

Provide a maximum 5 page narrative for the proposed program and attach relevant documentation.

Justification/Need for Program (Attach Relevant Documentation):

- State, Regional and National Data Relative to Demand for Program
- Projected Program Enrollment for 3-5 Years. Based on Internal & External Prospective Students Who Indicate a Commitment (not interest) in Enrolling (consider attrition)
- Impact on Existing Internal and External Programs (Russellville & Ozark)

Curriculum Outline

- List Major Courses and Credit Hours (denote new courses with an asterisk)
- List All Support Courses Required from Other Departments/Programs

Resources

- Anticipated New Program Costs/Expenses (i.e., faculty (FT, PT, Adjunct)/GAs/staff/lab assistant, supplies, library resources, equipment, space renovations) for 3-5 Years and How Program Will Support
- Other

Faculty

- Impact on Workload for Current Faculty
 - Other
-

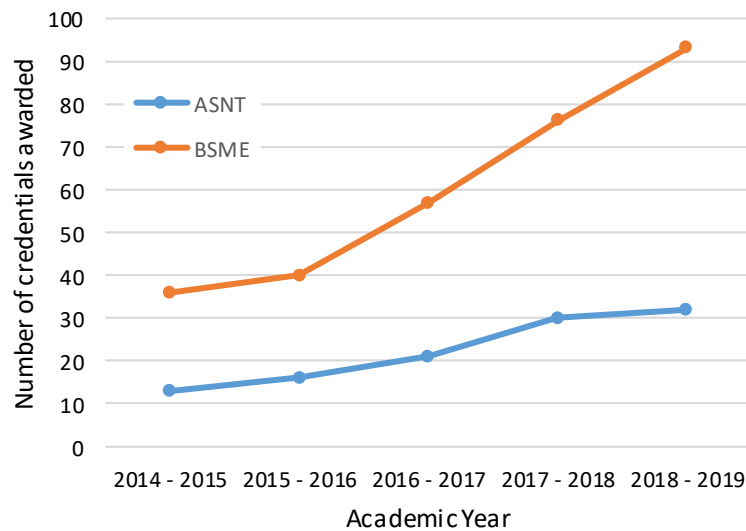
Justification/Need for Program

According to the National Association of Manufacturing, approximately 12.7% of the workforce in Arkansas is involved in manufacturing, the 7th largest percentage in the United States and the 3rd largest percentage in the South (see attachment 1).

Manufacturing occurs in many of the important industrial sectors identified by the Arkansas Economic Development Commission including Aerospace & Defense, Food & Beverage, Paper & Timber Products, Firearms & Ammunition, and Transportation Equipment (see attachment 2). The manufacturing sector has been a major employer of the department's graduates for many years.

There is a need for engineers to understand the manufacturing environment to contribute to the industries noted above. Mr. Jerry Bever, Senior Manufacturing Engineering Manager at Lockheed Martin in Camden, AR, noted during the Tech for Tech panel that many mechanical engineering students from ATU receive an AS in Nuclear Technology (ASNT), which is not relevant for his industry. The proposed AS in Manufacturing will provide the needed background for the Aerospace & Defense industries and beyond. Similar comments regarding the need for engineers with knowledge of manufacturing methods and processes have been received from other employers and members of the department's Industrial Advisory Board.

As shown in the chart to the right, the number of credentials awarded from degree programs in the Department of Mechanical Engineering continues to increase. The department offers a Bachelor of Science in Mechanical Engineering (BSME) and an Associate of Science in Nuclear Technology (ASNT). In



general, students pursue the ASNT simultaneously with the BSME degree since the ASNT program consists of courses and electives within the BSME degree program (with

the exception of two general education courses). Over the 5-year span shown, an average of 37% of students receiving a Bachelor of Science in Mechanical Engineering also completed the ASNT degree. It is assumed that some of the students who completed the ASNT program did so in order to obtain an extra credential rather than as preparation for a career in the nuclear industry. The proposed AS in Manufacturing would give these students an option that may better meet their career goals. In addition, the AS in Manufacturing would also be marketed to the other 60% of students who do not pursue the ASNT. It is anticipated that enrollment within the ASNT program will decrease, but that this enrollment decrease will be more than offset by students pursuing the AS in Manufacturing. It is anticipated that this new degree program will attract a total of 40 students per year in roughly equal numbers from the ASNT program and new students.

