
*A Workshop on*

# Integration of Design and hands-on learning into STEM Curriculum

**The Great Midwestern Space Grant Region**

MOSGC
Missouri Space Grant Consortium

# Integration of Design and hands-on learning into STEM Curriculum

***When:***

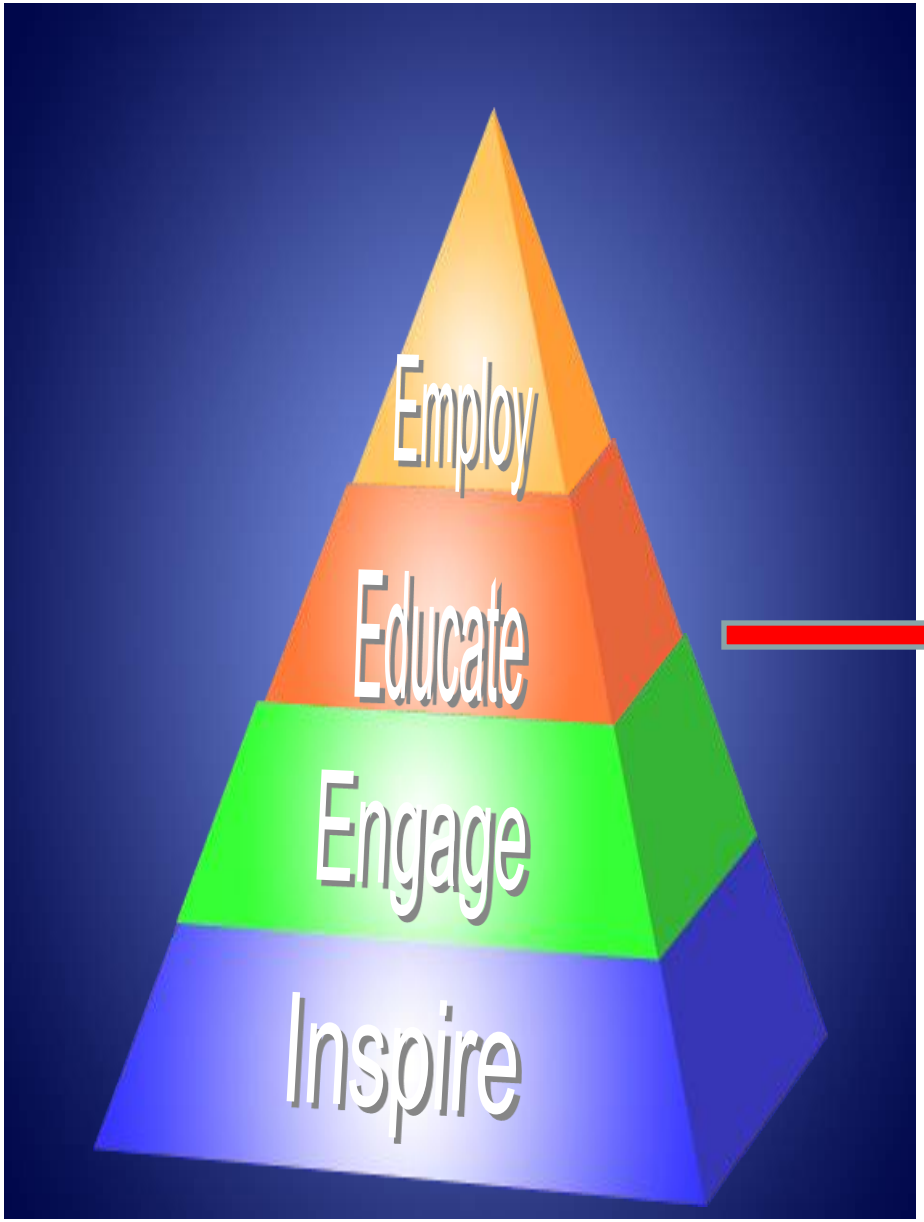
**June 17-19, 2010**

***Where:***

***M*issouri University of Science and Technology**

MOSGC

MISSOURI SPACE GRANT CONSORTIUM




# Early Design and hands-on learning in Higher Education Programs

# Workshop objectives

1) Teach applied as opposed to purely theoretical knowledge where design is emphasized

2) Provide opportunities for hands-on learning, testing, and experimentation with different design concepts.

3) Provide opportunities for high-level and critical thinking

4) Enhance process skills such as teamwork, technical writing, …

- **The workshop material is suitable for**
  - **freshman** engineering programs and/or **sophomore curriculum** of four-year University bachelor's degree programs in aerospace engineering
  - Associate's degree engineering/pre-engineering programs in **community colleges**
  - institutions who are seeking to emphasize and **integrate hands-on training and implementation of system design, simulation, building, and testing**.

