



ROBOTIC MINING COMPETITION

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NASA's Robotic Mining Competition 2014 Recap

Go to You Tube

[http://www.youtube.com/watch
?v=vkluOMes1aY](http://www.youtube.com/watch?v=vkluOMes1aY)

May 19-23, 2014



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THE EVENT

First event held in 2010

Astronaut Hall of Fame, FL

Called “Lunabotics Mining Competition”
(to reflect the planned mission of the time)

Next event is May 18 – 22, 2015

Located at the Kennedy Space Center
Visitor Complex, FL

Called “Robotic Mining Competition”
(to reflect wide-scope of mission options)

Design it. Build it. Dig it.



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Traverse
Martian
CHAOTIC
terrain,
excavate
and deposit
the regolith
into the
collector
bin within
10 minutes.



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WHO CAN COMPETE

Undergraduate and graduate student teams enrolled in a U.S. college or university.



Teams should have a sufficient number of members to

successfully operate their mining

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WHAT IS AN OFF WORLD MINING ROBOT?

- It is a teleoperated or autonomous robotic excavator
- Include mechanical and electrical equipment, batteries, gases, fluids and consumables
- If remotely operated, the Robot and Operator are isolated

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WHAT IS AN OFF WORLD MINING ROBOT?

- Max Mass 80 kilograms
- Max Dimensions
Length 1.5 meters, Width 0.75 meter,
Height 0.75 meter
- May deploy or extend and exceed 1.5
meters in height.

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WHAT IS AN OFF WORLD MINING ROBOT?

- **Swarmies**
(multiple robot mining systems)

Are allowed but mass & dimensions of the whole system must comply with the volumetric dimensions above.

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OFF-WORLD MINING CHALLENGES

- Reduced Gravity
Moon $1/6^{\text{th}}$ Mars $3/8^{\text{th}}$
Asteroids (if any)
variable, shifting
- Abrasive characteristics of the
basaltic regolith



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COMPETITION MINING CHALLENGES

Teams must consider numerous design and operation factors:

- dust tolerance & projection,
- communications & energy/power
- vehicle mass and size limitations
- autonomy
- abrasive basaltic regolith simulant

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COMPETITION

REQUIRED

- **ON-SITE MINING**
- **SYSTEMS
ENGINEERING PAPER**
- **OUTREACH PROJECT**

OPTIONAL

- **SLIDE PRESENTATION**
- **TEAM SPIRIT**

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SCHOLARSHIP AWARDS

REQUIRED

- **ON-SITE MINING**

1ST - \$3,000 2ND - \$2,000 3RD - \$1,500

- **SYSTEMS**

ENGINEERING PAPER \$500

- **OUTREACH PROJECT \$500**

OPTIONAL

- **SLIDE PRESENTATION \$500**

- **TEAM SPIRIT \$500**

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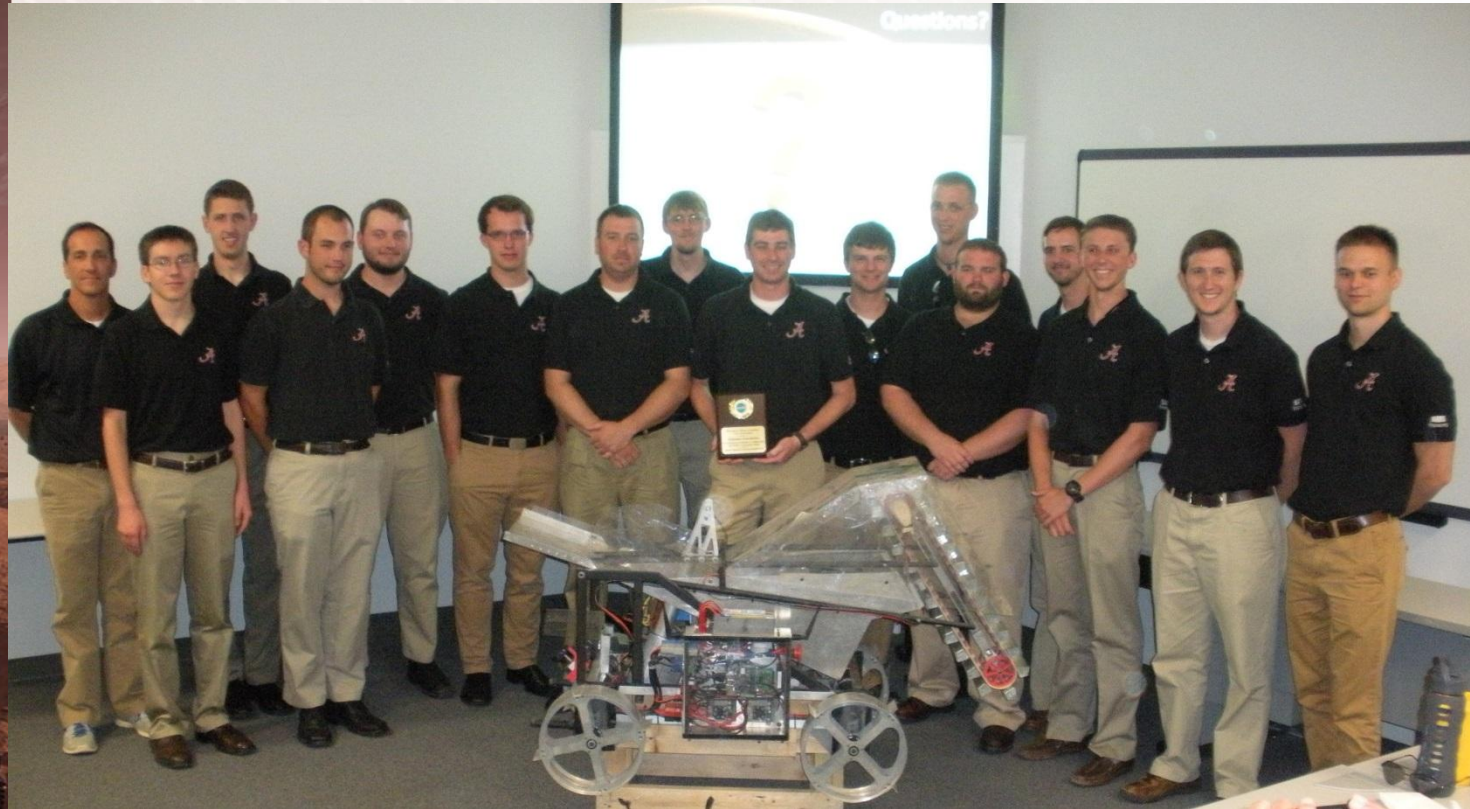
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The Caterpillar Autonomy Award