This degree program is not expected to significantly impact degree programs on either the Russellville or Ozark campuses outside of the Department of Mechanical Engineering. The impact on faculty teaching loads, both within and outside of Mechanical Engineering, are discussed in a later section.

Curriculum Outline

The proposed curriculum is modeled after the Associate of Science degree in Nuclear Technology, also housed within the Department of Mechanical Engineering. All courses within the ASNT, with the exception of two general education courses, count toward the BS degree in Mechanical Engineering and this will be the case for the newly proposed degree in Manufacturing as well.

The proposed curriculum for the Associate of Science in Manufacturing is shown below. The single new lab course is denoted by an asterisk while support courses from other programs are in bold. General education courses shown in italics.

1st Semester

<i>ENGL 1013 – Composition I</i>	3
<i>Social Sciences</i>	3
<i>MATH 2914 – Calculus I</i>	4
<i>CHEM 2124 – General Chemistry I</i>	4
<i>MCEG 1011 – Intro to Mech. Engr.</i>	1
TECH 1001 – Orientation to Univ.	<u>1</u>
Total	16

2nd Semester

<i>ENGL 1023 – Composition II</i>	3
MATH 2924 – Calculus II	4
<i>PHYS 2114 – Physics I</i>	4
<i>MCEG 2023 – Engineering Materials</i>	3
<i>MGEG 1002 – Engr Graphics</i>	2
Total	—
Total	16

3rd Semester

<i>SS/FA/Hum/Speech</i>	3
<i>Fine Arts/Humanities</i>	3
<i>U.S. History/Government</i>	3
<i>MCEG 2013 – Statics</i>	3
STAT 3153 – Applied Statistics	<u>3</u>
Total	15

4th Semester

<i>Social Sciences</i>	3
<i>Fine Arts/Humanities</i>	3
<i>MCEG 3013 – Mechanics of Mat’ls</i>	3
<i>MCEG 3023 – Manuf. Processes</i>	3
<i>*MCEG 3xx2 – Manuf. Lab</i>	2
STAT 3183 – Stat. Process Control	<u>3</u>
Total	17

Grand Total: 64 hours

Resources

Since the proposed degree program consists mostly of courses already being taught, minimal new faculty resources will be needed for the program. Dr. Mehmet Kelestemur, Assistant Professor of Mechanical Engineering, has the expertise to develop and teach the proposed lab course. In addition, there is currently an open position in the Department of Mechanical Engineering from the line vacated when Dr. Krohn became interim department head. Should Dr. Krohn be named department chair following a national search, the vacated position could be used to bolster the department’s expertise in the manufacturing area.

The current laboratory and shop facilities in Mechanical Engineering are adequate to demonstrate basic manufacturing techniques including subtractive and additive

manufacturing. Plant trips to various manufacturing facilities have been used in the Manufacturing Processes course to demonstrate manufacturing techniques using equipment not available on campus and these resources will continue to be used. The department will work with the Advancement Office to identify industry donors for additional lab equipment. In addition, the Engineering Innovation Center proposed for one-time funding from the Governor would also support this curriculum.

Faculty

The proposed degree program will have minimal impact on faculty loading within Mechanical Engineering. The BSME curriculum includes a 2-credit hour Engineering lab elective course requirement which can be satisfied by any 3000-level laboratory course in any Engineering curriculum. Currently mechanical engineering students generally choose one of the following lab courses for this elective: MCEG 3512: Radiation Detection Laboratory, MCEG 4042: Metallurgy Laboratory, or MCEG 4332 Thermal Systems Lab. Students choosing the new lab course MCEG 3xx2 Manufacturing Laboratory will lower the enrollment in the other elective courses. Thus, the total number of lab sections required each year is likely to remain constant.

The Department of Mathematics generally offers two sections of STAT 3153: Applied Statistics in the fall and spring semesters. During the 2019-2020 academic year, the total course capacity was not reached in either semester, suggesting there is some availability for additional students in these courses. A large percentage of BSME students currently take STAT 3153 to meet a program requirement (Math Elective). Therefore, it is anticipated that the new program may lead to the need for no more than one additional section of STAT 3153 in the future. STAT 3183: Statistical Process Control is a new course and has not yet been taught and thus the impact of the proposed program on the enrollment for this course is unknown.

