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## **AC 2007-440: A GENERAL ENGINEERING TECHNOLOGY PROGRAM IN MOTORSPORTS TECHNOLOGY**

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# **A General Engineering Technology Program in Motorsports Technology**

## **Abstract**

Southside Virginia, in particular the cities of Danville, Martinsville and the surrounding area, is the home of Virginia International Raceway and a rapidly growing motorsports industry. There is a strong need for educational opportunities to support manufacturing and related industries in this region. In the early 2000's Patrick Henry Community College in Martinsville established an associate of applied science degree in Motorsports Technology to help meet the need for technical support personnel. As the industry has grown it has become evident that engineers and technologists are needed at the baccalaureate and masters levels.

Old Dominion University (ODU), located in Norfolk, Virginia (about 200 miles from this region) has a recognized well-established distance learning system called TELETECHNET. Additionally, the institution provides engineering technology education at the baccalaureate level, including a General Engineering Technology (GET) program. The need for higher education in southside Virginia, the availability of the minor courses in Motorsports Engineering and ODU's long history in distance education set the stage for the development of a General Engineering Technology program with an emphasis in Motorsports Technology.

This program builds on the associate degree in Motorsports Technology program at Patrick Henry Community College, by providing additional laboratory science courses and mathematics courses through calculus, as well as traditional engineering science courses such as thermodynamics and fluid mechanics. The four Motorsports Engineering minor courses are used as major courses in the curriculum. The Old Dominion University courses will be offered in Martinsville both live and through ODU's TELETECHNET satellite television distance learning system. Laboratories for the Motorsports Technology courses will be uniquely situated at the Virginia International Speedway in Martinsville and at the NASA Langley Windtunnel facility (operated by ODU), in Hampton, Virginia. Plans are to initiate the program in the Fall 2007, as funding becomes available. This paper will describe the detailed development and implementation of this unique program in addition to course and laboratory descriptions for the proposed curricula.

## **Background**

The southside region of Virginia, primarily that region bordered by the cities of South Hill on the east and Martinsville on the west has gone through some rough economic times in the past two decades. With competition from overseas companies, the textile and furniture industries in this region have diminished greatly. In more recent years, the Commonwealth of Virginia has invested heavily in activities related to economic growth in this region. One focus area in economic development has been the motorsports industry. This region is home to Virginia International Raceway (VIR) near Danville and Martinsville Speedway, as well as smaller racetracks in the region. Associated with VIR, Old Dominion University has already teamed

with Virginia Tech and the recently formed Institute for Advanced Learning and Research (IALR) to form the Virginia Institute for Performance Engineering and Research (VIPER). A major goal of this organization is to support southside Virginia economic development via motorsports high performance vehicle research and laboratory-based development. Newly developed and developing laboratory faculties at VIR in Danville will support academic research, revenue generating commercial research and an ODU graduate program in Motorsports Engineering. Funding from the State Tobacco Commission has been secured to build additional laboratory facilities.

Patrick Henry Community College (PHCC) located in Martinsville, Virginia (about 35 miles from Danville and VIR) offers one of the few associate degree programs in the nation in Motorsports Technology. This program was initiated in the early 2000's and graduates have traditionally entered the motorsports industry as technicians, working in engine/chassis manufacturing or testing, or with racing teams. Students in this program have come, not only from the southside region of the State, but also from other regions of the State and beyond to pursue the degree fulltime. It is unusual for a community college program to attract students from outside its region. The opportunity for graduates of the associate degree program to earn a baccalaureate degree in the motorsports discipline would provide graduates for entry into the motorsports industry at the technologist and engineering levels. This would enhance the growth of motorsports related industries in the region and promote economic growth. It would also attract additional students to the associate degree and baccalaureate program. Old Dominion University is in a unique position to provide that opportunity.