Awarded to the teams with the
most Autonomous points
averaged from both
competition runs

1ST - \$1,500

2ND - \$750

3RD - \$250

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The Joe Kosmo Award for Excellence

- Excavate the basaltic and icy regolith
 - Score the most points
 - Win ...

The JKAE Trophy

KSC Launch Invitations

Team Certificates

\$5,000 Team Scholarship.

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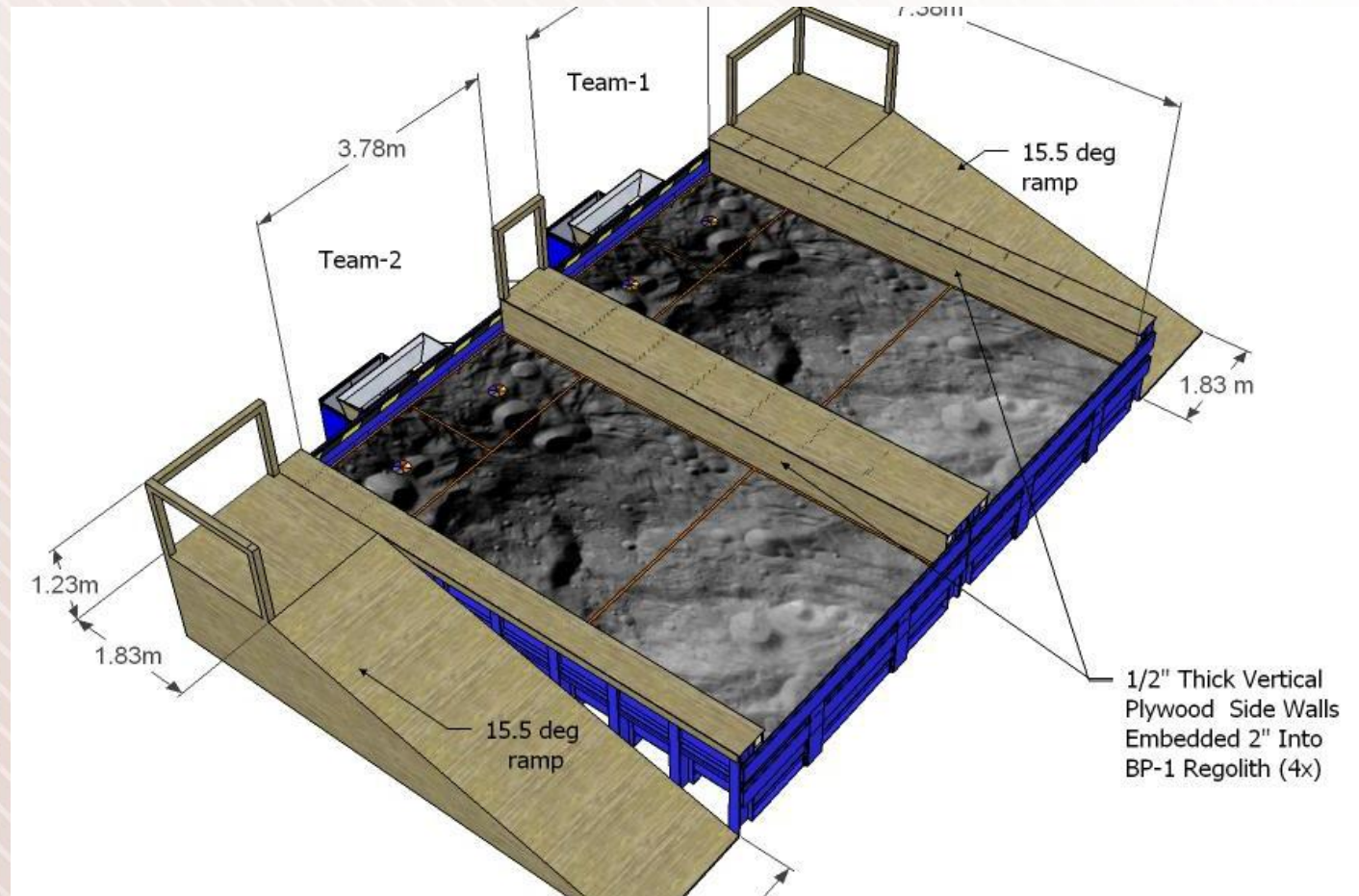
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MINING ARENA