# Learning Outcomes

Enhance the content of your curriculum in order to improve the flowing student's learning outcomes

**(a)** **an ability to apply knowledge of mathematics, science, and engineering,**

**(c)** **an ability to design a system, component, or process to meet desired needs,**

**(e)** **an ability to identify, formulate, and solve problems**

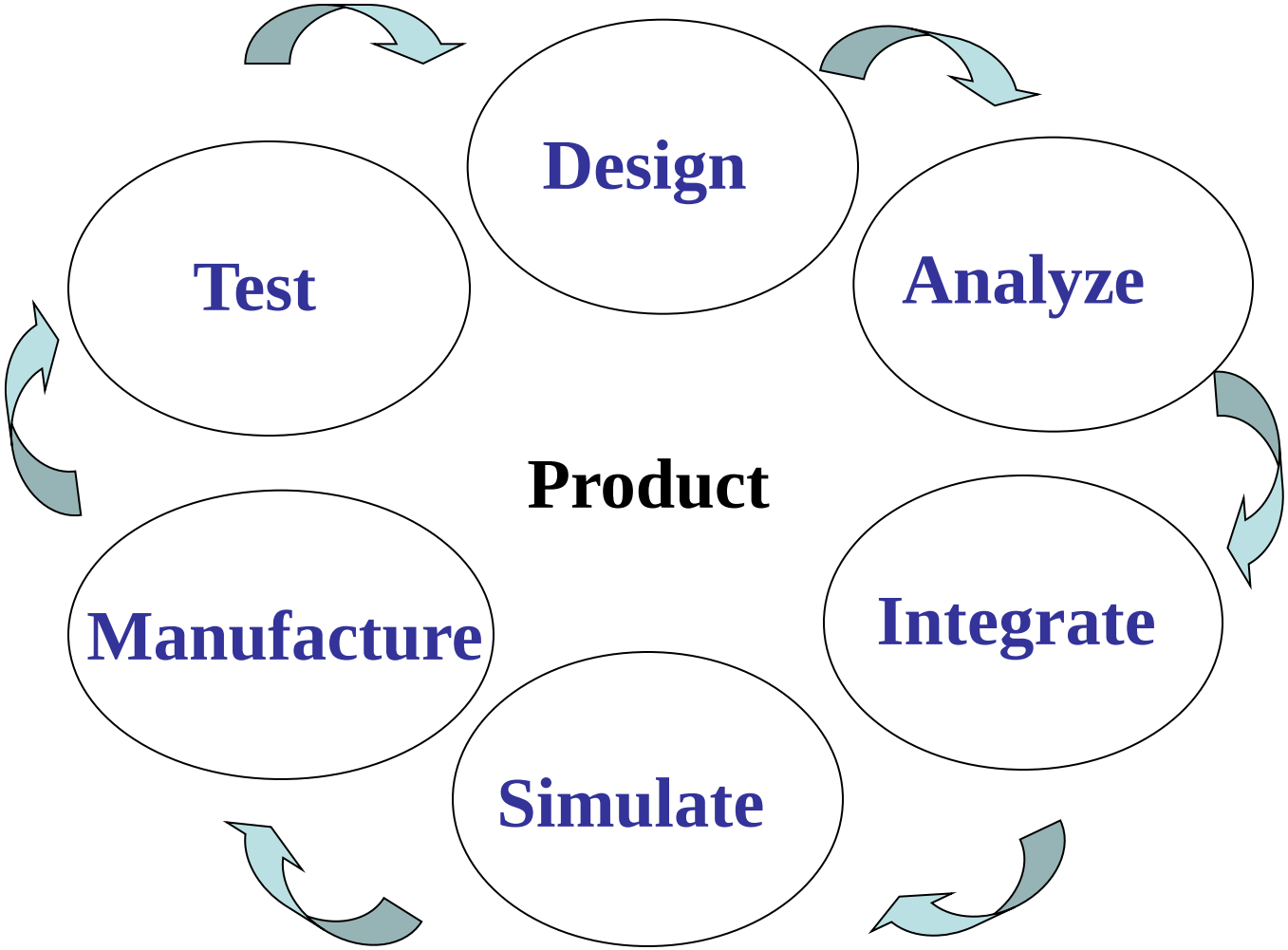
**(g)** **an ability to communicate effectively**

