiles of a potential customer of MassMEP's services. In these personas we identified potential titles, responsibilities, concerns and levels of influence of these players based on our conversations with MassMEP and research into the SME manufacturers identified in our list.

Title: Production Engineer/Manager, Quality Engineer/Manager, Process Engineer/Manager, Operations Engineer/Manager/Director
Responsibilities: Managing and/or planning production, keeping facilities in order and running efficiently. Responsible for managing cost effective operations and troubleshooting issues that arise. Also responsible for adhering to quality standards and/or best practices.
Concerns: Maintaining productivity and standardizing operations, lowering costs, improving effectiveness of operations, and mitigating risk.
Influencer Levels: Decision-makers, often in charge of technicians and operators who would benefit from the training and changes.

4. Marketing Campaign

4.1 Problem

MassMEP has had difficulty engaging with companies in the medical device manufacturing industry that do not understand how the services offered by the MEP can help their operations. The companies that can benefit from MassMEP's offerings, often can improve their production processes, as inefficiencies in manufacturing operations can reduce overall profit that they could be achieving.

4.2 Campaign Objectives

MassMEP's objectives of this campaign are focused on driving brand awareness and generating leads. Through this the MEP will make it clear that they have the skills, knowledge, and experience to achieve success when working with medical device manufacturing companies in their target market, and that they can deliver successful offerings and trainings by:

- Educating target customers about how *Operational Excellence for Medical Device Manufacturers* services are applicable and beneficial to them and generate interest in the offerings.
- Convey MassMEP as a reputable manufacturing consultant offering proven, effective, and specialized services to improve operations.
- Showing the ability to bridge the gap in technical language and understanding between prospects and MassMEP.
- Generate initial interest for potential clients to attend informational events specific to this industry that MassMEP hosts, sponsors or is associated with.

4.3 Support

MassMEP has ample consulting experience across various manufacturing industries in Massachusetts, with experienced employees in the medical device manufacturing industry. Exolytics, the company partner for ISO standards training has experience in training medical device manufacturers. The *Operational Excellence for Medical Device Manufacturers* offerings cover a wide span of services that allow MassMEP to be the central point for training and operations improvement, instead of clients having to go to multiple consultants/trainers.

Awareness	**Interest**	**Desire**	**Action**
Problem statement	Solution needs	MassMEP can offer	Why MassMEP

Medical device manufacturing companies need to achieve ISO or FDA compliance. Manufacturers are losing money because of an inefficient process. Research companies are trying to implement a manufacturing system for a new product	Need an experienced consulting firm to guide them towards a certification in their industry. Need to identify pain points and plan solutions with a professional Need to plan a new system that will be optimized for success.	Industry standard training, configured to the specific needs of a customer and their organization. Expert advice and planning from experienced consultants.	Resource expert in advancing your topline, bottom line and pipeline for all your manufacturing needs. One of 51 national MEPs dedicated to developing the manufacturing industries of Massachusetts for over 20 years More than 2,000 clients receive a 35 to 1 return on their investment on average. Success stories with Interscope and American Surgical

Table 5. Supporting claims for MassMEP Marketing Campaign

4.4 Campaign Media Plan

For this campaign, we recommend a 6~ month timeline for MassMEP to follow. The culmination of the campaign will be the promoted event that we recommend MassMEP host, or partner in hosting. The campaign is divided into stages that represent the moves that a potential customer would make as they progress through a marketing funnel (White, 2019).

The first stage of this campaign will focus on primarily driving awareness for MassMEP's offerings among the identified medical device manufacturing community in Massachusetts. Messaging in content at this stage will focus on highlighting the industry as a whole and pain points that the industry is experiencing, which can be found in the background of the report and Support section of the creative brief. This will be achieved through social media channels, blog and email content, and a snippet for MassMEP's newsletter.

The next stage of the campaign will focus on driving interest in the offerings that MassMEP has. At this point, the messaging will focus on highlighting the needs that companies in the industry are looking for to solve issues they are facing that would be highlighted in the prior stage. This will be achieved through social media channels, blog and email content, a dedicated medical device manufacturing newsletter and landing page, and a recommended paid search engine marketing campaign.

The last stage will focus on building desire for MassMEP's offerings and leading to action by potential customers. The messaging in this stage will be focused on highlighting how MassMEP can help customers and why MassMEP is the correct choice to solve this problem. This will be achieved through social media channels, blog and email content, and the recommended medical device manufacturing event itself.

Integrated Campaign Media Plan																								
	Awareness								*Interest*								*Consideration & Action*							
	Month 1				*Month 2*				*Month 3*				*Month 4*				*Month 5*				*Month 6*			
Social																								
Email																								
Newsletter																								
Blog																								
Landing Page																								
Event																								

Table 6. Integrated Campaign Chart

The chart above is an example of when assets can be published related to the campaign. The asset category is on the left, and the green blocks represents a week in which the asset can be launched for prospects to see. This plan can be adapted to work around existing campaigns, and can also be shortened and lengthened based on need.

4.4.1 Channels & Campaign Assets

For this campaign, the primary distribution channels will be email, newsletter, social media, and MassMEP's website. Regarding social media, the campaign will focus on sharing content through the existing channels that MassMEP has established, particularly LinkedIn and

Facebook. According to Facebook, the platform reaches over 60% of internet users as of 2019, while LinkedIn has over 500 million active users (Hubspot, 2019). According to a report by IEEE, over 90% of surveyed engineers find that they are more likely to engage with companies that regularly produce and publish new content (IEEE, 2019). Because of the widespread reach these platforms provide, they are particularly useful for reaching a large audience. Content on MassMEP's website will allow prospects to move from social media and learn more specifics about their offerings and solutions for the medical device industry.

This campaign will utilize several media assets that were created during this project, and recommend several existing assets that MassMEP can promote further to the medical device manufacturing industry. According to a survey conducted by SproutSocial, one in five respondents preferred graphic and visual content in social media posts from businesses (Sprout Social, 2019). Because of the importance of capturing attention and portraying information through engaging visuals to clients, we have developed engaging content for MassMEP to utilize in this campaign. Descriptions of the campaign assets are below:

Infographic: *Medical Device Manufacturing Industry Overview* (Appendix A)

The purpose of this infographic is to showcase the opportunity presented in the medical device industry in Massachusetts specifically. It was created by compiling information from an industry report (Grant Thornton LLP, 2019). This graphic would be used in the awareness stage of the campaign, as it does not mention MassMEP's services directly, but frames the opportunity.

Infographic: *Common Problems and Innovative Solutions for the Medical Device Manufacturing Industry* (Appendix B)

This infographic highlights problems that the medical device industry is facing, and features a call-to-action (CTA) that points viewers towards MassMEP to learn more about solutions to the problem. The problems were selected based on the research into the industry that was conducted for the project, and the needs that MassMEP can meet through its services and offerings. This asset can be used to expand interest in MassMEP's offerings and to begin to show prospects some of the ways MassMEP can be helpful to them.