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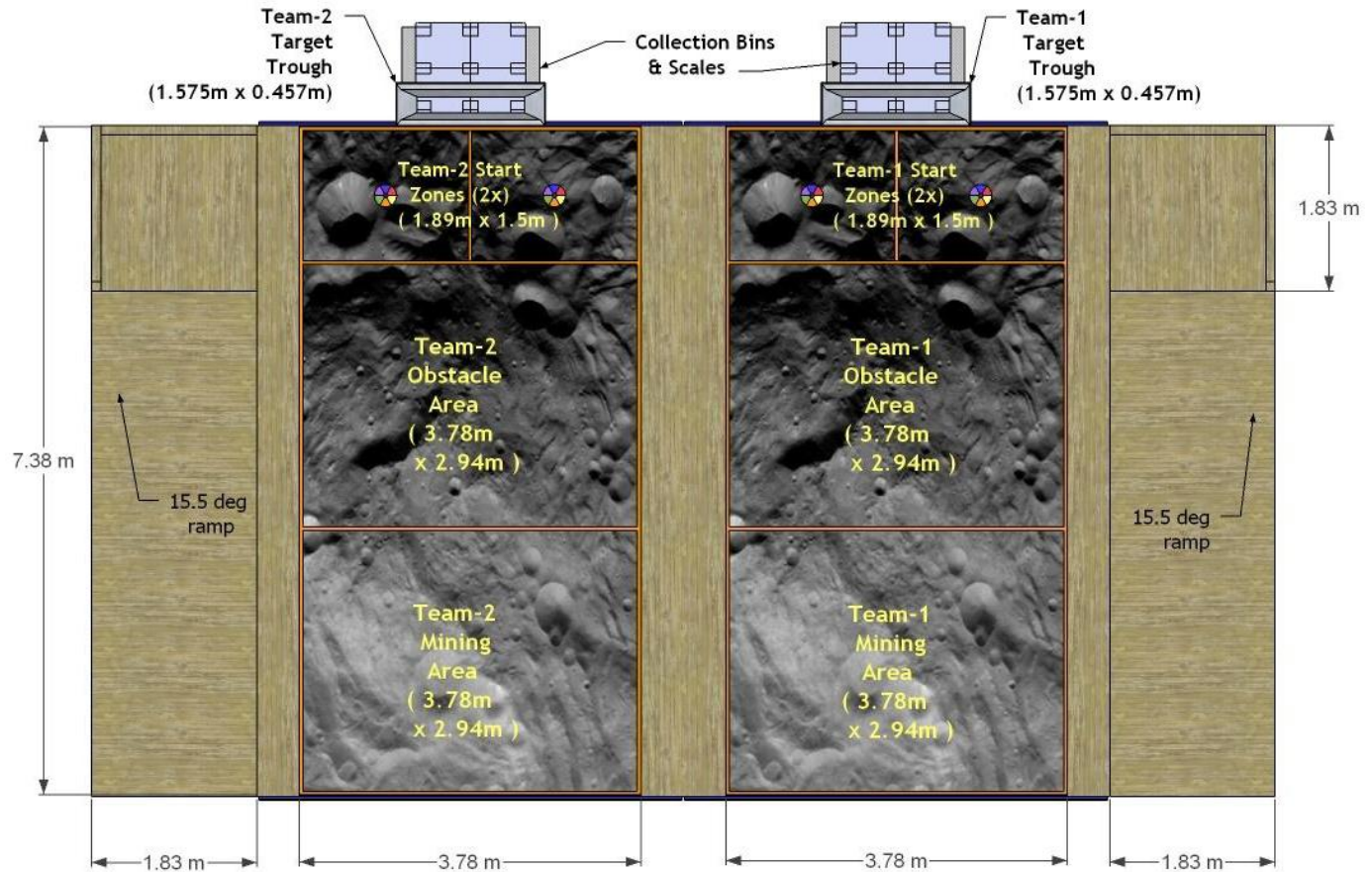


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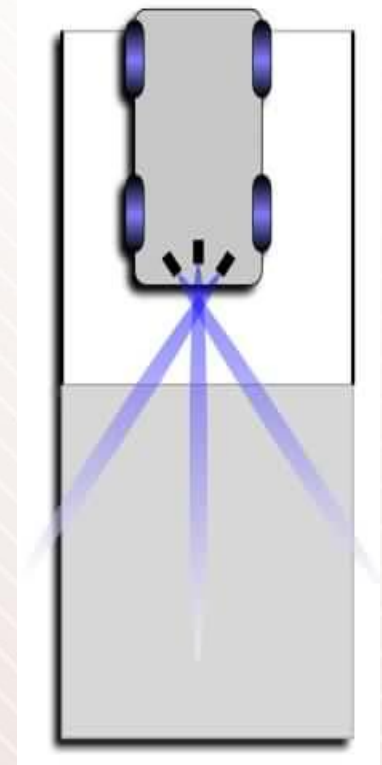
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The walls of the Caterpillar Mining Arena cannot be used for sensing by the robot to achieve autonomy.



NEW THIS YEAR

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NEW THIS YEAR



ICY-REGOLITH
SIMULANT
Gravel up to 2 cm.
in dia. will be
layered below the
surface of BP-1.

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- Gravel – May be mixed in with the BP-1 in small quantities, majority of will be 15 - 30 cm below mining area surface.



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TEAM FUNDING

Teams may apply for NASA grants
through their state's
Space Grant Consortium

Teams are encouraged to request
funds from

- Colleges & Universities; &
- Engineering Societies

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TEAM FUNDING

Teams are encouraged to
request funds from

- Private Industry
- Crowdfunding (ex: Kickstarter, Companisto, Indiegogo, FundAnything, Brainpool, etc.)

Estimate \$20,000 for materials, testing,
shipping, travel, etc.