There may be additional resources required for general education courses if the proposed program leads to an overall increase in enrollment in the Department of Mechanical Engineering. The enrollment in the BSME has grown significantly in the past several years, however, and the University has had the capacity to absorb the enrollments in general education courses for these students.

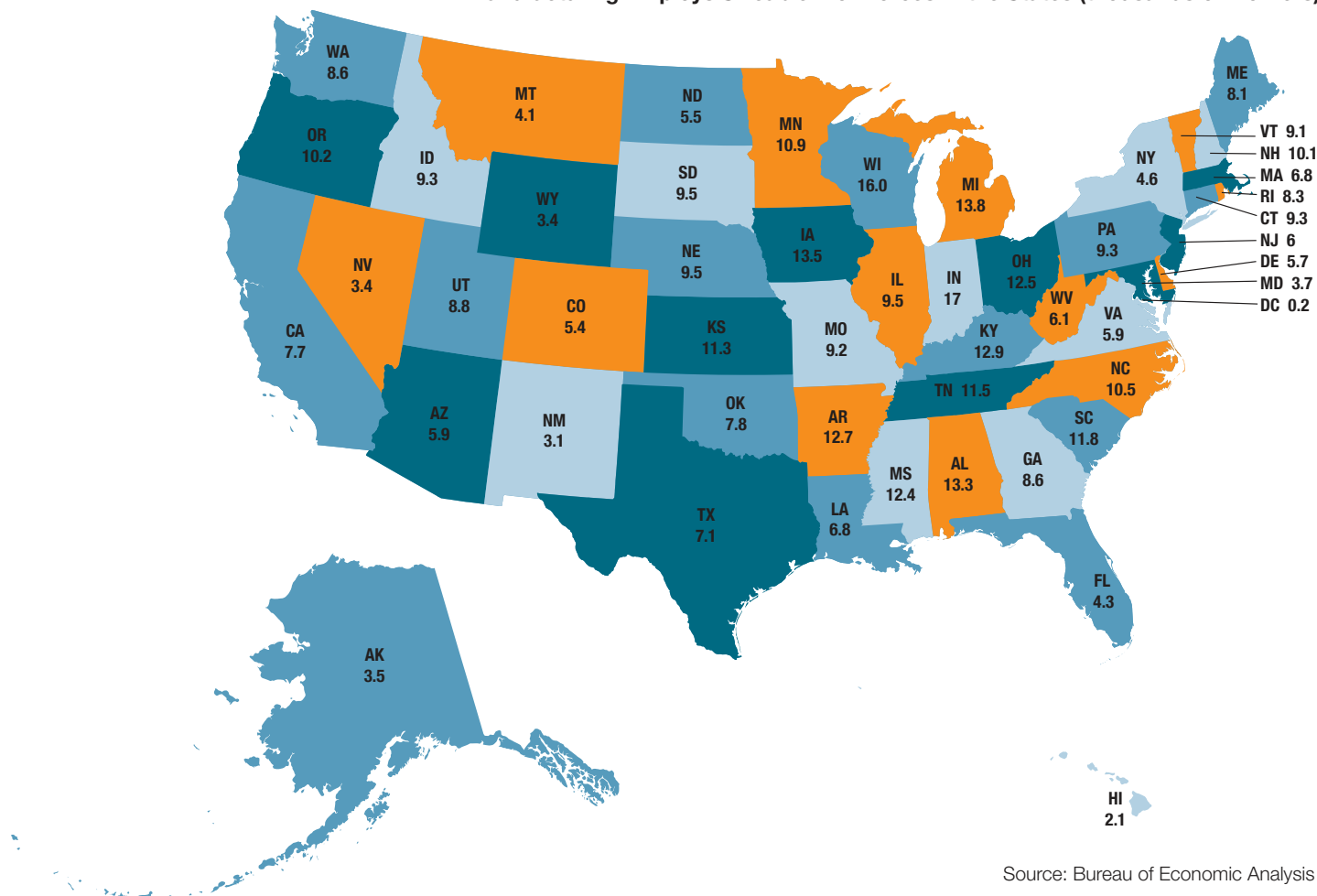
Manufacturing Employment by State

nam.org/statedata • mfgdata@nam.org

Nearly 9 percent of all nonfarm workers in the United States work for a manufacturer, but manufacturing has played an outsized role in recent economic recovery. Some states are more closely tied to production than others, and in several states, a large percentage of overall employment is devoted to working for a manufacturer.