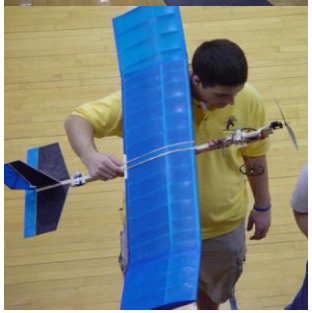
**(k)** **an ability to use the techniques, skills, and modern tools necessary for engineering practice**

# Who Should Attend

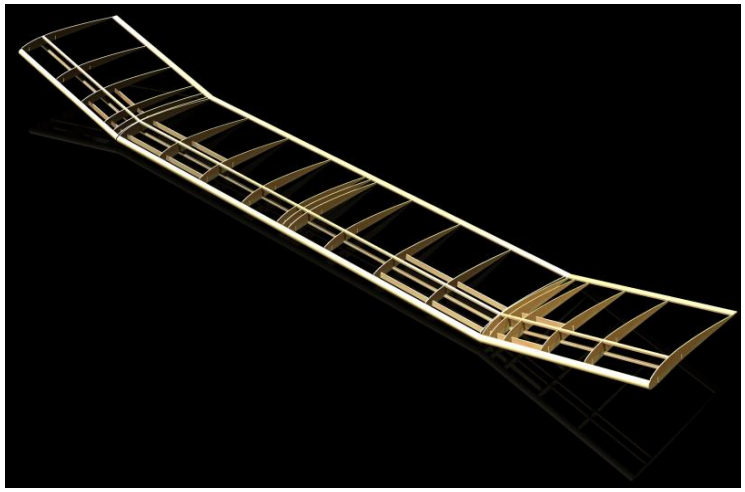
- Directors and Managers
- Curriculum developers in institutions who are seeking to emphasize and integrate hands-on training and implementation of system design, simulation, building, and testing.
- Faculty members/Graduate students in four-year University bachelor's degree programs
- Faculty/instructors in Associate's degree engineering/pre-engineering programs in community colleges