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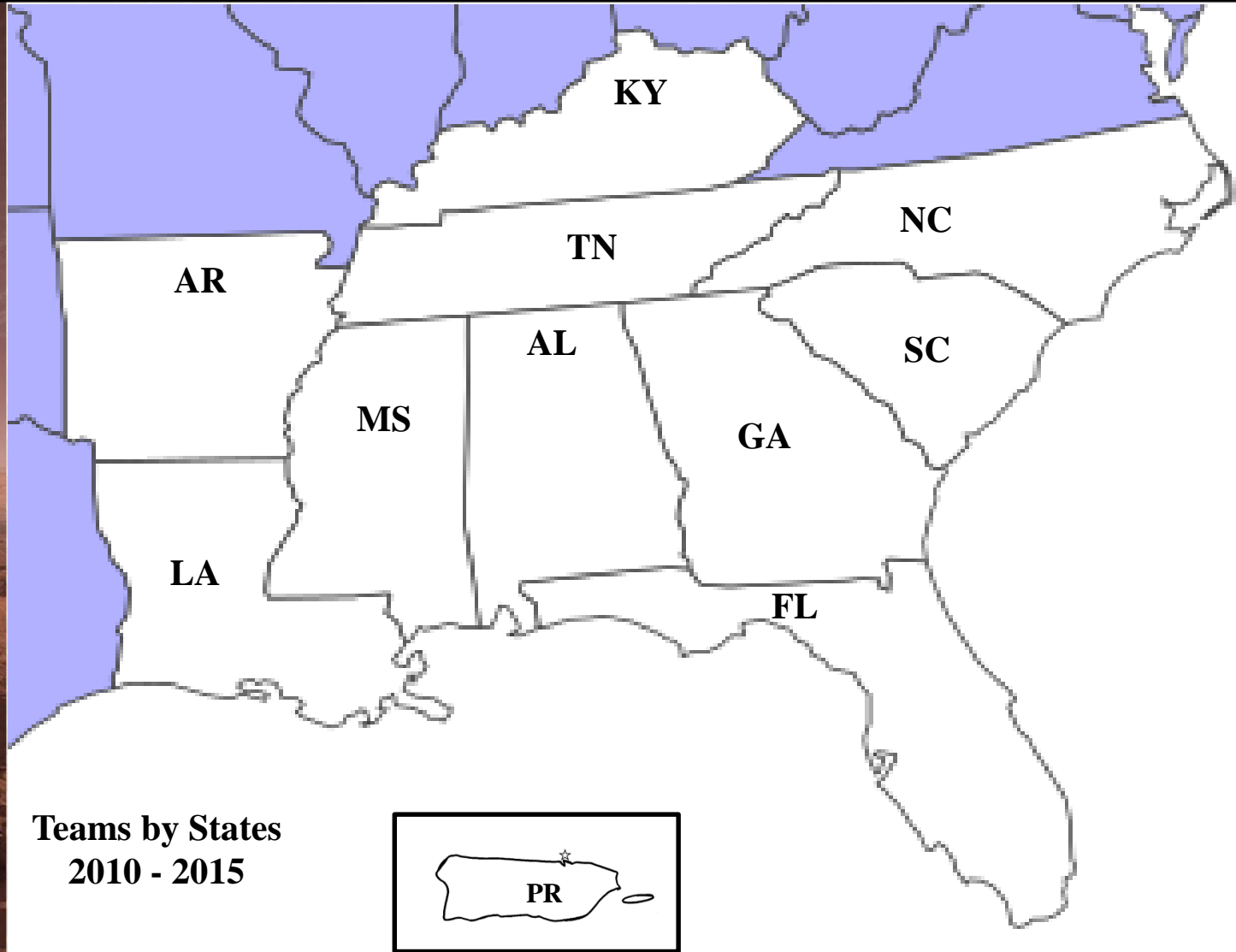
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