Infographic: *American Surgical Success Story Outcomes* (Appendix C)

This infographic was created to summarize important outcomes of MassMEP's services in practice with a company in the medical device manufacturing industry. MassMEP compiled their experiences with this client into a success story document, and this infographic was developed from that document. The goal of this is to showcase MassMEP as a reputable company in this field, and show that customers of MassMEP can achieve outstanding results by adopting these services.

Video: *American Surgical Success Story Outcomes*

Similar to the above American Success Story Outcomes infographic, this video asset was created with the same information and goal behind. The motivation behind the video content however is to provide dynamic and engaging alternatives that can be used to recycle great content without letting it feel as repetitive to viewers. According to a report published by Hubspot, video is increasingly becoming the number one form of media in content strategies by businesses, so it is important to provide MassMEP with a platform to engage in this opportunity (Hubspot, 2020).

Video: *Interscope Success Story Outcomes*

This video highlights MassMEP's success with another client in the medical device manufacturing industry, Interscope. Similar to the American Surgical video, this video provides a dynamic and engaging alternative to an infographic to attract the interest of prospects. The video and information also build MassMEP's image as a successful, experienced consultant in the industry.

Email: *Operational Excellence for Medical Device Manufacturers* (Appendix D)

This email highlights the *Operational Excellence for Medical Device Manufacturers* product. The team recommends that MassMEP include the services that can be offered and how they are beneficial to the potential customers. This email provides a deeper insight into how MassMEP's reputable services can be accommodated to the needs of medical device manufacturers. The email will also provide potential customers with the assurance that MassMEP is well-versed in the industry and can be used to promote an information session.

Newsletter: *Medical Device Manufacturing Industry Focused* (Appendix E)

The team recommends that MassMEP dedicate a portion of or the entirety of one of its newsletters to the medical device manufacturing industry. A themed newsletter about this topic would allow existing clients or newsletter members to see MassMEP's expertise and reputable knowledge in the industry. MassMEP could include its success stories, link to product offerings, content created for this campaign, or 3rd party resources. This would also provide a launching point to promote the event that the campaign would culminate with.

Landing Page: *Medical Device Manufacturing Industry Focus* (Appendix F)

The team recommends that MassMEP create a specific landing page on their website that highlights some of the problems faced by the medical device manufacturing industry and how MassMEP's solutions can help. Industry-specific landing pages are a great choice to highlight existing content and resources that MassMEP has and can be a place for resources for new content such as blog posts (Webflow, 2019). The landing page would have CTAs to drive engagement for customers to join a mailing list or register for events. The team compiled a draft

of the information that can be found on the landing page, to use as a basis for the development of their own page if MassMEP decides to implement it.

In order to support the campaign and MassMEP, several additional assets were developed. These assets are not media focused, but instead recommendations of events and resources MassMEP can utilize as it works in the medical device manufacturing industry:

Event Topics: *Medical Device Manufacturing Industry Focused*

The recommended conclusion of the campaign is to hold an event specifically for the medical device manufacturing industry. This event would be free or low cost, and open to companies in the industry. This event can take numerous forms, but by focusing it on this industry it can drive interest in MassMEP's offerings, while solidifying its stance as an expert in the industry. Some recommended event forms and topics include:

- Hosting a panel on a current issue or topic in the industry with influential voices
- Hosting a panel or conference on upcoming standards changes
- Hosting a workshop for companies in the industry
- Sponsoring an industry event that is hosted by an influential organization or company

Company List: *Medical Device Manufacturing Industry Companies in Massachusetts* (Appendix G)

While researching the campaign and the medical device manufacturing industry, the team compiled a list of companies that would meet the criteria to be MassMEP customers. The criteria were created through conversations with MassMEP, and the final list includes companies in the medical device manufacturing industry and supply chain that have between 30-200 employees and locations in Massachusetts. The list was developed to include information about each company such as what they do and SIC Codes when available from the databases that were used (Hoover, 2020; MassMEDIC, 2020). The list has a total of 463 companies that MassMEP could potentially market to in this industry.

4.4.2 Measurement and Evaluation

To best evaluate the success of the campaign, we recommend that MassMEP monitor several metrics for each asset type involved in the campaign. Existing benchmarks and goals that MassMEP follow for their campaigns will be applicable to monitor the levels of success that this campaign as it is inline with the campaigns that MassMEP usually puts on. Some metrics can include:

- Engagement with social media posts: Views, Likes, Shares, and click through rate
- Email open rates and click through rates
- Organic/social media traffic, and bounce rates for the landing page
- Registration for the recommended event

5. Conclusion

The team's goal for this project was to develop a marketing strategy and supporting materials that will generate interest and obtain new clients for MassMEP in the medical device manufacturing industry. The team identified the current services offered by MassMEP that would best address the issues and processes of the target customer. Gathering industry information and further exploring MassMEP's business model, the team developed an *Operational Excellence for Medical Device Manufacturers* product to serve as the basis of the marketing strategy. This module consists of lean process improvement services as well as quality assurance, distinctly focusing on ISO certification training specific to the medical device industry. Furthermore, the team created a suggested timeline for MassMEP to implement the campaign.

The team has recommended MassMEP follow a six month timeline to distribute marketing content, build its brand in this space, and generate new leads. The timeline consists of three different stages that address customers at different stages of interest. The intention of the stages is to introduce, generate interest, and spark action from the target customer. The associated marketing materials were created with the consideration of customer needs, hesitations, and persona. Given this information, the team believes that these materials can successfully highlight MassMEP's dynamic service offerings and their applicability to the medical device manufacturing industry.

5.1 COVID-19 Adaptations

In response to the current circumstances regarding the COVID-19 virus, the team has modified the marketing strategy to be adaptable to both face-to-face and virtual gatherings. While the intention of the final stage of the campaign is to bring representatives from potential customers together to physically engage with MassMEP, the event guidelines can be implemented in a virtual setting as well.