### **Old Dominion University and Distance Learning**

Old Dominion University has been involved in delivering courses and programs at a distance for more than fifteen years.<sup>1,2,3,4</sup> The major thrust of its distance learning system (called TELETECHNET) is one-way video, two-way audio satellite television. ODU has over 40 downlink sites, primarily in Virginia, with a few sites in other states. In addition, ODU offers these courses and others via synchronous video-streaming to any student with access to high-speed Internet. Other courses are offered using CD-ROMS, two-way video and audio, and via the Internet. The upper two years of all of ODU's engineering technology programs are offered via these methods. These include three TAC of ABET accredited programs: Civil Engineering Technology, Electrical Engineering Technology and Mechanical Engineering Technology; and a non-accredited General Engineering Technology program. More than one-third of the students in engineering technology are distance learning students.

### **The New College Institute (NCI) in Martinsville**

There are few opportunities for a baccalaureate level education in southside Virginia and, specifically no university in the Martinsville area. Because of the strong desire for economic recovery in that region, there was a strong push for baccalaureate level education. The result was the establishment of the New College Institute, a physical entity initially housed in a refurbished building in Martinsville. The Institute provides office space, mediated classrooms, computers and other facilities for established colleges and universities to deliver full programs, both at the baccalaureate and masters degree level. Currently there are five institutions offering seven

programs at the New College Institute. A major goal of the Institute is that these programs be delivered on-site, not in a distance learning mode. Because of the associate degree program in motorsports technology at Patrick Henry Community College in Martinsville, Old Dominion University's strong history of delivering programs at a distance and the desire for economic development in the region, the Director of the New College Institute approached ODU about the development of a baccalaureate program in motorsports technology, and the delivery of the program on-site at the New College Institute.

### **Motorsports Technology Program Development**

Graduates of all engineering technology programs at ODU earn a Bachelor of Science in Engineering Technology (BSET), in lieu of a discipline specific degree. This was by design, and allows the Department of Engineering Technology to introduce new programs under the BSET without approval from outside the university. While the CET, EET and MET programs were initiated in the early 1970's, the General Engineering Technology (GET) program was initiated in 2001. The GET program was developed to allow students from a wide variety of associate degree technical science programs to pursue a baccalaureate degree in one of six GET options or even one of their own design (with approval of the Department Chair). It was felt that development of a Motorsports Technology option under the GET program was the best approach to initial establishment of the program. It should be noted here that, unlike all other engineering technology programs which are offered both on campus and at a distance to a large number of sites, the GET program in Motorsports Technology would initially be offered at only one distance site, the New College Institute in Martinsville.

A major contributing factor to ODU's development of the Motorsports Technology program was the existence of four previously developed courses in Motorsports Engineering. Old Dominion University has an upper-level general education requirement of either one of ten established three course clusters or one of over 75 four course minors in various disciplines. About three years ago, the Aerospace Engineering Department, with only graduate level programs, initiated a minor in motorsports engineering in order to increase their enrollments. That department has been operating a large scale windtunnel leased from NASA for several years and has been performing a substantial number of vehicle tests for several race car teams. This minor in Motorsports Engineering has been a favorite for Mechanical Engineering and Mechanical Engineering Technology majors. The four courses in the motorsports engineering minor coupled with existing supporting courses from the Mechanical Engineering Technology curriculum make up the technical courses at the upper level. The minor courses thus became major courses for this program. The minor specified for this program is in Engineering Management since it is already offered via distance learning. The lower level curriculum is that offered by Patrick Henry Community College in Motorsports Technology.

### **Articulation with Patrick Henry Community College**

Articulation with PHCC and their Motorsports Technology program has been initiated and will take several iterations to come to complete fruition. The curriculum at PHCC produces graduates with an Associate in Applied Science and requires 68 semester hours. The technical courses are more hands-on, skills oriented with less emphasis on analysis. Associate degree

students currently must take an additional 39 semester hours of lower level courses, primarily science (Physics and Chemistry), mathematics (thru Calculus) and general education courses. An additional 45 semester hours of upper level ODU courses are required to complete the baccalaureate degree. This brings the total required for the degree to 149. Steps are underway to bring the total number of semester hours closer to those required for CET, EET, and MET, currently 126-127.

