

Academic Program Review for Mechanical Design Technology Program

March 2017

The Mechanical Design Technology Associates degree program is designed to prepare students with the skills needed to enter the engineering and manufacturing work environment. Our graduates may be employed as Designers, Engineering assistants, and Mechanical drafters. Students that choose to further their studies may attend four year engineering schools like the University of Lowell, UNH Durham or continue their studies at UNH Manchester through the NCC partnership with Mechanical Design.

Program Goals

What are the program's goals and how do they relate to the College's mission? How do the program goals relate to the current and future needs of the community and the region?

The Community College's mission is: The Community College System of New Hampshire (CCSNH) is committed to providing comprehensive, market-driven, accessible, quality programs of higher education that respond to the needs of students, businesses, and communities.

The Nashua Community College mission is:

Nashua Community College (NCC) provides quality, academically rigorous, higher-education programs focused on the diverse needs of students and community.

The Mechanical Design Technology's Program objectives and competencies closely relate to both the System's and the college's mission closely. The program has students studying courses like, Computer Aided Drafting/Design, Manufacturing Processes, and Hydraulics and Pneumatics. Additionally, foundation courses will provide them with knowledge of physics, mathematics, machine shop practices, machine theory, and automation programming. This knowledge will enable the students to handle the requirements of performing successfully in today's high-tech manufacturing environment.

The goals of the program are mirrored in the program outcomes. An Associate's degree graduate should have mastered the following competencies:

1. Evaluate, categorize and interpret technical information effectively.
2. Generate engineering drawings that conform to current industry standards.

3. Create three dimensional CAD models and assemblies that meet specific design criteria.
4. Use three dimensional CAD models for strength and motion analysis, animation, machining and rapid prototyping processes.
5. Evaluate and specify economical and environmentally friendly manufacturing processes and materials for product development.
6. Produce complete and comprehensive drawing packages as well as understand Engineering Change Order procedures.
7. Develop, design and manufacture a socially responsible industrial product.
8. Demonstrate critical and creative thinking skills to meet design and production deadlines.
9. Perform basic automation programming, fluid power, machining, and electronics related tasks in a production or test environment.

The Mechanical Design program is currently collecting and assessing data from our instructors in the program. This data will be used to identify the methods used to meet the program goals listed above. We will be able to pinpoint specific tests, lessons and lab work that demonstrate how our program teaches the skills needed in today's industrial workplace.

Upon completion of the program, students will have a strong understanding of long-term sustainable design and problem solving capabilities. Graduates are prepared for the rapid pace of technological changes in the workplace or to go onto a baccalaureate program at a four year college.

The Mechanical Design Technology Program shares its advisory board with the Precision Manufacturing. While the two programs differ in scope the boards are similar in many ways. One example of that is our association with General Electric in Hooksett NH. While GE is primarily interested in our Precision Manufacturing students they benefit from our association in that they employ a staff of Mechanical Engineers and designers including one of our Mechanical Design graduates. Their input into our program is paramount to our success. We have Mechanical Engineers on our advisory board as well.

Program Relevancy and Competitiveness

Has the program's related industries or markets changed in the past five years and, if so, how does it influence the relevancy and attractiveness of the program? Have you made changes to the program to accommodate changes in the market and, if so, what

have you changed? What skills taught by the program are important to keep its graduates competitive in the program's related industries?

The Mechanical Design Technology program is in a unique position. This program has the added component of having students learning about manufacturing in a working Precision Manufacturing Lab, in addition part of the curriculum has them making parts, which they design. This hands-on component of the curriculum leads to better understanding of the whole design and manufacturing process. There are not many programs which offer such hands on creative problem solving and design experience within an Associate's Degree program.

Industry partners' feedback emphasized the ability to be agile with technology. The Manufacturing courses were updated and hybridized. In addition, all courses have been technology enhanced. In the labs we have moved from computer projectors and white boards to smart monitors which allow us the features of a touch screen.