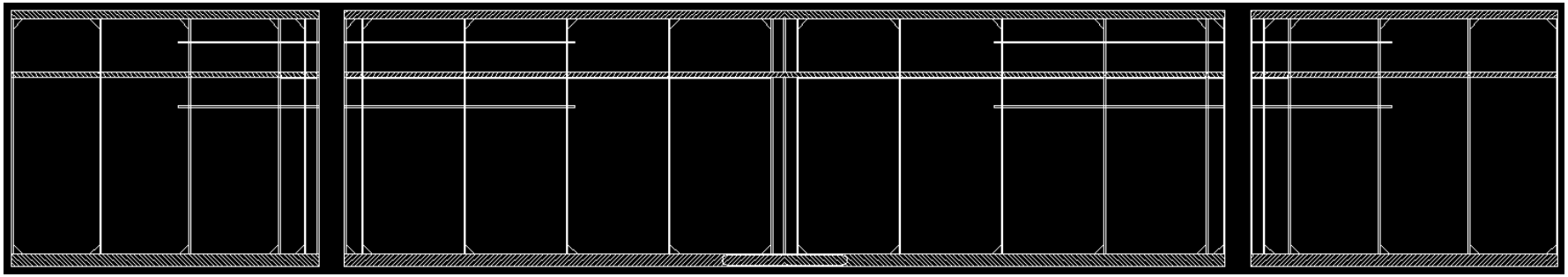
# Engineering/Product development

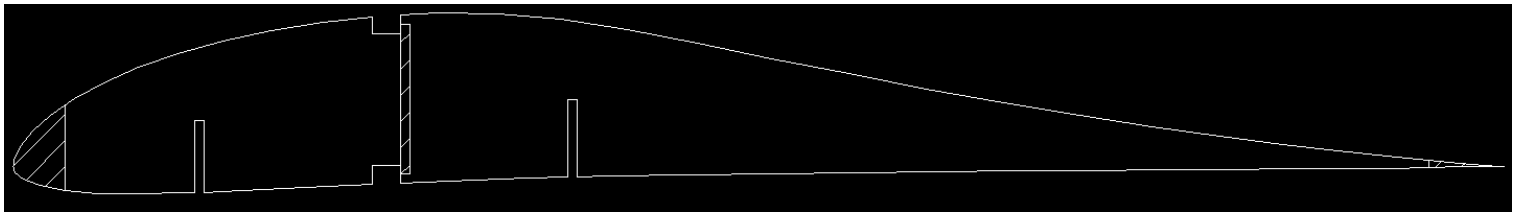


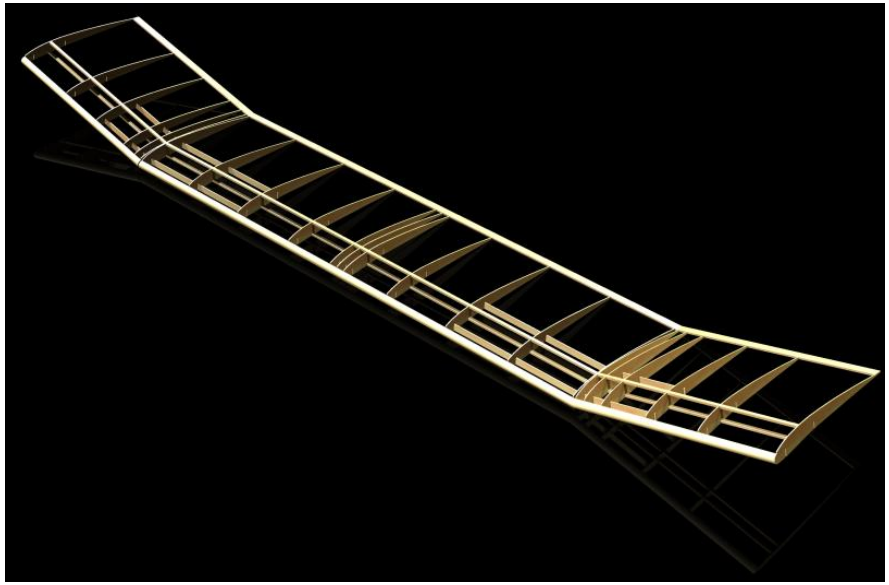
# Design/Implement



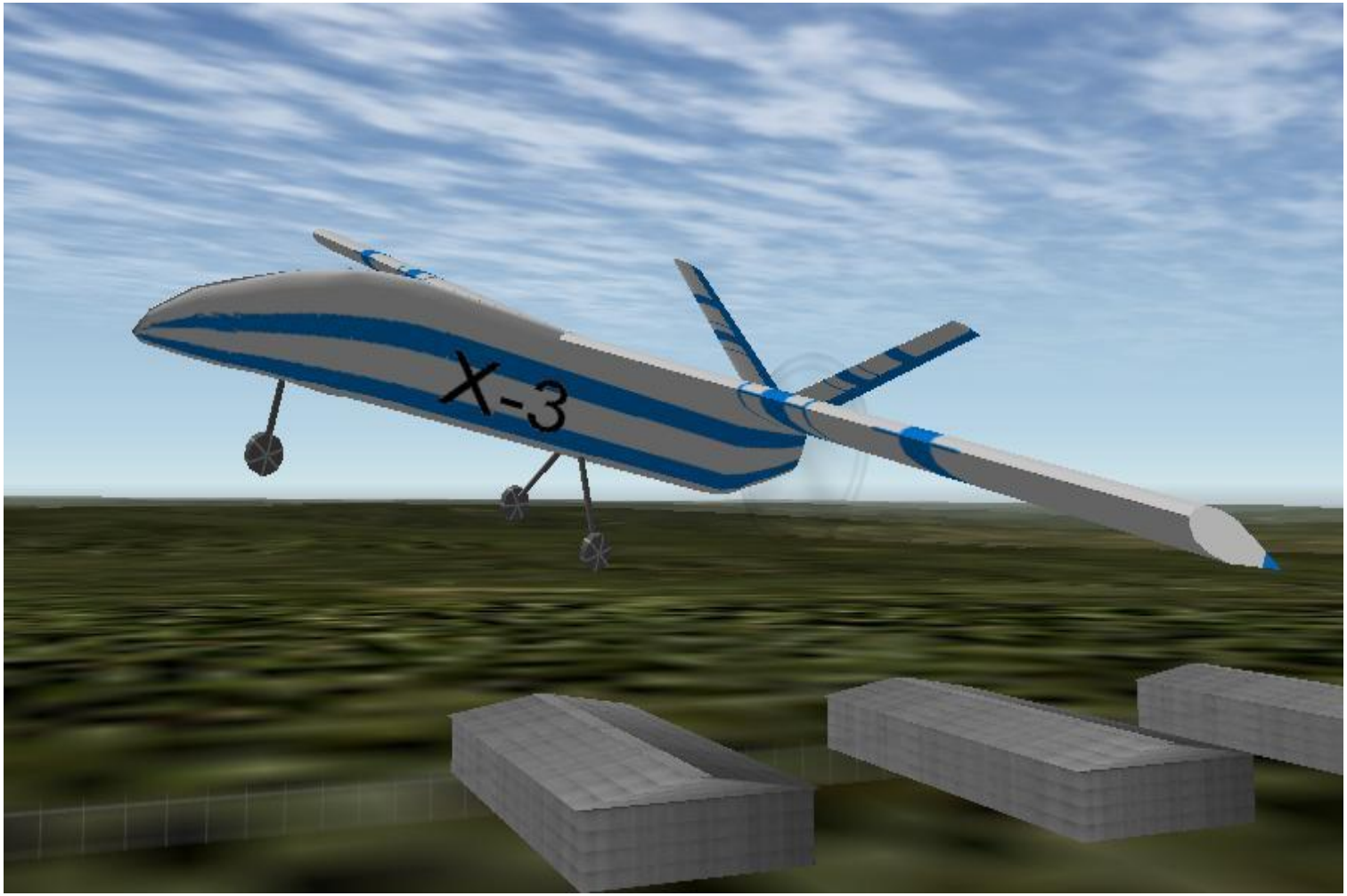




# Product Realization



# Simulate




***Computer screen depicts simulation of an aircraft model***

# Flight Test

- Determine the maximum speed of the aircraft model in straight and level flight at full power.
- Determine the lift-off distance and velocity of the aircraft model.
- Determine the distance from the start of the takeoff roll for the model to clear a 6 foot obstacle

# Workshop Program

# 2 ½ Days

# Day One: June 17th, 2010 (Full Day 8:00 a.m. – 4:00 p.m.)

**Session 1: Introduction**

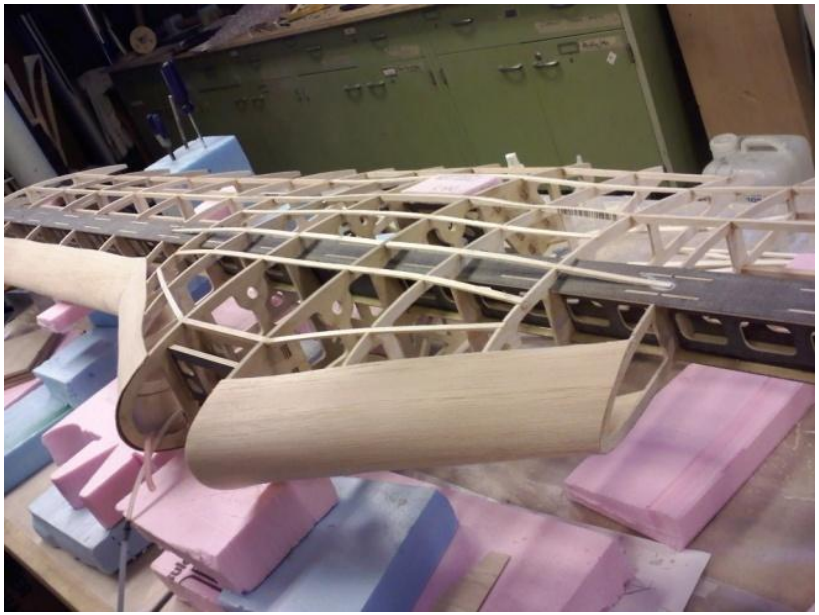
Critical Attributes of future graduates
IQ and EI (Emotional Intelligence)
Inspiring and Engaging Students: Design, Simulate, Build, and Test Approach

**Session 2: Project overview**

Main aircraft components
Basic aerodynamic forces and moments
Basics of aircraft performance
Basics of Propulsion
Work Statement for a design project
A ten-Step program to design, simulate, build, and fly a radio-controlled aircraft model

**Session 3: Principles of Design**

Design of an aircraft wing to produce needed lift
Design aircraft tail for a given stability specification
Engine thrust determination and selection of an appropriate powerplant
Configuration and layout of wing, horizontal and vertical surfaces
Determining wing optimum aerodynamic performance
Model weight & balance
Aircraft model stability
Aircraft model performance



**Session 4: Principles of Simulation**

Simulation of designed model
Model Performance evaluation
Takeoff testing
Cruise speed testing
Survey of critical competencies that can be nurtured in students
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# Day two: June 18th, 2010 (Full Day 8:00 a.m. – 4:00 p.m.)