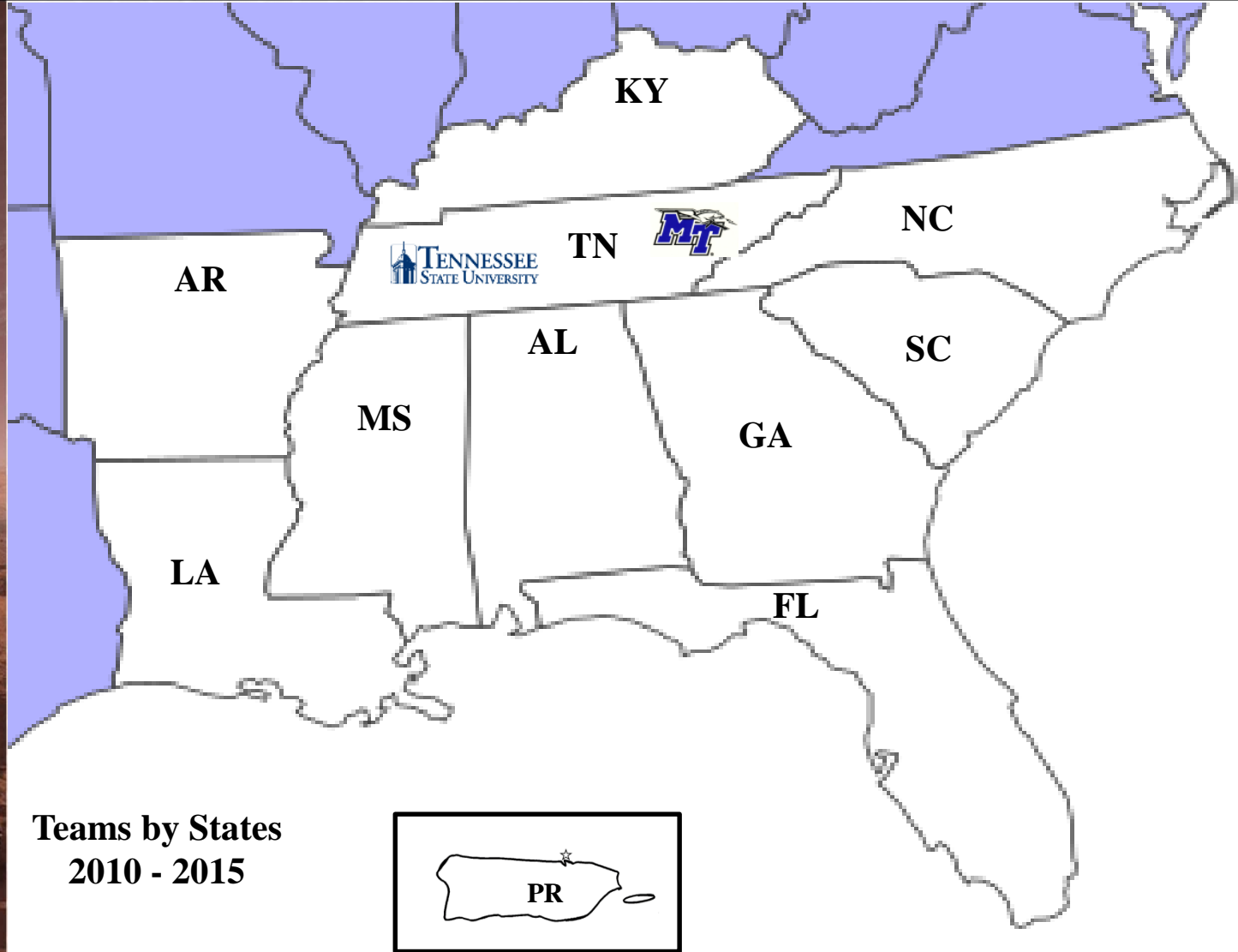
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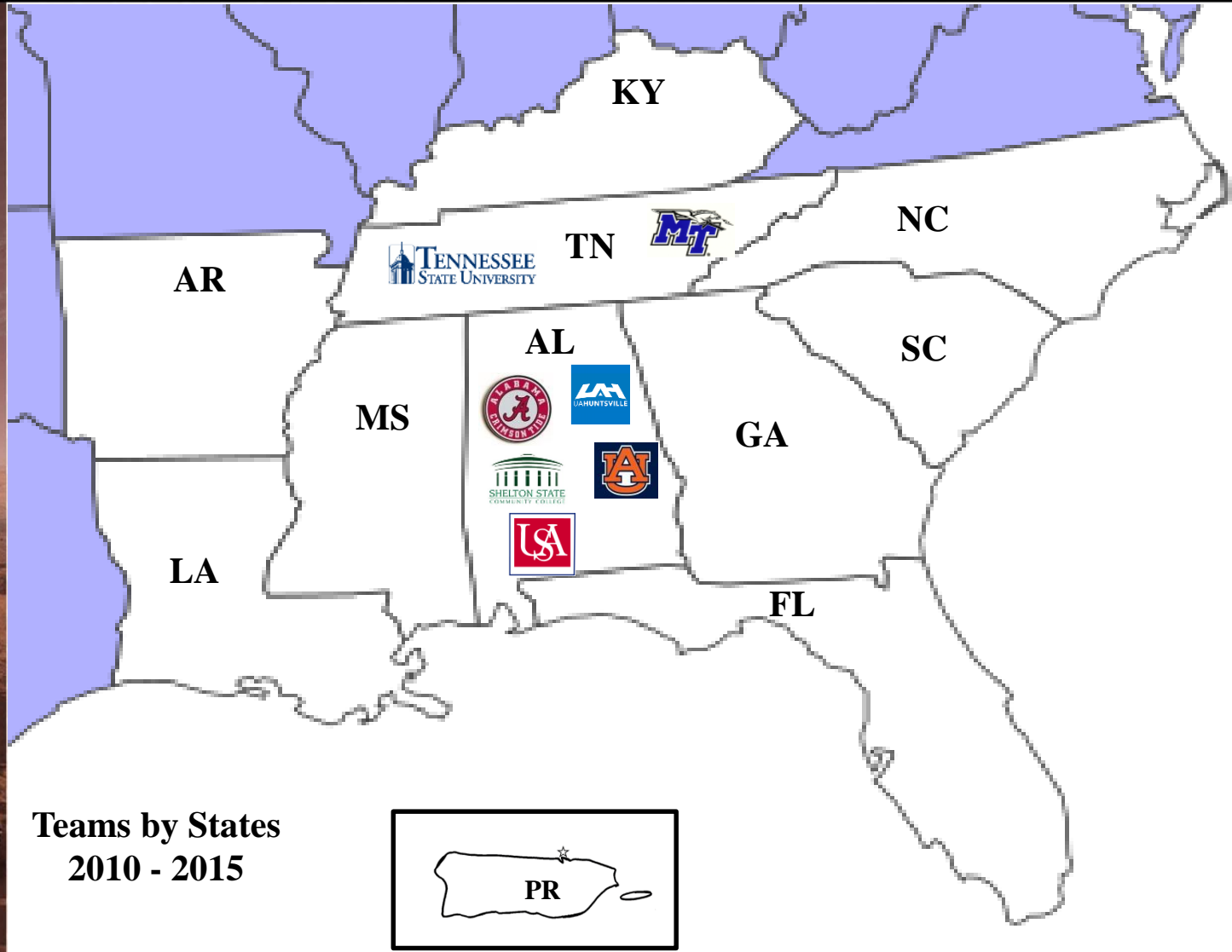
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