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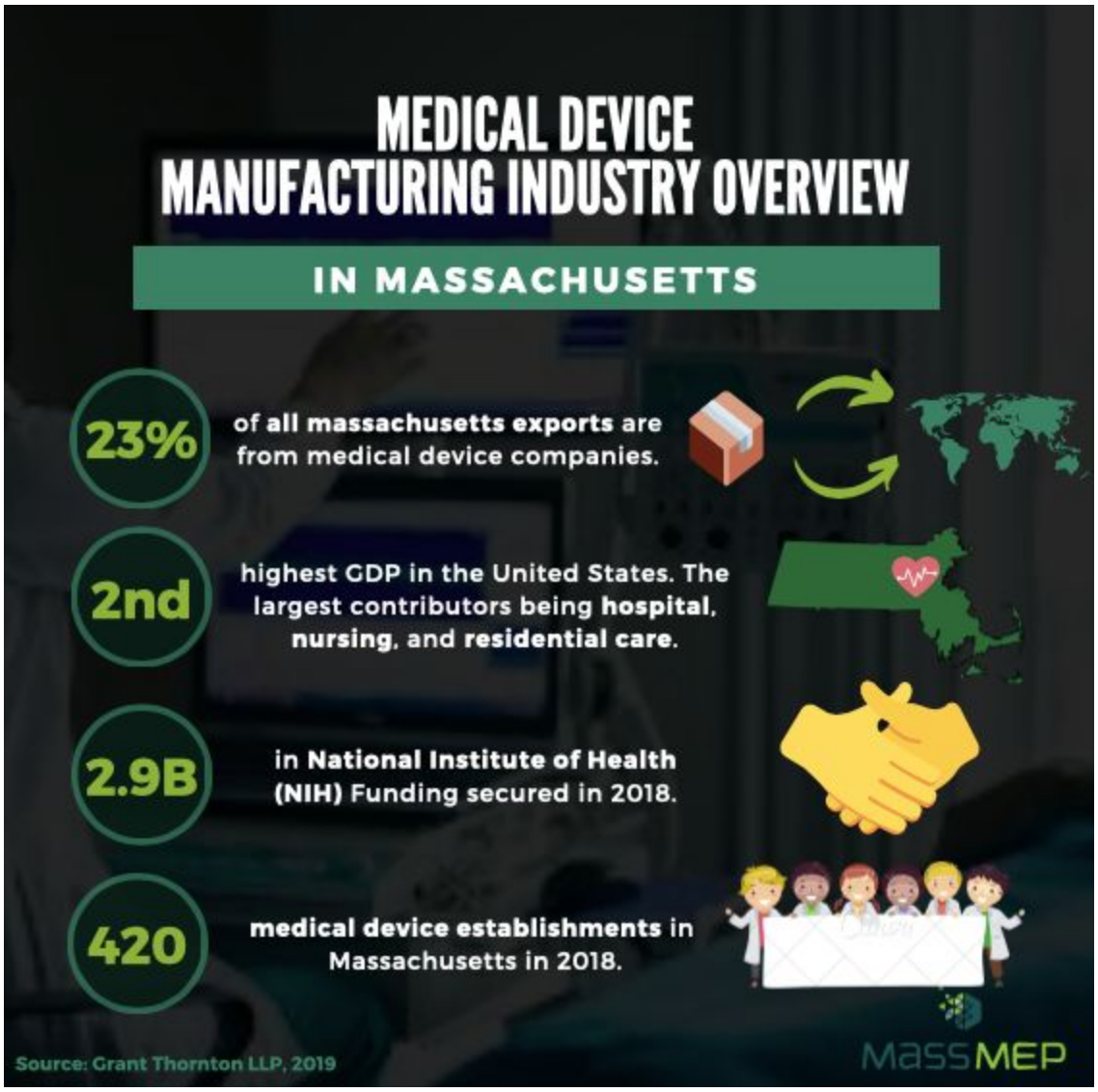
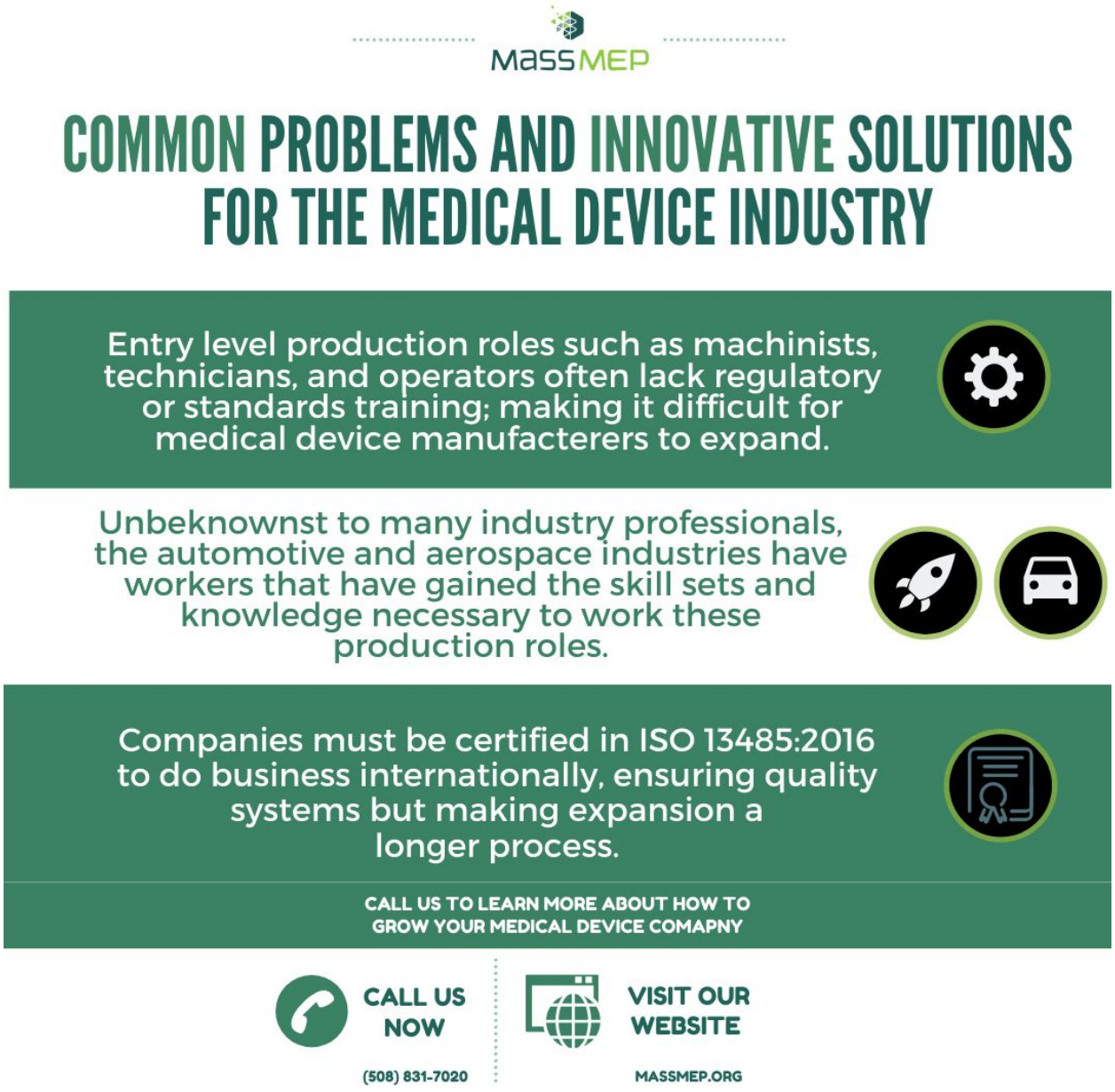
Appendices