**Session 5: Principles of Building and assembly of radio-Controlled Aircrafts**

Survey of critical competencies that can be nurtured in students

Basics of aircraft model construction

Construction of wing, horizontal and vertical surfaces

Wing attachment method

Fuselage assembly including horizontal, vertical stabilizers and landing gear

Installation of adjustment of servos, control horns, control rods

Engine Installation

Battery installation

Radio receiver and speed controller installation

Model weight and balance

Preflight Check

# Day Three: June 19th, 2010 (Half a Day 8:00 a.m. – Noon)

**Session 6: Fly testing of radio-controlled aircrafts**

Finalize model assembly

Pre-flight preparation

Flight Testing

- Determine the maximum speed of the aircraft model in straight and level flight at full power.
- Determine the lift-off distance and velocity of the aircraft model.
- Determine the distance from the start of the takeoff roll for the model to clear a 6 foot obstacle

# Future Technical Workforce: Critical Competencies

# A Sample Of Competencies Future Graduates Must Have

1. **Ability to apply knowledge**
2. **Ability to identify and solve problems**
3. **Ability to communicate**
4. **Ability to collaborate**
5. **Understanding of basic economics (Cost)**
6. **Understanding of professional and ethical obligations**
7. **Commitment to continuous learning**
8. **Commitment to self assessment**
9. **Curiosity**
10. **Creativity**

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# Panel Discussions

***Panel Discussion I:***
***Preparing the next generation of graduates***

***What should engineering, science, and technology education do today to prepare the next-generation of students?***

***What are the qualifications and the Characteristics?***

***Panel Discussion II:***
***Knowledge, skills, and Practical Wisdom***

Educating the next-generation technical workforce will require more than their professional training.

What we need are technically competent graduates with more integrity, good judgment, self-discipline, moral courage, and more public sense in public life.

**Higher education is for preparing students for lives** of significance and responsibility.

# Registration

**http://web.mst.edu/~spaceg/**

- **Limited enrollment:**
  - Enrollment is limited to forty participants.

- **Registration due date:**
  - Registration is due **April 9th, 2010**. Full payment of registration fees is due May 7th, 2010

- **Registration Fees:** $975
  - The $975 registration includes: a breakfast and lunch each day of the workshop, workshop handbook, and workshop materials and supplies need to build a radio-controlled aircraft.