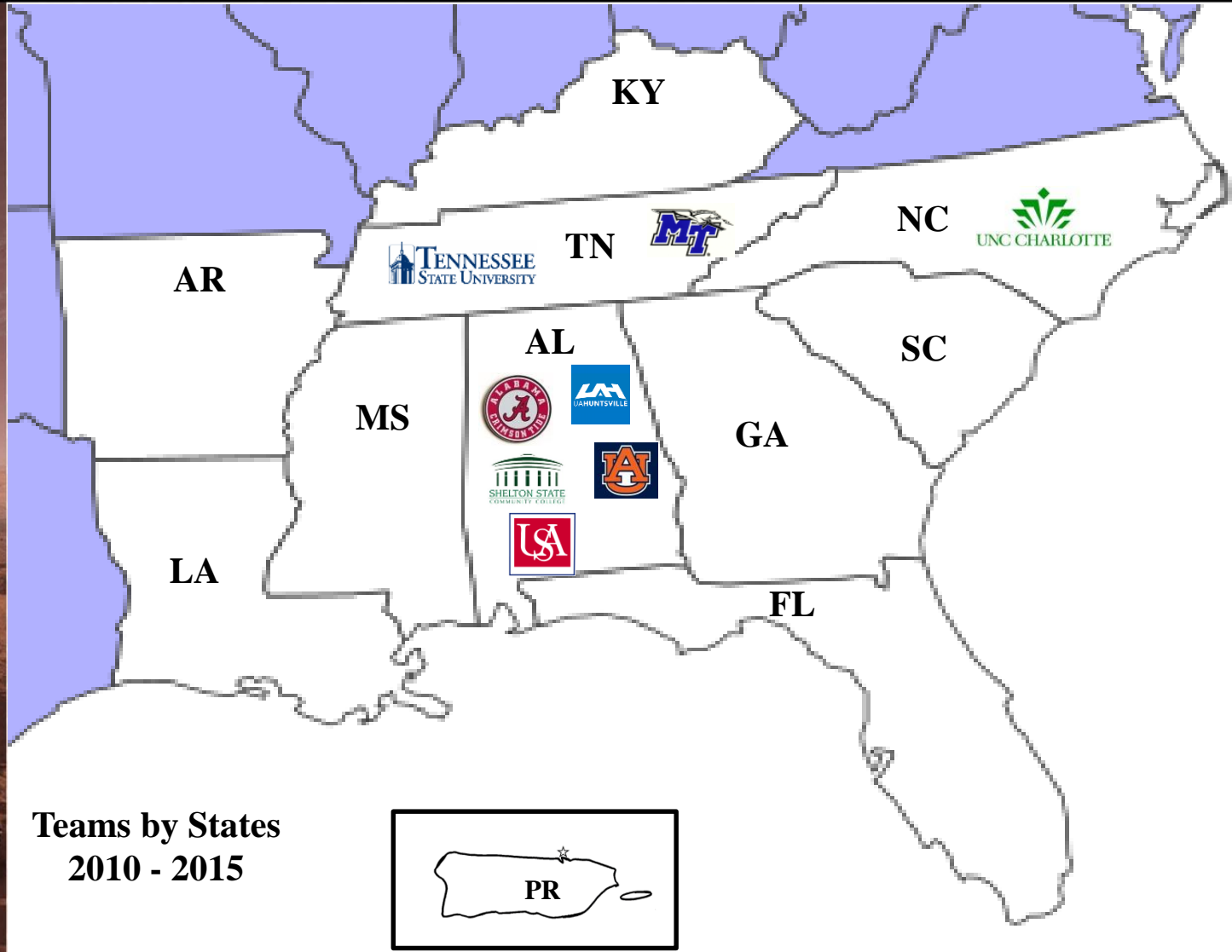
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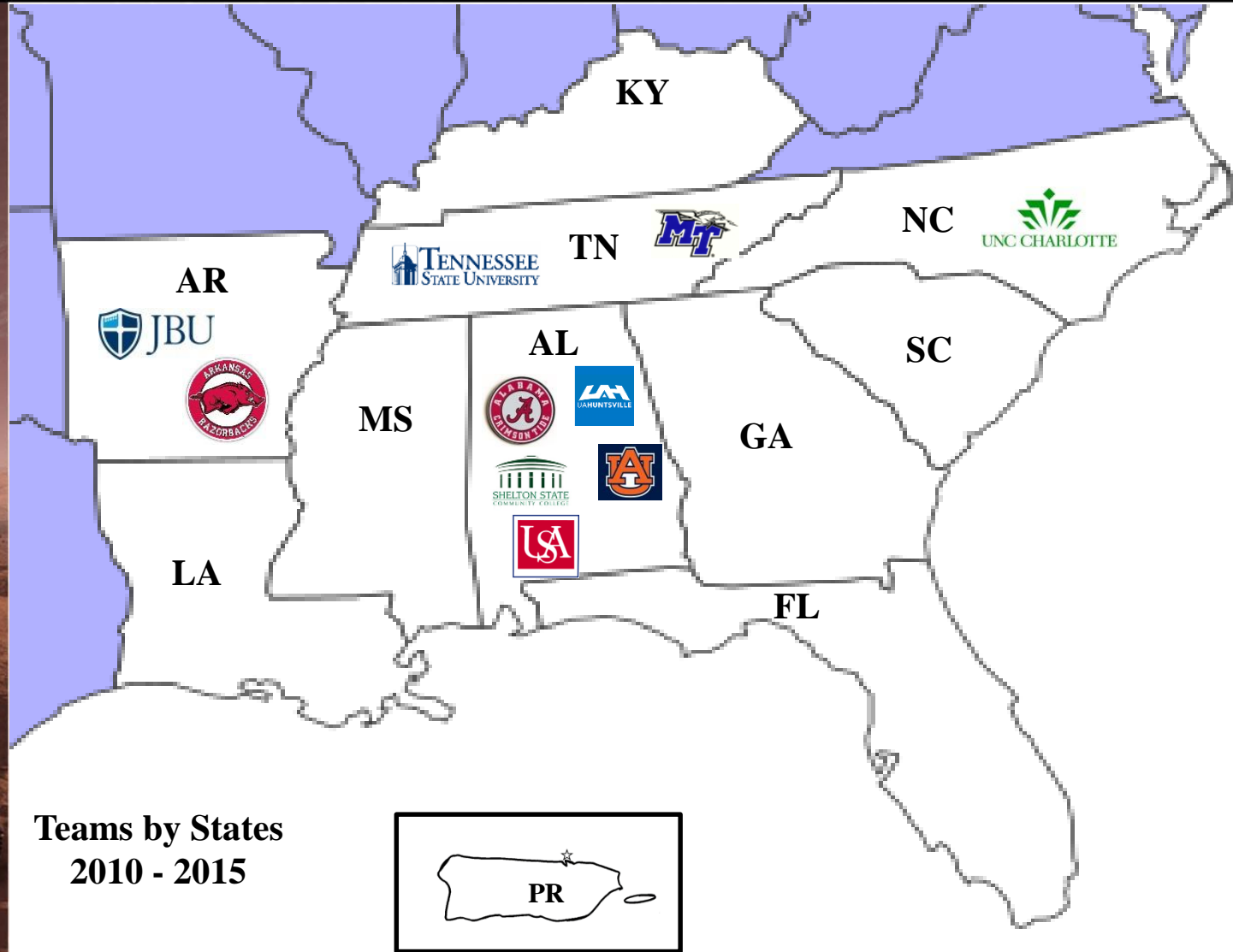