## The Curriculum

At the associate degree level at PHCC, the following technical courses are required.

### Patrick Henry Community College Technical Courses

		Course	Credits
ITE	115	Introduction to Computer Applications & Concepts	4
MTS	125	Motorsports Technology I	3
MTS	126	Motorsports Technology II	3
MTS	130	Motorsports Structural Technology I	3
MTS	131	Motorsports Structural Technology II	3
MTS	135	Sheet Metal Fabrication	3
MTS	140	Stock Car Engines I	3
MTS	150	Engine Machining Processes I	4
MTS	210	Race Car Setup I	3
MTS	211	Race Car Setup II	4
MTS	240	Stock Car Engines II	3
MTS	250	Engine Machining Processes II	4
MTS	290	Coordinated Internship II	3
MTS	295	Advanced Engine Tuning OR	3
MTS	132	Motorsports Structural Technology III	3
Total			46

As previously mentioned, students will take 45 semester hours of additional upper level courses from Old Dominion University. These courses are listed below.

## Old Dominion University Courses

Courses			Credits
MET	305	Principles of Mechanics	3
MET	300	Thermodynamics	3
MET	310	Dynamics	3
MET	330	Fluid Mechanics	3
MET	335	Fluid Mechanics Laboratory	1
MET	350	Thermal Applications	3
MET	387	Power &Energy Laboratory	2
AE	407	Ground Vehicle Aerodynamics	3
AE	467	Race Car Performance	3
AE	457	Vehicle Dynamics	3
AE	477	High Performance Piston Engines	3
MET	435W	Senior Capstone Project	3
ENMA	301	Engineering Management	3
ENMA	302	Engineering Economics	3
ENMA	401	Project Management	3
ENMA	420	Statistics	3
Total			45

All of the courses listed above are currently being offered at the main campus. The MET courses are also part of the MET program and already being offered at a distance as part of its TELETECHNET system to Patrick Henry Community College. These courses and the four Aerospace courses, AE 407, 467, 457, and 477 will be offered live on-site at the New College Institute in Martinsville for this program. While the MET courses are fairly standard in description, the uniqueness of the Aerospace Motorsports Engineering courses warrant their description below.

### **AE 407 Ground Vehicle Aerodynamics**

Catalog Description: (3 credits) Lecture and Laboratory. Prerequisites: MET 303 or MET 330 or CEE 330. (Fluid Mechanics). Introduction to ground vehicle aerodynamics, bluff body aerodynamics, automobile aerodynamics, high performance vehicle design,

truck and bus aerodynamics, high speed trains, boats, overview and discussion of methods and facilities.

### **AE 457 Motorsport Vehicle Dynamics**

Catalog Description: (3 credits) Lectures and Laboratory. Prerequisites: MET 204 (Statics), 205 (Dynamics), or equivalent. Basic mechanics governing vehicle dynamic performance. Analytical methods in vehicle dynamics. Laboratory consists of tests of various vehicle suspension-systems components and skidpad tests of several small race cars (Legends and Baby Grand) to illustrate dynamics performance change associated with tire, springs and dampers, ride height, and wedge.

### **AE 467 Race Car Performance**

Catalog Description: (3 credits) Lectures and Laboratory. Prerequisites: AE 457 Motorsports Vehicle Dynamics, AE 407, Motorsports Aerodynamics. On-track performance of a typical racecar (Legends and Baby Grand racecars) to demonstrate and evaluate changes in suspension system geometry and tire selection. Operation and installation of sensors and data acquisition system. Use of computer simulation in specification of car set-up.