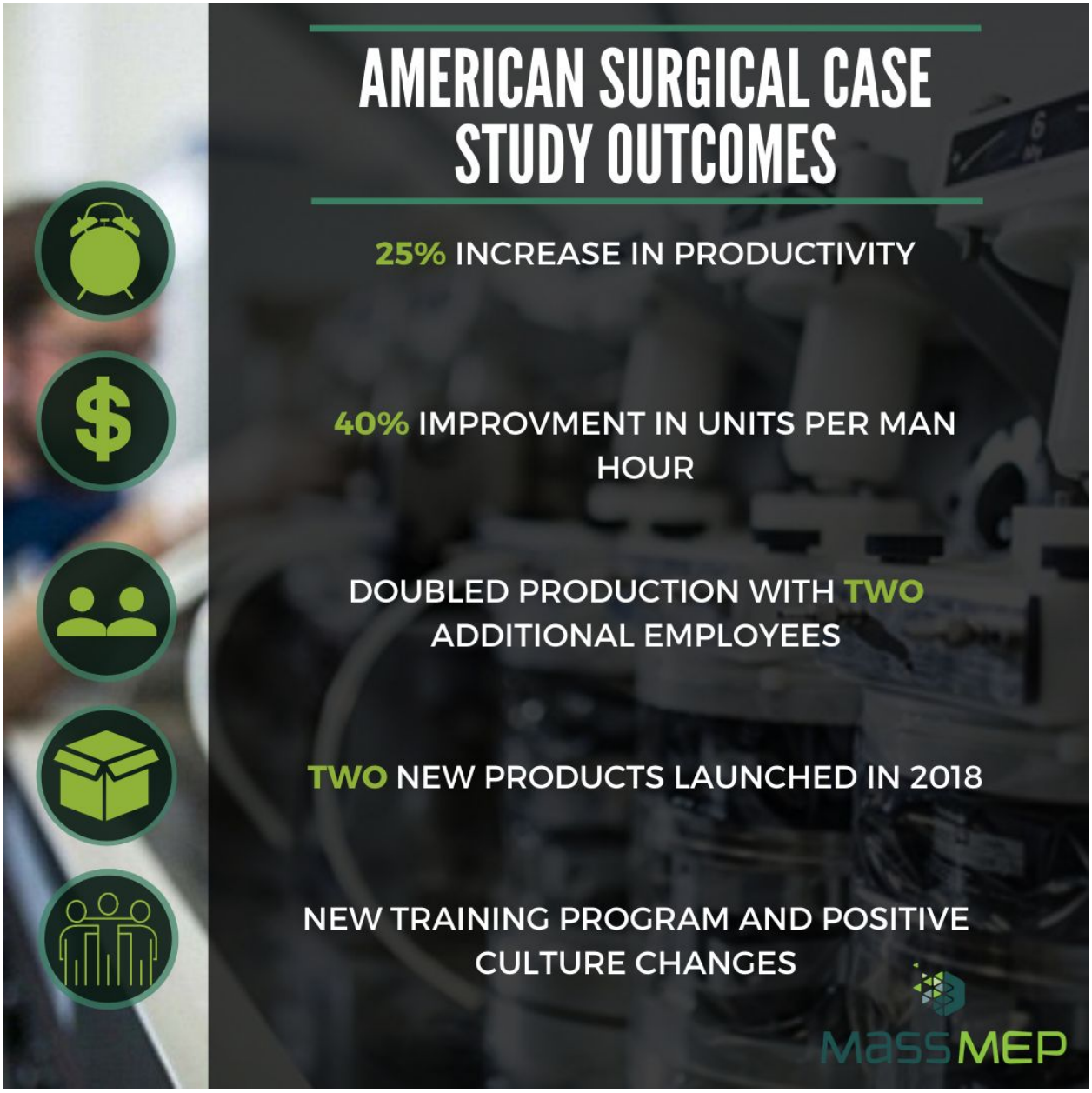
Appendix A



Appendix B


MASSMEP
COMMON PROBLEMS AND INNOVATIVE SOLUTIONS FOR THE MEDICAL DEVICE INDUSTRY
Entry level production roles such as machinists, technicians, and operators often lack regulatory or standards training; making it difficult for medical device manufacterers to expand.
Unbeknownst to many industry professionals, the automotive and aerospace industries have workers that have gained the skill sets and knowledge necessary to work these production roles.
Companies must be certified in ISO 13485:2016 to do business internationally, ensuring quality systems but making expansion a longer process.
CALL US TO LEARN MORE ABOUT HOW TO GROW YOUR MEDICAL DEVICE COMAPNY
CALL US NOW
(508) 831-7020
VISIT OUR WEBSITE
MASSMEP.ORG

Appendix C


AMERICAN SURGICAL CASE STUDY OUTCOMES
25% INCREASE IN PRODUCTIVITY
40% IMPROVMENT IN UNITS PER MAN HOUR
DOUBLED PRODUCTION WITH TWO ADDITIONAL EMPLOYEES
TWO NEW PRODUCTS LAUNCHED IN 2018
NEW TRAINING PROGRAM AND POSITIVE CULTURE CHANGES
MassMEP

Appendix D

MassMEP
Manufacturing Extension Partnership
YOUR RESOURCE FOR MANUFACTURING GREATNESS

COMMON PROBLEMS AND INNOVATIVE SOLUTIONS FOR THE MEDICAL DEVICE INDUSTRY

Entry level production roles such as machinists, technicians, and operators often lack regulatory or standards training; making it difficult for medical device manufacterers to expand.

Unbeknownst to many industry professionals, the automotive and aerospace industries have workers that have gained the skill sets and knowledge necessary to work these production roles.

Companies must be certified in ISO 13485:2016 to do business internationally, ensuring quality systems but making expansion a longer process.

Identify with these issues?

Learn more about how MassMEP can help you increase efficiency and profit through our Operational Excellence Offerings.

Key Features:
Lean manufacturing
ISO 13485 and ISO 14971 certification training
Cybersecurity evaluation and training

Explore Operational Excellence

Information Session

Join us on [insert date] to learn how our services can benefit your company. Learn how you can create an adaptable Operational Excellence Package to meet your company needs related to manufacturing and beyond.