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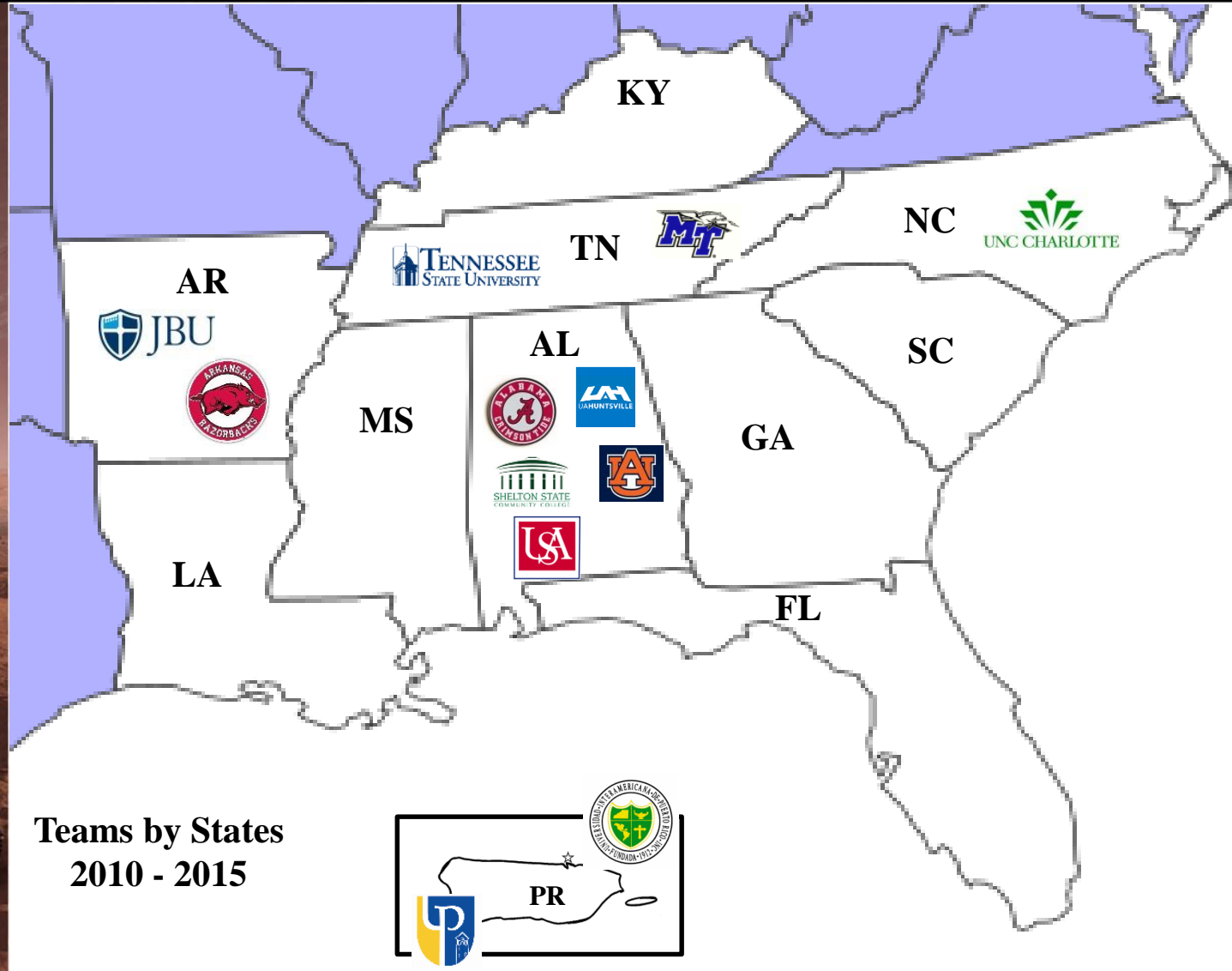
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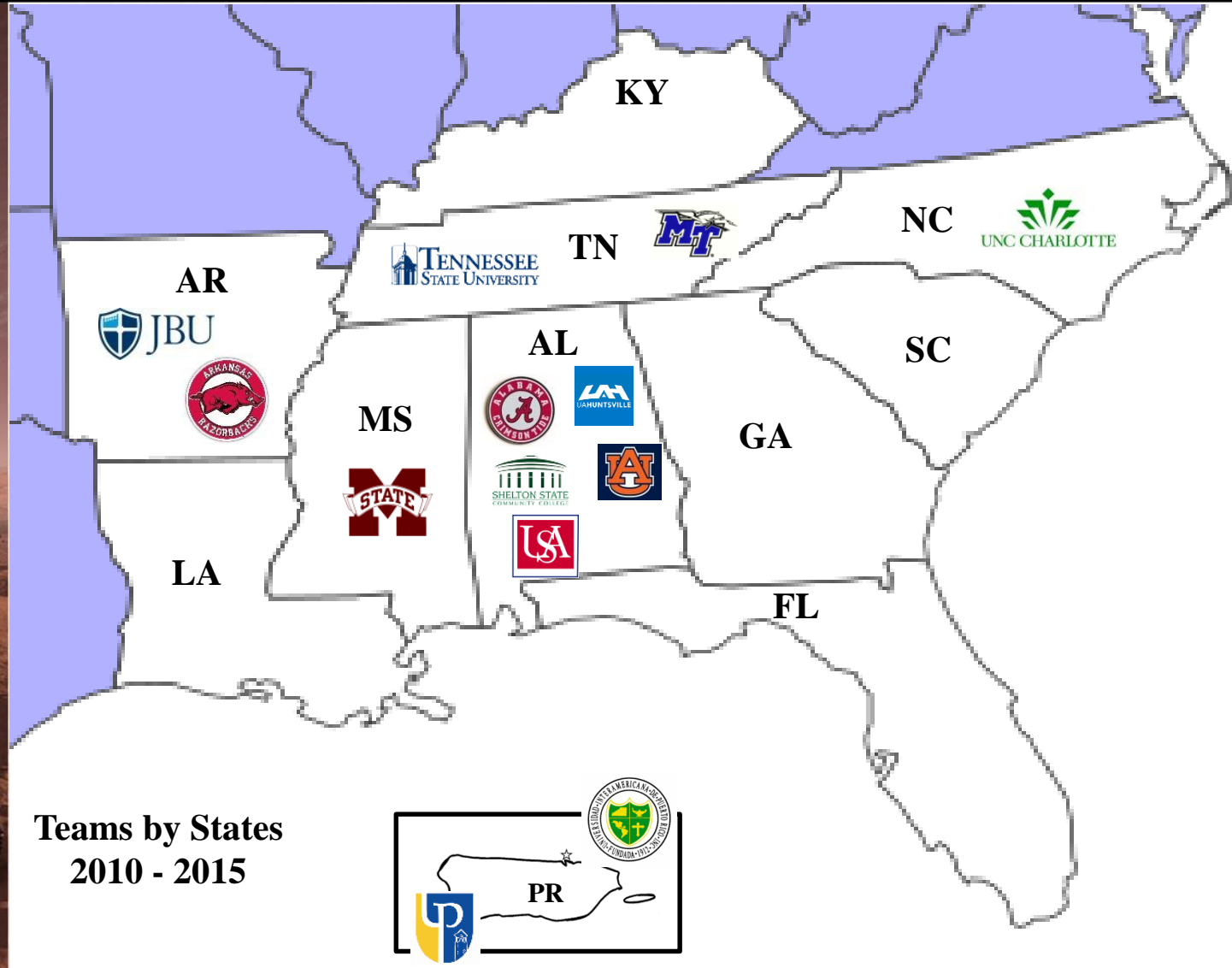