# Workshop: When and Where

***When:***

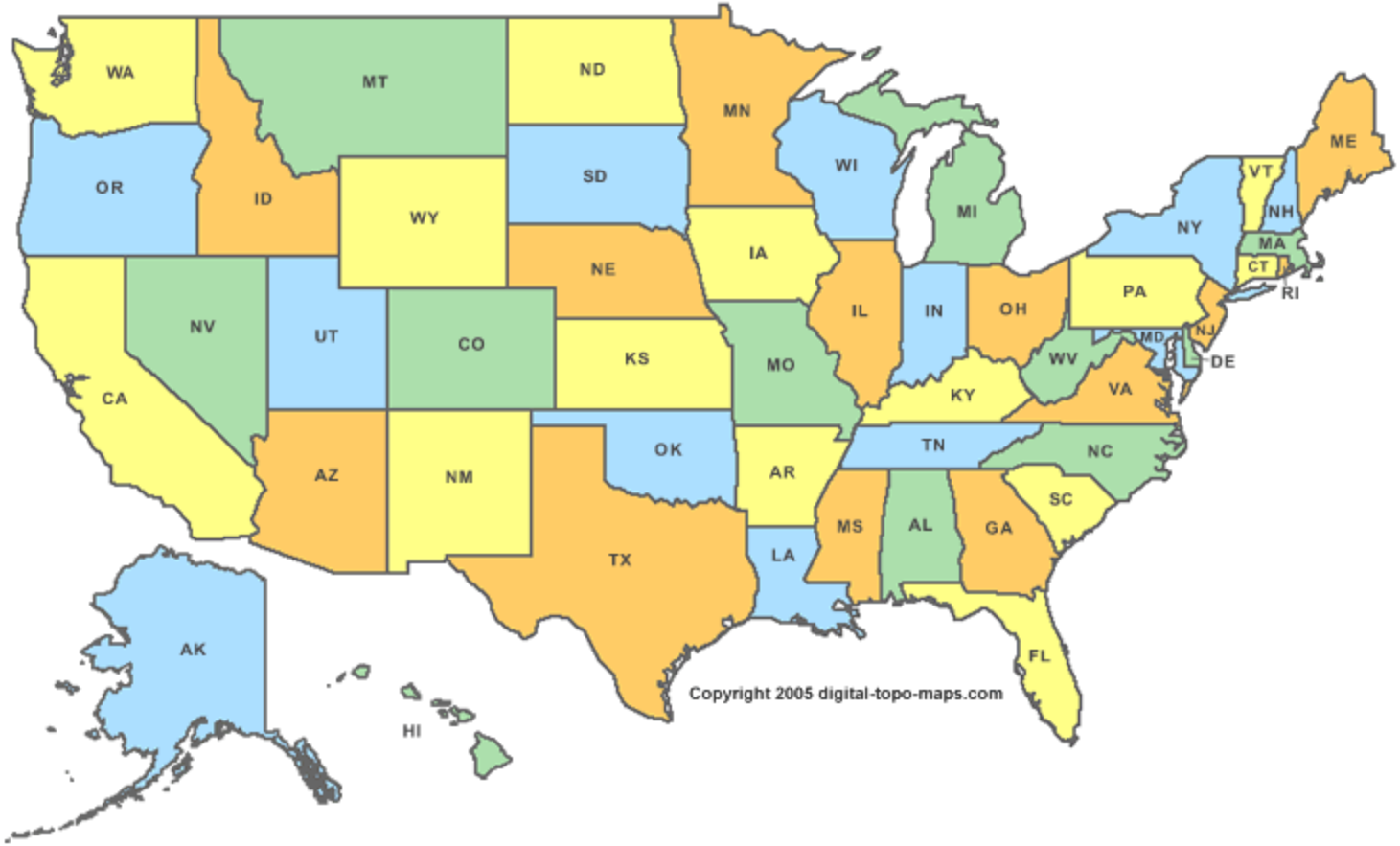
**June 17-19, 2010**

***Where*:**

***M*issouri University of Science and Technology**

**Rolla, Missouri**

***Where is Rolla, Missouri?***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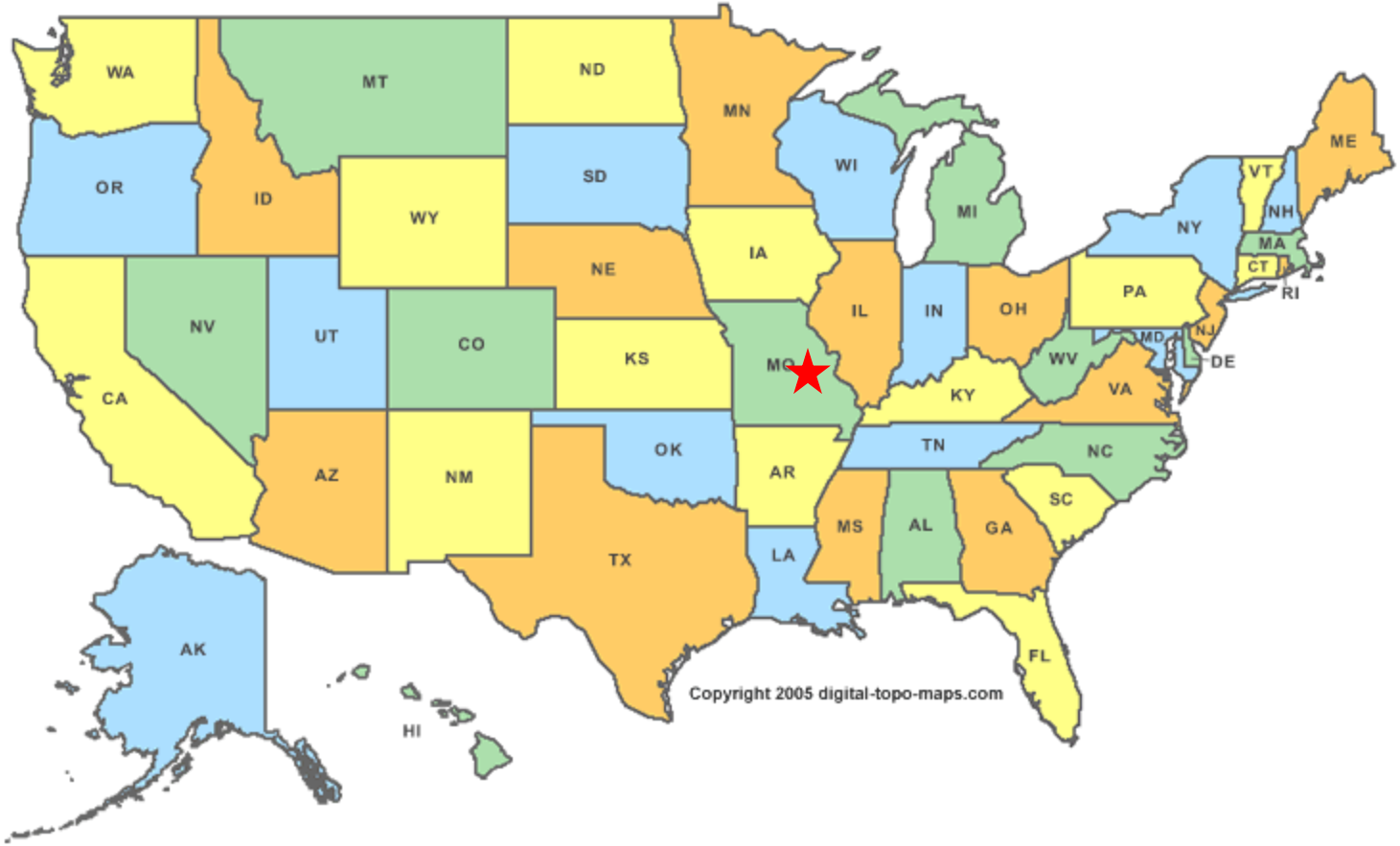
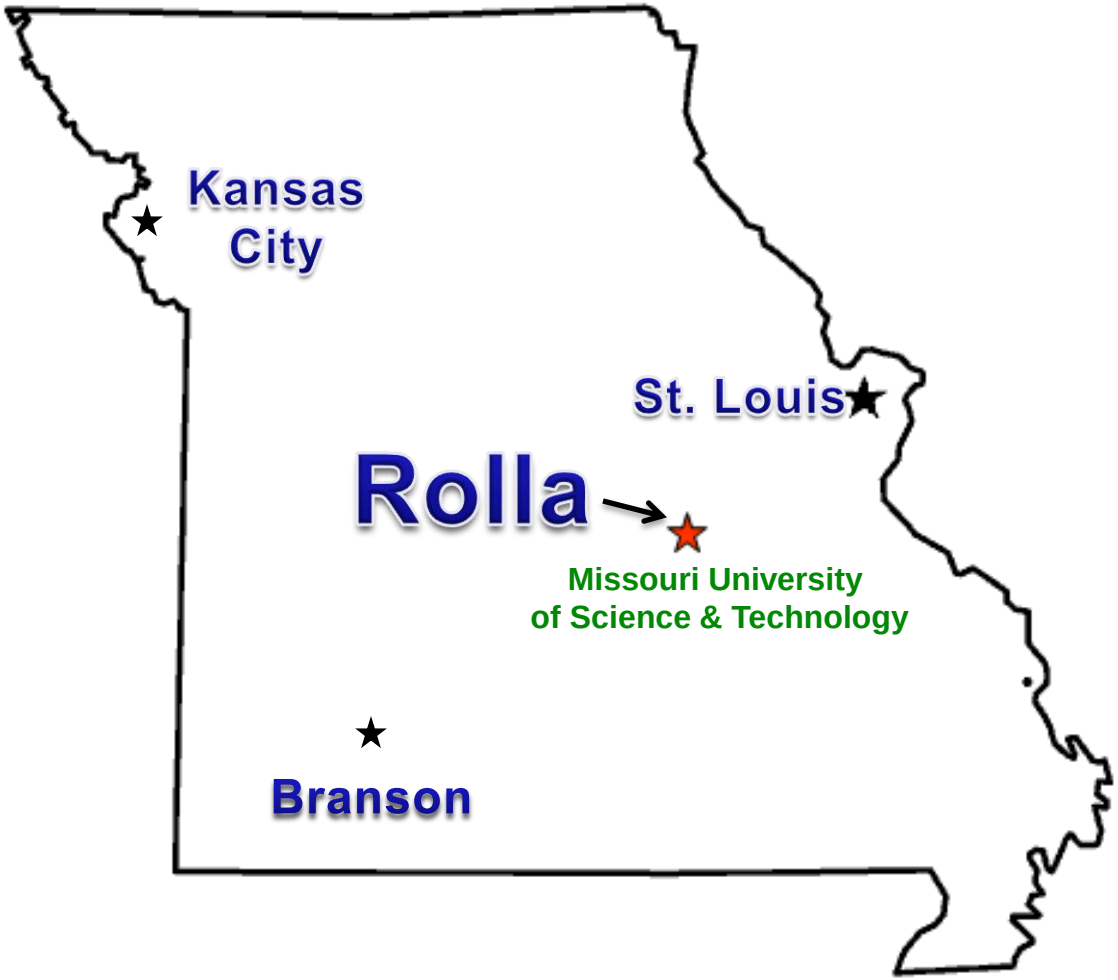
# Great Midwestern Space Grant Region



# Missouri


Kansas City
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Branson

# Places you can visit in MO

Lake Bransonn

***M*issouri University of Science and Technology**

**Rolla Missouri**

# Since 1870

# Missouri S&T Astronauts


Tom Akers



Janet Kavandi

**Sandra H. Magnus**

# Workshop sessions will be held in Toomey Hall


- Built in 2007
- Features state of the art learning centers, laboratories and computer facilities

***We look forward to seeing in the Show Me State***