Register for Webinar

Appendix E

MassMEP
Manufacturing Extension Partnership
YOUR RESOURCE FOR MANUFACTURING GREATNESS

Medical Device Manufacturing

MassMEP Overview

Established in 1996, we take servicing the Massachusetts manufacturing community with pride. Click on the link below to learn more about our organization.

Who We Are

COVID-19 Response

Explore Operational Excellence

We offer manufacturing and management solutions to help you achieve success in your organization. Learn more about our Operational Excellence Package and additional services.

Key Features

- Lean Manufacturing
- Training Within Industry
- ISO 13485 & ISO 14971 Training
- Risk Mitigation

Transform Your Operations

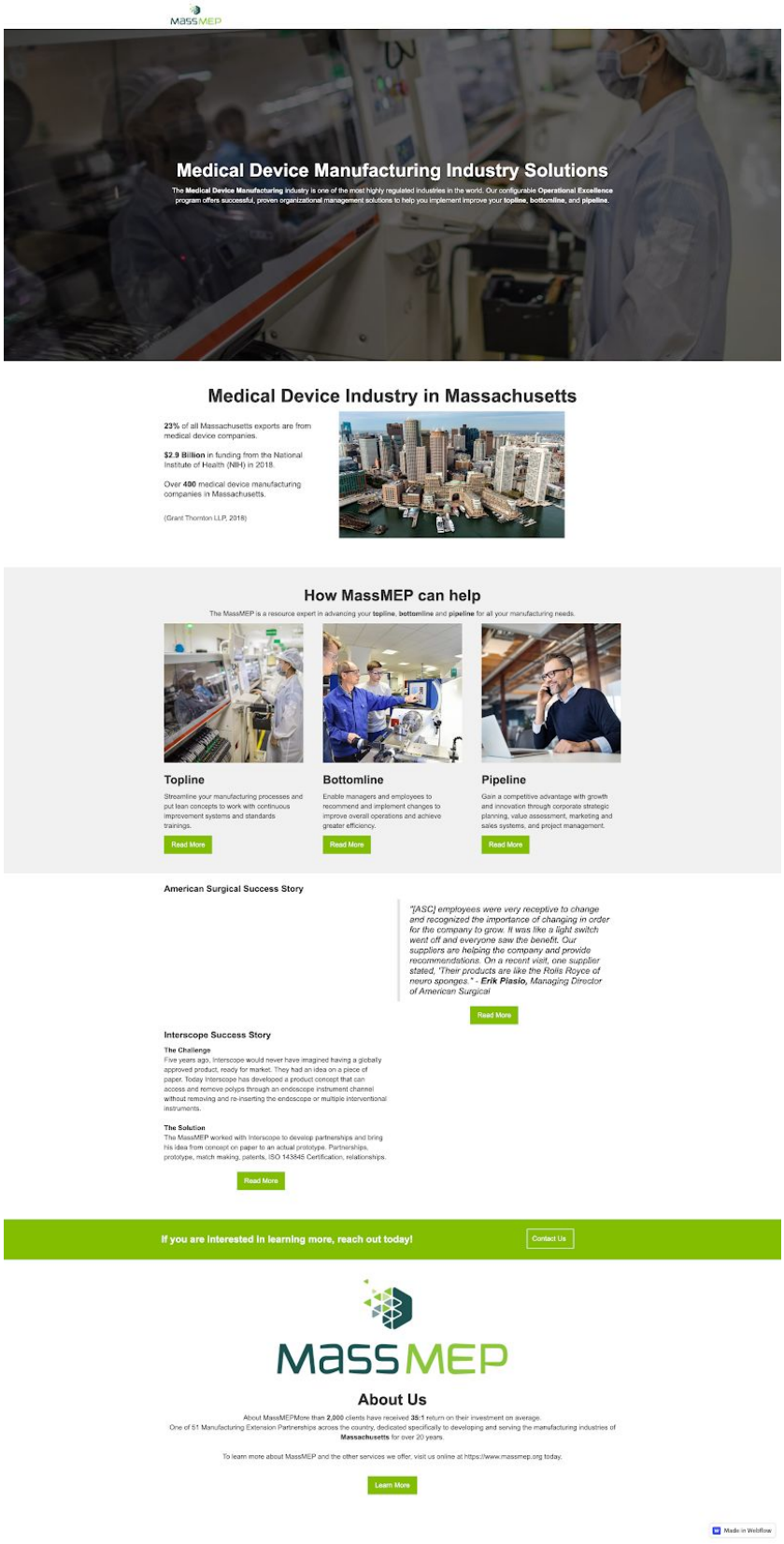
Success Story: Interscope

Interscope worked with MassMEP to find someone in the medical device industry to manufacture the product that would meet strict requirements of the medical device industry.

Interscope Success

MassMEP | 508 831-7020 | 27A Midstate Dr., Suite 200, Auburn, MA 01501 | Website

Appendix F


MassMEP
Medical Device Manufacturing Industry Solutions
The Medical Device Manufacturing industry is one of the most highly regulated industries in the world. Our configurable Operational Excellence program offers successful, proven organizational management solutions to help you implement improve your topline, bottomline, and pipeline.
Medical Device Industry in Massachusetts
23% of all Massachusetts exports are from medical device companies.
$2.9 Billion in funding from the National Institute of Health (NIH) in 2018.
Over 400 medical device manufacturing companies in Massachusetts.
(Grant Thornton LLP, 2018)
How MassMEP can help
The MassMEP is a resource expert in advancing your topline, bottomline and pipeline for all your manufacturing needs.
Topline
Streamline your manufacturing processes and put lean concepts to work with continuous improvement systems and standards trainings.
Read More
Bottomline
Enable managers and employees to recommend and implement changes to improve overall operations and achieve greater efficiency.
Read More
Pipeline
Gain a competitive advantage with growth and innovation through corporate strategic planning, value assessment, marketing and sales systems, and project management.
Read More
American Surgical Success Story
"[ASC] employees were very receptive to change and recognized the importance of changing in order for the company to grow. It was like a light switch went off and everyone saw the benefit. Our suppliers are helping the company and provide recommendations. On a recent visit, one supplier stated, 'Their products are like the Rolls Royce of neuro sponges." - Erik Piasio, Managing Director of American Surgical
Read More
Interscope Success Story
The Challenge
Five years ago, Interscope would never have imagined having a globally approved product, ready for market. They had an idea on a piece of paper. Today Interscope has developed a product concept that can access and remove polyps through an endoscope instrument channel without removing and re-inserting the endoscope or multiple interventional instruments.
The Solution
The MassMEP worked with Interscope to develop partnerships and bring his idea from concept on paper to an actual prototype. Partnerships, prototype, match making, patents, ISO 143845 Certification, relationships.
Read More
If you are interested in learning more, reach out today!
Contact Us
MassMEP
About Us
About MassMEPMore than 2,000 clients have received 35:1 return on their investment on average.
One of 51 Manufacturing Extension Partnerships across the country, dedicated specifically to developing and serving the manufacturing industries of Massachusetts for over 20 years.
To learn more about MassMEP and the other services we offer, visit us online at https://www.massmep.org today.
Learn More
Made in Webflow