The need for Mechanical technicians continues to grow as evidenced by the following data:

Training Category: Associate none none	Industry 2014 Share 2024 Share
2015 Average Wage: \$ 25.22 333 2014 Estimated Employment: 375 2024 Projected Employment: 406 Growth Rate, 2014-2024: 8.3% 334	Scientific Research and Development Svc 34.1% 38.2% Machinery Manufacturing 15.2% 13.8% 332 Fabricated Metal Product Manufacturing 10.9% 10.8%

Source:

<https://www.nhes.nh.gov/elmi/products/documents/job-locator-soc17.pdf>

17-3027 Mechanical Engineering Technicians

The growth rate for Mechanical Engineering Technicians is projected to be 8.3% over the next ten years.

New Hampshire Long-term Industry Projections, 2014 to 2024

		2014 Estimated	2024 Projected	2014-2014 Change	Percent Change	Average Annual Growth
	Total Employment	677,951	725,244	47,293	7.0%	0.68%
5413	Architectural, Engineering, and Related	5326	5739	413	7.80%	.75%
5414	Specialized Design Services	347	424	77	22.20%	2.02%

5416	Management, Scientific, and Technical Consulting Services	3739	4976	1237	33.10%	2.90%
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Source:

New Hampshire Employment Security Economic & Labor Market Information Bureau
www.nhes.nh.gov/elmi/products/proj.htm

New Hampshire Short-term Occupational Projections, 2016Q2 to 2018Q2

Occupation	2016Q2 Estimated	2018Q2 Estimated	Numeric Change	Percent Change	Annual Growth	Growth	Replacements
Mechanical Engineering Technicians	331	339	8	2.4%	1.2%	4	8

Source:

New Hampshire Employment Security Economic & Labor Market Information Bureau
www.nhes.nh.gov/elmi/products/proj.htm

Program Performance

Based on the performance statistics on enrollment, persistence, completion, transfer, gainful employment and licensure passage rates (where relevant), how successful do you believe the program has been? Please explain your reasoning. Note: Most of the data will be supplied by the Office of Institutional Research but should be supplemented with information supplied by the program personnel.

The Mechanical Design program achieved its highest enrollment in 2014 with 42 students, up from 2013 when we had 40 students. In 2016 we are just below our six year average of 34.6 students. The TAACCCT grants (Trade Adjustment Assistance Community College and Career Training) and the continued attention focused on STEM programs across the country have indeed helped our program. Industry leaders continue to contact us in search of our highly trained graduates.

Mechanical Design Technology - Enrollment

Enrollment	2011	2012	2013	2014	2015	2016	Totals
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MDT							
Fall	27	33	40	42	32	34	208

Nashua Community College - Number of Graduates by Program 2011-2016

2011	2012	2013	2014	2015	2016	Totals
7	9	8	5	7	7	43

The program has been growing for the last 7 years.

Top 5 NCC A.S. Programs in Growth	%change AY2010 - 11 AY2013 - 14
Precision Manufacturing	272.7
Liberal Arts	62.5
Bus. Admin Marketing	47.7
Mechanical Design Technology	27.9
Average of all A.S. degree programs	27.

While our growth is modest we are slightly ahead of the average of all of the programs taught at NCC at nearly 28%.

Our retention rate is significantly above the average at NCC, MDT had a 78.1% last year. Students are not only excited by what they are learning, but also by the level of dedication of our instructors and the job opportunities that exist. The high-tech nature of manufacturing captures the interest of many of our students. We have the latest 3D printers in our labs capable of printing high strength parts in plastics, fiberglass and even carbon fiber. The Mechanical Design experience incorporates parametric design software with 3D printing, machining, hydraulics and pneumatics. This gives students a taste of many different technologies and, for some, the desire to go on to a four year college.