### **AE 477 High Performance Piston Engines**

Catalog Description: (3 credits) Lectures and Laboratory. Prerequisites: MET 300, MET 350. A study of fundamental principles and performance characteristics of the internal combustion engines (spark ignition). The study includes introduction to chemical reactions, engine types and their operation, engine design and operating parameters, ideal models of engine cycles, combustion in spark ignition engines, and heat transfer.

As listed in the course descriptions, each of the motorsports courses have a laboratory components. Currently, in the on-campus delivery of the minor, those laboratory sessions are delivered in facilities on campus and at the NASA Full-Scale Wind Tunnel in Hampton, Virginia operated by ODU. ODU operates the Langley Full-scale Tunnel (LFST), the largest University-operated wind tunnel in the world. ODU also has access to the NASA 14 by 22 wind tunnel for motorsports testing, through an agreement with Jacobs Sverdrup, who operates the facility for NASA. These two wind tunnels, located in Hampton, VA, for the foundation for ODU's motorsports activities and represent a unique combination of world-class experimental capabilities. Over the last decade, ODU has successfully operated the LFST for motorsports, other automotive, aeronautical, and architectural applications. Motorsports testing has included NASCAR, ALMS, Sprint cards, dragsters and a wide variety of sports cars. ODU has also commenced construction of a facility at Virginia International Raceway (VIR) including chassis dynamometer and engine instrumentation laboratories. This is part of the VIPER organization, a collaboration between ODU, Virginia Tech, and the Institute for Advanced Learning and Research (IALR) in Danville. VIPER will also operate an 8-post chassis dynamics test rig and a motion-base driving simulator, which ODU will have access to for the program and others. Students in Martinsville will also have access to facilities currently being used by Patrick Henry Community College in its associate degree program. These facilities are currently provided by Arrington Industries, at their nearby manufacturing and test facilities. Arrington is a provider of



engines for Dodge trucks and race vehicles. Students will also travel to the NASA Wind Tunnel in Hampton, Virginia for weekend laboratory experiences.



### **Program Implementation**

The baccalaureate Motorsports Technology program was approved by ODU and submitted to the New College Institute for approval and initial funding. That funding has been approved and ODU and the New College Institute are currently working out details for Fall, 2007 implementation. Courses will be offered primarily on-site at the New College Institute, with some ODU courses being provided by the ODU distance learning network, TELETECHNET, particularly during the time of initial growth and small enrollments of the program. ODU will articulate with Patrick Henry Community College to insure smooth transition of associate degree students into the baccalaureate program. In order to effectively administer and deliver the program, a twelve-month full-time on-site program director will be hired. This program director will teach courses, maintain a strong relationship with the community college and initiate and maintain strong recruitment efforts in the region and beyond. As the program grows, additional part-time faculty will be utilized. The Chair of the Department of Engineering Technology at the main campus of ODU will oversee the overall delivery of the program.

### **Summary**

All of the components for the development of a new program in Motorsports Technology were in place before the initiation of this program. There was a need for the program to promote economic development in a region of Virginia. There was a commitment from an institution, the New College Institute, to provide substantial funding to initiate the program. There was an institution, ODU, ready and able to take on the responsibility of delivering the program at a distance site. There were existing courses to support the program, requiring no new course development to initiate the program. There were laboratories, existing and under construction, to

support the program. There was in place an existing resource of students from the associate degree program at Patrick Henry Community College. Establishing the need and having the funding, institution, courses, laboratories and potential students have made the initiation of this program possible. The baccalaureate level program in Motorsports Technology administered by Old Dominion University will provide associate degree graduates with the opportunity to increase their analytical skills in this area and enter the Motorsports workforce as technologists/engineers. Having skilled technician and technologists to enter the workforce will enhance the region's ability to continue to grow the motorsports industry which will have a positive economic impact. It is also felt that a baccalaureate program in that region will attract more students from outside the region and state to enter the motorsports profession. It is also anticipated that many graduates of the baccalaureate program will also pursue the newly developed graduate program in Motorsports Engineering being delivered by Old Dominion University in that region.

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