Appendix G

Company Name	Size (200-30) Single Site or Entire Company	Revenue (USD, 2018 Est)	Description (Manufacturing, Suppliers, Equipment)	SIC Code
Merit Medical Systems, Inc.	20	1.2M	Manufacturing	38410000
Union Biometrica, Inc.	20	2.6M	Manufacturing	38260000
Nordson Medical Design and Development, Inc.	22	6.1M	Manufacturing	38410000
Haemonetics Asia Incorporated	23	1.3M	Manufacturing	38410500
Invensense, Inc.	24	1.8M	Manufacturing	38230403
Qualtre, Inc.	24	2.3M	Manufacturing	38120119
Arteriocyte Medical Systems, Inc.	25	4.7M	Manufacturing	38450121
Sciaps, Inc.	25	6.6M	Manufacturing	38260000
Test Devices, Inc.	27	5.9M	Manufacturing	38290404
Falmouth Scientific, Inc.	28	3.9M	Manufacturing	38120000
Abcam Inc	30			
Arcari Dental Laboratory Inc	30	2.1M		80729902
Atc Group Services LLC	30		Manufacturing	38269907
Auburn Filtersense LLC	30	186k	Manufacturing	38290700
Benco Dental	30	2.9M	Manufacturing	38430100
Consolidated Machine Corporation	30	1M	Manufacturing	38210124
Electric Time Company, Inc	30	5.3M	Manufacturing	38739904
EMD Millipore Corporation	30		Manufacturing	38260000
Genomic Solutions Inc.	30	4.1M	Manufacturing	38260000
Hamilton Thorne, Inc.	30	5.1M	Manufacturing	38290000
Hydrocision, Inc.	30	4.5M	Manufacturing	38410400
Invivo Therapeutics Holdings Corp.	30		Manufacturing	38410000
Mds Nxstage Corporation	30	6.7M	Manufacturing	38410505
North Shore Dental Porcelains Laboratory Inc	30	2.3M		80729901
Quadtech, Inc.	30	4.8M	Manufacturing	38250200
Rigaku Analytical Devices, Inc.	30	4.5M	Manufacturing	38120600
Sud-Chemie Protech Inc.	30	8.9M	Manufacturing	38229911
Teledyne Lecroy, Inc.	30		Manufacturing	38250000
Xcerra Corporation	30		Manufacturing	38250226
Arrow Interventional, Inc.	31	5M	Manufacturing	38410000
Cambridge Heart, Inc.	31	2.2M	Manufacturing	38410200
Nanmac Corp.	31	7.2M	Manufacturing	38290702

Wintriss Controls Group, LLC	31	12M	Manufacturing	38230403
Raytheon Southeast Asia Systems Company	32	5.7M	Manufacturing	38120306
Advanced Mechanical Technology, Inc.	33	7.7M	Manufacturing	38290700
M R Resources Inc	33	5.5M	Manufacturing	38260600
Nmc-Rri Partnership	33	1.8M	Manufacturing	38410000
Thermo Fisher Scientific Inc.	33		Manufacturing	38260302
Integrated Dynamics Engineering, Inc.	34	3.9M	Manufacturing	38290000
Louis M. Gerson Co., Inc	34		Manufacturing	38420112
Microsense, LLC	34	6.2M	Manufacturing	38290000
Raytheon Company	34		Manufacturing	38120500
Axya Medical, Inc.	35	4.7M	Manufacturing	38410000
Belmont Instrument, LLC	35	8.3M	Manufacturing	38450100
Big Belly Solar, Inc.	35	8.8M	Manufacturing	38230000
E. S. Ritchie & Sons, Inc.	35	12M	Manufacturing	38120400
Marine Polymer Technologies, Inc.	35	10M	Manufacturing	38420000
Middlesex General Industries Inc	35	6.8M	Manufacturing	38250226
Omnilife Science, Inc	35	5.7M	Manufacturing	38420400
Protom International, Inc.	35		Manufacturing	38449901
Rmd Instruments Corp.	35	5.5M	Manufacturing	38290000
Spinal Technology, Inc.	35	13M	Manufacturing	38420403
Teledyne Instruments, Inc.	35		Manufacturing	38290000
Temp-Pro Incorporated	35	9.5M	Manufacturing	38230103
The Chelsea Clock LLC	35	6.1M	Manufacturing	38730000
The Salk Company Inc	35	5M	Manufacturing	38420102
Vacuum Process Technology, LLC	35	7.4M	Manufacturing	38260200
Andor Technology, Inc.	36	1.7M	Manufacturing	38260000
Steelcraft, Inc.	36	5.3M	Manufacturing	38429922
Cusp Dental Research Inc	37	4.2M	Manufacturing	80720000
Matec Instrument Companies, Inc.	37	6.5M	Manufacturing	38290000
Measurement Specialties, Inc.	37		Manufacturing	38290000
Nova Instruments LLC	37	3.1M	Manufacturing	38260000
Precision Digital Corporation	37	9.8M	Manufacturing	38230408
Fresenius USA Marketing, Inc	38	4.5M	Manufacturing	38410000
Aclara Technologies LLC	40		Manufacturing	38240200
Advanced Thermal Solutions Inc.	40	9.4M	Manufacturing	38230104
Altair Avionics Corporation	40	4M	Manufacturing	38120100
Amptek, Inc.	40	979k	Manufacturing	38290507
Covaris, Inc.	40	7.8M	Manufacturing	38260000