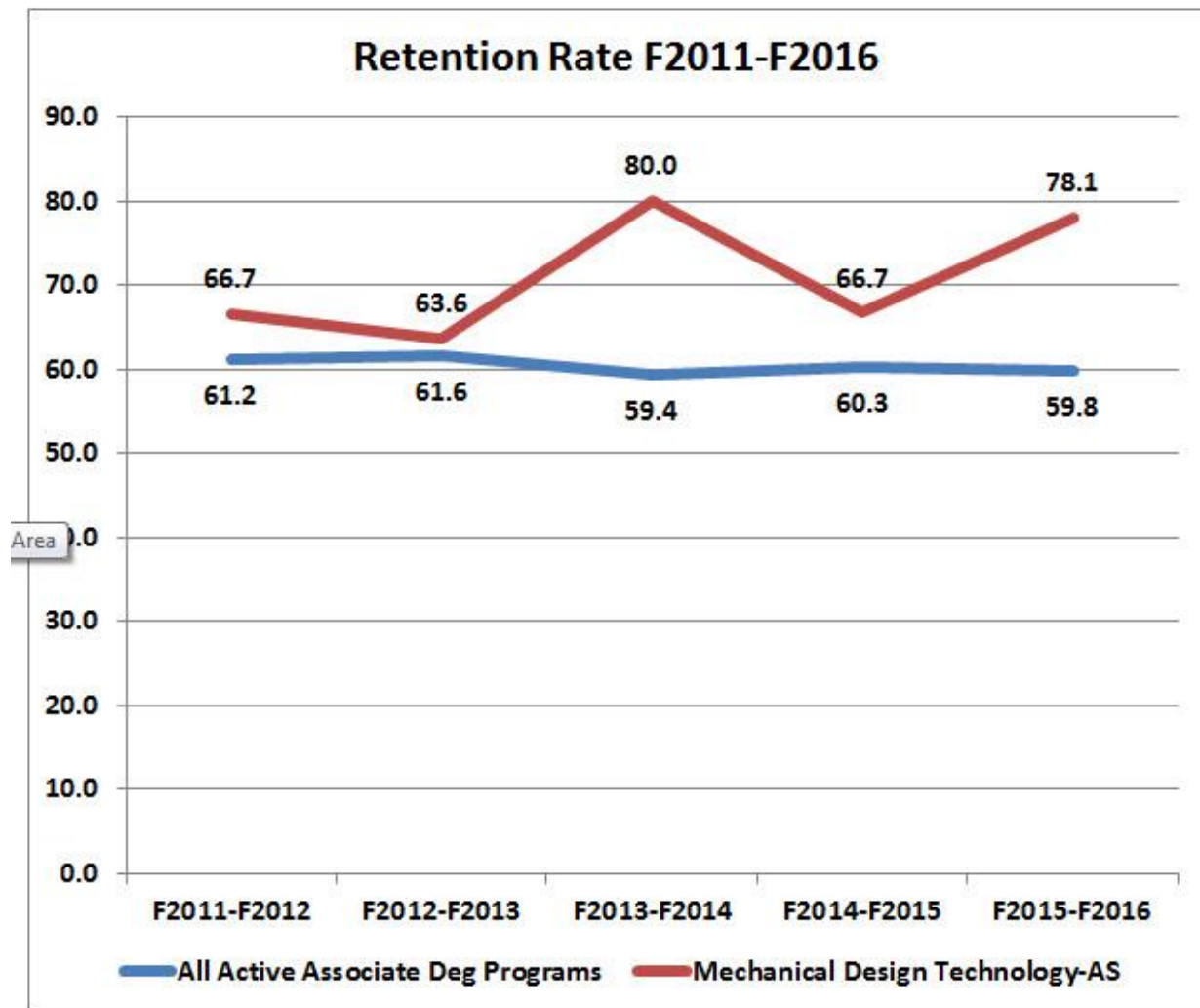
The TACCCT 3 grant was different than the previous TAACCCT 1 grant in several ways. The first grant (TAACCCT 1) focused largely on updating our machine tools and renovating the machine tool lab. The second grant that we received (TAACCCT 3) was more focused on curriculum delivery and program support than equipment, although we did receive some equipment and an expansion of our shop area. The support in this grant came in our Student Navigators. Two Student Navigators were hired to support our programs and assist students during their time taking classes at NCC. The Navigators supported our students in a variety of ways. They helped introduce new students to our programs, registered them for classes, helped many find gain

employment in their field of study, and even checked on them when they missed classes. The Student Navigators clearly helped us attain our high retention rates as seen in the charts below.