The map shows what percentage of each state's workforce is employed in manufacturing in 2017, using the average for the year.

Manufacturing Employs Sizeable Workforces in the States (thousands of workers)



Source: Bureau of Economic Analysis

States with the Highest and Lowest Shares of Manufacturing Employment (as a Percentage of the Total)

Top 5 States

Indiana	17.0%
Wisconsin	16.0%
Michigan	13.8%
Iowa	13.5%
Alabama	13.3%

Bottom 5 States

District of Columbia	0.2%
Hawaii	2.1%
New Mexico	3.1%
Wyoming	3.4%
Nevada	3.4%



2019 Arkansas Manufacturing Facts

Arkansas Manufacturing Facts

Manufacturers in Arkansas account for 15.50% of the total output in the state, employing 12.72% of the workforce. Total output from manufacturing was \$19.85 billion in 2018. In addition, there were an average of 161,000 manufacturing employees in Arkansas in 2018, with an average annual compensation of \$58,343.71 in 2017.

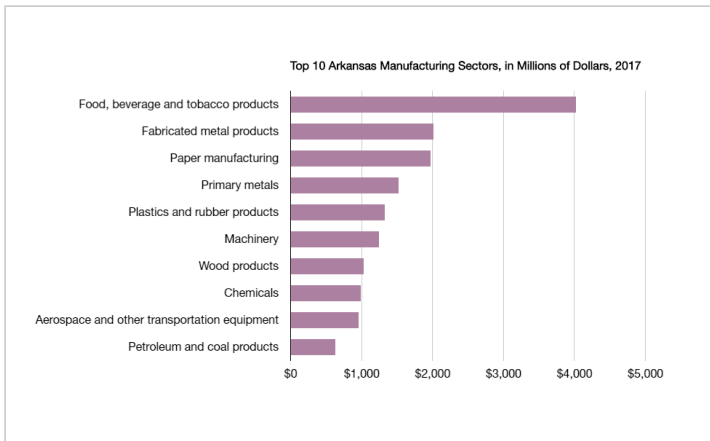
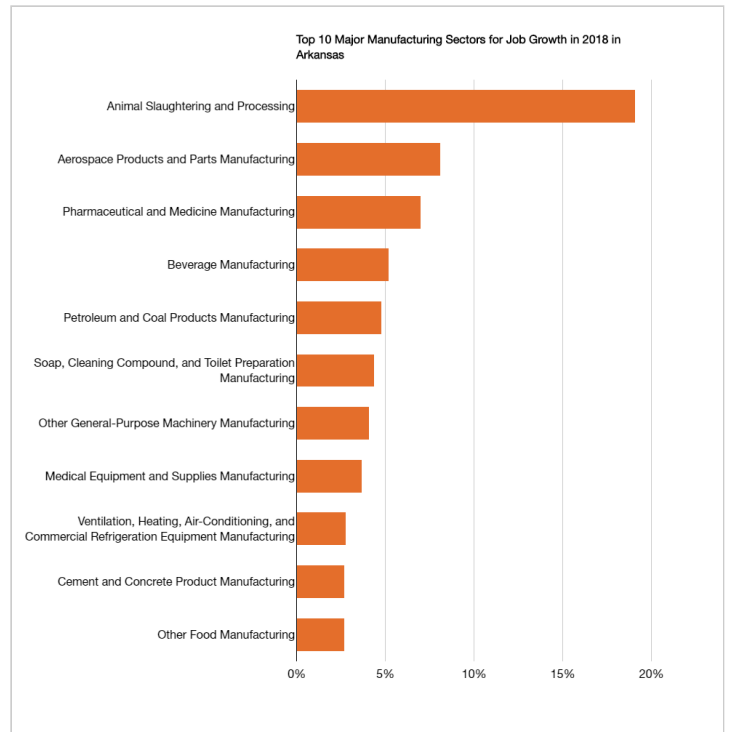
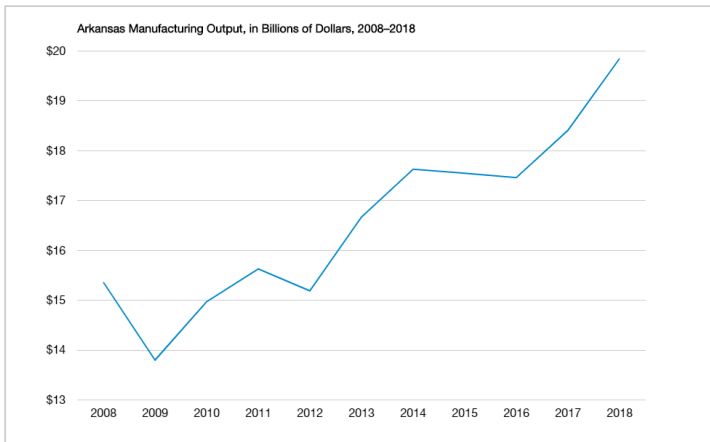
Manufacturing Output and Firms