Headwall Photonics Inc.	40	3M	Manufacturing	38260000
KPM Analytics North America Corporation	40	4.7M	Manufacturing	38230000
Lockheed Martin Sippican, Inc.	40		Manufacturing	38120000
Mettler-Toledo Rainin, LLC	40		Manufacturing	38290000
Mija Industries, Inc.	40	10M	Manufacturing	38230203
Nova Technology Corporation	40	4.2M	Manufacturing	38410000
Perkinelmer Health Sciences, Inc.	40		Manufacturing	38260000
Quincy Hospital Auxiliary Inc	40	2.4M	Manufacturing	38260605
Randolph Engineering, Inc.	40	7.6M	Manufacturing	38510102
Select Engineering Inc.	40	4.7M	Manufacturing	38450000
Sigma Systems Corp	40	4.1M	Manufacturing	38220501
Unity Scientific, LLC	40	1M	Manufacturing	38210104
Draeger Medical Systems, Inc.	41		Manufacturing	38410401
Ivenix, Inc.	41	9.9M	Manufacturing	38410506
Massachusetts Clean Energy Center	41	9M	Manufacturing	38220000
Neurometrix, Inc.	42	16M	Manufacturing	38410000
Micro Cast Inc	43	2M		80729902
Vasca, Inc.	43	4.1M	Manufacturing	38450203
Eyepoint Pharmaceuticals, Inc.	44	2.9M	Manufacturing	38410000
Smith & Nephew, Inc.	44		Manufacturing	38410000
Barnhardt Manufacturing Company	45		Manufacturing	38420201
Continental Metal Products Co, Inc.	45	8.1M	Manufacturing	38420000
Kinetic Systems, Inc.	45	9.9M	Manufacturing	38299923
Krohne, Inc.	45	60M	Manufacturing	38230301
Lake Region Medical, Inc.	45	469M	Manufacturing	38410000
Sathorn Corporation	45	1.3M	Manufacturing	38120101
Temptronic Corporation	45	25M	Manufacturing	38230418
V. J. Electronix, Inc.	45	7.1M	Manufacturing	38440000
Myomo, Inc.	46	2.4M	Manufacturing	38420400
Aja International, Inc.	47	10M	Manufacturing	38290000
Dolan-Jenner Industries, Inc.	47	5.1M	Manufacturing	38230000
Medical Device Business Services, Inc.	48		Manufacturing	38410000
Visionaid, Inc.	48	7.7M	Manufacturing	38510202
Aetruim Incorporated	50	7.2M	Manufacturing	38250236
American Surgical Company, LLC	50	9.7M	Manufacturing	38429918
Aurora Imaging Technology Inc	50	13M	Manufacturing	38410200
Boston Brace International, Inc.	50	21M	Manufacturing	38420300
Brownmed, Inc.	50	9.7M	Manufacturing	38420400
Bruker Optics Inc.	50	57M	Manufacturing	38260114

Convergent Dental, Inc.	50	11M	Manufacturing	38430000
Corindus, Inc.	50	5M	Manufacturing	38269909
Etex Corporation	50	8.4M	Manufacturing	38410500
Fms New York Services LLC	50	3.7M	Manufacturing	38410000
Hamilton Storage Technologies, Inc.	50	14M	Manufacturing	38230000
Honeywell International Inc.	50		Manufacturing	38250000
Horizons Research Laboratories Inc	50	4.4M	Manufacturing	38410000
Horsepower Technologies, Inc.	50	25M	Manufacturing	38410300
Lynn Products Co	50	7.7M	Manufacturing	38230500
Magellan Diagnostics, Inc.	50	10M	Manufacturing	38260000
Megapulse Incorporated	50	6.8M	Manufacturing	38120300
Mtoz Biolabs, Inc.	50	1.7M	Manufacturing	38260403
Optim LLC	50	10M	Manufacturing	38410000
Orion Thermo Inc	50	37M	Manufacturing	38230000
Paramount Corp.	50	10M	Manufacturing	38510202
Vaisala Inc.	50		Manufacturing	38290000
Advanced Dental Technologies, Inc	51	3.7M		80729902
Bionx Medical Technologies, Inc.	51	8.3M	Manufacturing	38420000
Qinetiq North America, Inc.	51	12M	Manufacturing	38120500
Where, Inc.	52	6.5M	Manufacturing	38120306
L3harris Technologies, Inc.	53		Manufacturing	38120000
Digilab, Inc.	54	8.8M	Manufacturing	38210000
Abiomed Cardiovascular Inc	55	4.4M	Manufacturing	38450000
Csa Medical, Inc.	55	9M	Manufacturing	38450000
Rph Enterprises, Inc.	55	8.1M	Manufacturing	38410400
Digilab Genomic Solutions, Inc.	56	4.7M	Manufacturing	38410000
Toolmex Industrial Solutions, Inc.	56	12M	Manufacturing	38290000
Secure Point Technologies, Inc.	57	53M		38120602
Cytyc Surgical Products, LLC	58	930k	Manufacturing	38440000
Five Star Manufacturing, Inc.	58	4M	Manufacturing	38410000
Safariland, LLC	59		Manufacturing	38420101
ARC Technologies LLC	60	15M	Manufacturing	38250221
Cimetrics Inc.	60	5M	Manufacturing	38230000
Dynisco Instruments LLC	60		Manufacturing	38290000
Janis Research Company, LLC	60	8.6M	Manufacturing	38260000
Tnco, Inc.	60	6M	Manufacturing	38410400
Tekscan, Inc.	61	14M	Manufacturing	38430100
Smith & Nephew Endoscopy, Inc.	62	17M	Manufacturing	38410400
Fishman Transducers, Inc.	64	25M	Manufacturing	38250238

CTS Valpey Corporation	65	8M	Manufacturing	38250308
Edgeone LLC	65		Manufacturing	38120000
Pall Northborough	65	5.4M	Manufacturing	38210106
Tei Biosciences Inc.	65	7.5M	Manufacturing	38410400
AB Sciex Sales LP	67	14M	Manufacturing	38260000
Integra Luxtec, Inc.	67	8.9M	Manufacturing	38410000
Invetech, Inc.	67		Manufacturing	38230000
Janis Research Company, Inc.	67	15M	Manufacturing	38260000
Proven Process Medical Devices, Inc.	67	14M	Manufacturing	38450000
Ade Technologies, Inc	70	5.9M	Manufacturing	38290107
Cold Chain Technologies, Inc.	70		Manufacturing	38410400
Dynisco LLC	70	15M	Manufacturing	38290000
Gregory Manufacturing, Inc.	70	12M	Manufacturing	38410000
Qsa Global, Inc.	70	19M		38449908
Sensitech Inc.	70	105M	Manufacturing	38269907
Sil-Med Corporation	71	6.1M	Manufacturing	38410000
Cheetah Medical, Inc.	75	9.2M	Manufacturing	38410500
Diamond Diagnostics Inc.	75	12M	Manufacturing	38410200
Fresenius USA Manufacturing, Inc.	75	25M	Manufacturing	38410000
Mks Instruments, Inc.	75		Manufacturing	38230200
Ranfac Corp.	75	13M	Manufacturing	38410000
Thornton Mettler-Toledo Inc	75	20M	Manufacturing	38230404
Raytheon Systems Support Company	77	5.3M	Manufacturing	38120500
Bicon, LLC	80	10M	Manufacturing	38430100
Lab Medical Manufacturing, Inc.	80	16M	Manufacturing	38410400
Pulpdent Corporation	80	15M	Manufacturing	38430000
Technical Manufacturing Corporation	80	23M	Manufacturing	38290000
Mobius Imaging, LLC	84	23M	Manufacturing	38410000
Hampden Engineering Corporation	85	24M	Manufacturing	38250000
Infolibria, Inc	85	6.6M	Manufacturing	38230403
Tecomet Inc.	85		Manufacturing	38410200
Siemens Industry, Inc.	87		Manufacturing	38220100
Cosman Medical, LLC	88	14M	Manufacturing	38450200
KS Manufacturing Inc	88	1.5M	Manufacturing	38410200
Oxford Immunotec USA Inc.	90	22M	Manufacturing	38410200
Transmedics Group, Inc.	92	3M	Manufacturing	38450000
Advanced Instruments, LLC	94	19M	Manufacturing	38260000
Five Star Surgical, Inc.	94	15M	Manufacturing	38410400
Advanced Measurement Technology, Inc.	95		Manufacturing	38290507