Program Retention Rate

	F2011-F2012	F2012-F2013	F2013-F2014	F2014-F2015	F2015-F2016	Overall
All Active Associate Degree Programs	61.2	61.6	59.4	60.3	59.8	59.1
Mechanical Design Technology-AS	66.7	63.6	80.0	66.7	78.1	71.3

Retention rate = total students retained from fall to fall plus students who graduated in the spring.



Transfers to four year schools

The MDT program like the Precision Manufacturing Program is a hands- on program that often stimulates the growth of our students. Individuals that previously hadn't even seen themselves in a two year program often prosper and find themselves desiring to move on to an engineering or business degree upon completion of their two year degrees. The program's transfer rate is better than anticipated at an average of nearly 29%. Our students have found the transfer process to The University of Massachusetts Lowell to be one of the best matches for our program. We are finalizing our new partnership with the University of New Hampshire Manchester where students can obtain a degree in Mechanical Engineering Technology. Students can begin their pathway to the UNH Manchester when enrolling at NCC. A few additional courses must be taken along with the standard courses for the MDT program at NCC. Upon graduation students would enroll at UNH Manchester and begin the program there.

Mechanical Design Technology Graduates

Transferring to Four Year Schools

	AY2011-12	AY2012-13	AY2013-14	AY2014-15	AY2015-16	Total
4-Year College						
Southern NH University					1	1
University of NH Durham				1		1
University of Massachusetts Lowell	2	1	1			4
Clemson University			1			1
University of Maine Orono			1			1
Fitchburg State University		1				1
Granite State College		1				1
total 4-yr	2	3	3	1	1	10
graduates	9	8	5	7	7	36
% transfer	22.2	37.5	60.0	14.3	14.3	27.8

Program Staffing

Describe the program's current staffing composition (including adjunct faculty and the Advisory Council). How well does the current staff meet the needs of the program and, if deficient, what additional skills or personnel are needed to improve success of the program?

The Program Coordinator of Mechanical Design Technology (MDT) is a full-time NCC employee. He teaches one course in MDT that is shared with the Precision Manufacturing curriculum. This course is Manufacturing Processes. The majority of the MDT curriculum is taught by highly qualified adjuncts. Our adjuncts are Mechanical Engineers that are fully employed during the day and they teach our CADD courses during the evening. Currently most of our course are taught during the evening with a few classes running during the afternoon or day schedule. This can be a challenge for the student that works during the day and wants to take evening only classes. This is

under review. Unfortunately there are only a limited number of evenings each week and an all evening program would take more than two years' time to complete.

A dedicated full time Program Coordinator and instructor of this program would alleviate some of these problems. However the close association of MDT and Precision Mfr. and its instructors (including the MDT Coordinator) continue to make this program a priority. Students from both programs often take courses in both Precision Manufacturing and MDT and benefit greatly from their similarities and differences. An example of that would be the use of the parametric design software that we use (Solidworks) is useful for students in both programs.

We are pleased to have such a well-rounded and highly educated group of adjuncts available to teach our students!

Adjunct Faculty

Paul Berkebile, Professor (Retired), Robotics Program, Nashua Community College, B.S. Electrical Engineering, Instructor for- Applied Mechanics I and II, Automation Programming

John Berrigan, Principle Mechanical Engineer, Astronics - Aerosat Inc., B.S. Mechanical Engineering, Instructor for- CADD III (Creo) and Mechanical Design Capstone

Steve Jencks, Nashua Community College, BAE Intern Program, B.S. Electrical Engineering, Instructor for- Fluid Power

Michael Lecesse, Senior Mechanical Engineer, Sun Pharmaceuticals, B.S. Mechanical Engineering, Jurist Doctorate, Patent Attorney, Instructor for- CADD I and II (Solidworks)

Nick Serpa, Associates in Applied Science, Mechanical Design Technology, NCC Regional Sales Engineer, Gasho Inc, , Instructor for- Technical Drawing

Resources Usage of Program

Describe the inventory of program-specific equipment and lab space. How

well does it meet the needs of the program and, if deficient, what additional equipment is needed to improve support of the program? How well do the College's support services (e.g., Registrar, Student Services, Advising, Learning Commons, IT Support, Marketing, Library resources, etc.) assist the program in accomplishing its goals? What changes would you make to improve support of the program?