Total Manufacturing Output (\$billions, 2018)	\$19.85
(Percent share of total gross state product)	15.50%
Manufacturing Firms in Arkansas (2016)	2,276

Employment and Compensation

Manufacturing Employment (2018)	161,000
(Percent share of nonfarm employment)	12.72%
Average Annual Compensation (Manufacturing, 2017)	\$58,343.71
(Nonfarm Businesses, 2017)	\$40,553.08

Sources: U.S. Bureau of Economic Analysis and the U.S. Census Bureau



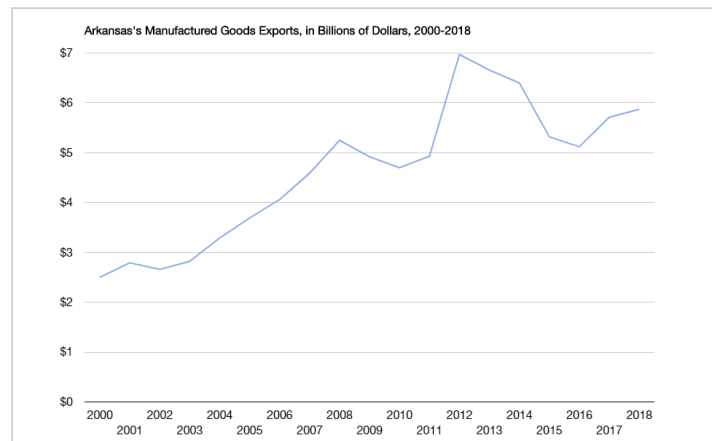
Arkansas Export Facts

Manufacturers help to drive Arkansas's economy, with \$5.87 billion in manufactured goods exports in 2018. That same year, \$2.62 billion in exports was with our free trade agreement (FTA) partners. This helps create jobs in the state, and 14.10% of its employment stemmed from exports in 2011. Small businesses comprised 80.00% percent of all exporters in Arkansas.

Manufacturing Exports

Manufactured Goods Exports (\$billions, 2018)	\$5.87	Manufactured Goods to Free Trade Agreement Partners (\$billions, 2018)	\$2.62
(Percent share of total goods exports)	90.76%	(Percent of total exports, 2018)	40.57%
Growth in Manufactured Goods Exports (2010–2018)	24.74%	Total Manufactured Goods Exports to Canada and Mexico (NAFTA, 2018)	\$1.84
U.S. Jobs Supported by Goods Exports (2016)	26,144	Top Five Export Markets (Percent of total manufactured goods exports, 2018)	31.34%
Employment from Manufacturing Exports (Export share of manufacturing jobs, 2011)	14.10%	Canada	19.74%
Small Business Share of Total Exporters (2015)	80.00%	Mexico	11.60%
		Saudi Arabia	6.76%
		France	5.55%
		China	4.61%

Sources: International Trade Administration, U.S. Census Bureau



Additional Trade Facts

- The 20 U.S. FTA partners purchased nearly 49 percent (\$679.46 billion) of U.S. manufactured goods exports in 2018 – even though these countries represent only six percent of the world's population and 10 percent of GDP.
- FTA countries: Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordan, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, Singapore and South Korea.

A DIVERSE ECONOMY

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