Brimfield Precision, LLC	95	8M	Manufacturing	38410000
Micron Solutions, Inc.	95	19M	Manufacturing	38450100
General Dynamics Mission Systems, Inc.	99	18M	Manufacturing	38120000
Oxford Instruments Measurement Systems, Inc	99	13M	Manufacturing	38290000
Raytheon Italy Liaison Company	99	2M	Manufacturing	38120000
United Electric Controls Company	99		Manufacturing	38230103
Anderson Power Products, Inc.	100	20M	Manufacturing	38290000
Arrow International, Inc.	100		Manufacturing	38410400
Bae Systems Information and Electronic Systems Integration Inc.	100		Manufacturing	38120000
Becton, Dickinson and Company	100		Manufacturing	38410000
Exergen Corporation	100	29M	Manufacturing	38260700
Kirwan Surgical Products LLC	100	1.7M		38410400
L T X International Inc	100	14M	Manufacturing	38250226
Microsemi Frequency and Time Corporation	100		Manufacturing	38250000
Scully Signal Company	100	39M	Manufacturing	38230404
Teleflex Incorporated	100		Manufacturing	38410000
Thermo Keytek LLC	100	15M	Manufacturing	38260000
Thoratec Corporation	100		Manufacturing	38450000
W D C Holdings Inc	100	10M	Manufacturing	38420105
DRUCK, LLC	101	84M	Manufacturing	38299913
Depuy Synthes Products, Inc.	104	19M	Manufacturing	38410000
Medica Corporation	105	3.2M	Manufacturing	38260400
Corindus Vascular Robotics, Inc.	106	10M	Manufacturing	38410000
Anika Therapeutics, Inc.	107	105M	Manufacturing	38410000
Hid Global Corporation	108		Manufacturing	38250321
Cytyc Corporation	109		Manufacturing	38410200
Bruker Scientific LLC	110	118M	Manufacturing	38260114
Dale Medical Products, Inc.	110	22M	Manufacturing	38410407
Adcole Corporation	111	31M	Manufacturing	38120100
Bruker Biospin Corporation	115	46M	Manufacturing	38260000
Palomar Medical Products, LLC	119	11M	Manufacturing	38420000
Teledyne Benthos, Inc.	119	18M	Manufacturing	38120000
Idex Health & Science LLC	120		Manufacturing	38210000
Jeol Usa, Inc.	120	68M	Manufacturing	38260000
Lee Electric, Inc.	120	26M	Manufacturing	38220501
Onset Computer Corporation	120	31M	Manufacturing	38230000
Perkinelmer, Inc.	120	2.7B	Manufacturing	38450000

Thermo Egs Gauging LLC	120	18M		38230000
Ineoquest Technologies, Inc.	125	25M	Manufacturing	38250000
Thermo Ice Inc.	125	8.5M	Manufacturing	38210102
Dff Corp.	129	74M	Manufacturing	38240200
Associated Environmental Systems, Inc.	130	11M	Manufacturing	38290000
Bio-RAD Laboratories, Inc.	130		Manufacturing	38260000
Integer Holdings Corporation	130		Manufacturing	38450202
Fosta-Tek Optics, Inc.	135	22M	Manufacturing	38510000
Ideal Industries, Inc.	138		Manufacturing	38290000
Transmedics, Inc.	139	27M	Manufacturing	38450000
Primo Medical Group, Inc.	140	47M	Manufacturing	38410000
Teradyne, Inc.	140		Manufacturing	38250226
Conmed Corporation	142		Manufacturing	38450100
Keystone Dental, Inc.	145	19M	Manufacturing	38430206
Thermo Environmental Instruments LLC	145	25M	Manufacturing	38260000
Btl Industries, Inc.	150	1.7M	Manufacturing	38410000
Gyrus Acmi, LLC	150	245M	Manufacturing	38410000
Johnson Controls, Inc.	150		Manufacturing	38229905
Lockheed Martin Corporation	150		Manufacturing	38120000
Mj Research Inc	150	24M	Manufacturing	38230400
Philips Electronics North America Corporation	150		Manufacturing	38260000
T2 Biosystems, Inc.	153	10M	Manufacturing	38410000
Microline Surgical, Inc.	160	33M	Manufacturing	38410000
Agilent Technologies, Inc.	163		Manufacturing	38250000
Needletech Products, Inc.	165	1.8M	Manufacturing	38410413
Hydroid, Inc.	167	32M	Manufacturing	38120000
Quanterix Corporation	177	37M		38450000
Neurologica Corp.	180	47M	Manufacturing	38410000
Bel Legacy Corporation	184	44M	Manufacturing	38260000
Ametek Arizona Instrument LLC	190		Manufacturing	38230000
Thermo Process Instruments, L.P.	190	28M	Manufacturing	38230000
Thermo Scientific Portable Analytical Instruments Inc.	190	50M	Manufacturing	38260000
Hologic, Inc.	195		Manufacturing	38440000
Accellent LLC	200	341M	Manufacturing	38410000
Beaver-Visitec International, Inc.	200	43M	Manufacturing	38410419
Caliper Life Sciences, Inc.	200	99M	Manufacturing	38260000
Dentsply Ih, Inc.	200	46M	Manufacturing	38410000

Emerson Process Management Power & Water Solutions, Inc.	200		Manufacturing	38230000
Gentex Optics, Inc.	200	95M	Manufacturing	38510105
Lawrence Instron Corporation	200	70M	Manufacturing	38290408
Sensormatic Electronics, LLC	200		Manufacturing	38120000
Siemens Healthcare Diagnostics Inc.	200		Manufacturing	38260400
Smiths Detection, LLC	200		Manufacturing	38120000
Straumann Usa, LLC	200	48M	Manufacturing	38430101
Surgical Specialties Corporation	200	67M	Manufacturing	38429923
Tac, Inc	200	122M	Manufacturing	38229901
Tegra Medical, LLC	200	99M	Manufacturing	38410000
Palomar Medical Technologies, LLC	250	22M	Manufacturing	38410420