Our main classroom (room 147) is a room that is shared with the Precision Manufacturing program. The classroom is used for teaching CADD I, III and MDTN-285 (the MDT capstone course). It is also used to teach (two sections) of CADN-131 the Technical Drawing course for Precision Manufacturing students. We also use Room 170 to teach CADD II in the spring semester. Our other technical courses like Fluid Power Design, Automation Programming, and Applied Mechanics I and II are taught in Room 233. This room contains the computers and machinery required for each of these courses. One exception is that the hydraulics and pneumatics stations used in the Fluid Power Design course are shared with the Aviation Program and reside in the Aviation area. These stations were originally part of the Robotics program which was discontinued and these stations became part of the Mechanical Design program. Through a verbal agreement with Don Vallerand, the former department chair of Aviation, it was determined to benefit both groups if the pneumatic –hydraulic stations were moved to the Aviation department.

The current room schedule in room 147 and the use of room 233 are satisfactory for the needs of the Mechanical Design Program. Evening courses in Precision Manufacturing are frequently taught in the room. Due to the fact that our equipment is available in room 233 and can be moved around quickly to suit the needs of any and all classes that are taught there. This flexibility allows the efficient use of the space, with little setup time.

The support the MDT program receives service from various service groups around the campus has been quite good. In particular our returns from the most recent open houses have been far better in terms of both student traffic and real potential candidates. The IT Department has been quite supportive in updating our software (annually) and keeping our computers working properly. The Maintenance staff is also always responsive to our needs.

Program Strengths, Weaknesses and Needs

Mechanical Design Technology is a great program for students that desire to be involved in the creation of mechanical parts but lack the higher level math skills needed to become a full Mechanical Engineer. Our program is very hands on giving the “technician type” student a place to grow and prosper. Only a small percentage of our graduates go on to an engineering degree, most go to work after graduation. The major MDT degree weakness is the scheduling of the program. We have mostly evening courses with a few late afternoon classes mixed in. The major CADD classes (I, II, III and MDTN-285 Capstone project) require two evenings per week. To schedule

classes students would easily be taking classes four nights per week and still be short a few classes each semester. The program cannot easily be offered during the day as most qualified adjuncts work during the day. We would have to fill several positions if we went to a daytime only format. A full time Program Coordinator/instructor could spend more time with the MDT program meeting some of these needs and potentially moving the program to a Day and Evening program again.

We will be interested in the outcome of the new math course procedure where students take the Accuplacer test and may test below the scores necessary to enter a particular Math class. They will take the math class (in our case MTHN-110) and an additional lab to assist them in the course. If this approach is successful then our students may indeed get their math requirements completed sooner which will help them in other courses such as Hydraulics and Pneumatics calculations in the Fluid Power course and in Applies Mechanics I and II.

Our equipment needs have largely been met by the past two TAAACCT grants as well as our need for classroom space. The grant has added a tremendous value to our program.

We will be working on upgrading our robotics capabilities in the future. Several manufacturers offer smaller real world units with industry grade controller packages. These units can be used to pick and place and be used in conjunction with machine tools as well. We will continue to pursue this technology and determine the best unit for our program.

Future Program Goals

- Continue to develop articulation agreements in Mechanical Design Technology or Mechanical Engineering with four-year institutions.
- Help students transfer or find employment as they graduate from the program.
- Continue to develop internships/coops for our students with BAE and others and cultivate relationships with new industry partners to employ our students.
- Remain current with the latest trends in Mechanical Design and integrate those factors/tools into the existing curriculum.
- Adjust program curriculum to meet local business needs identified by our industry partners.