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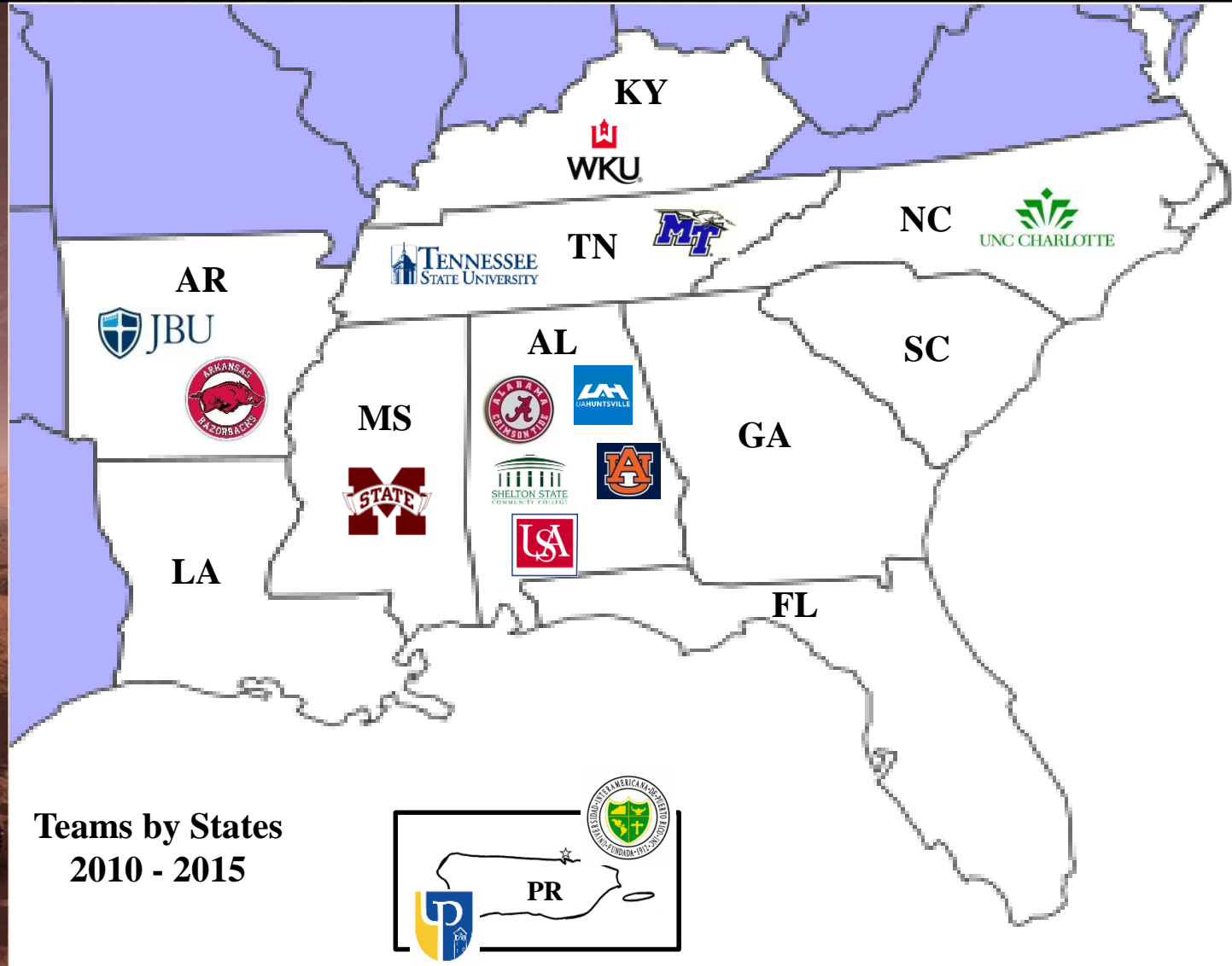
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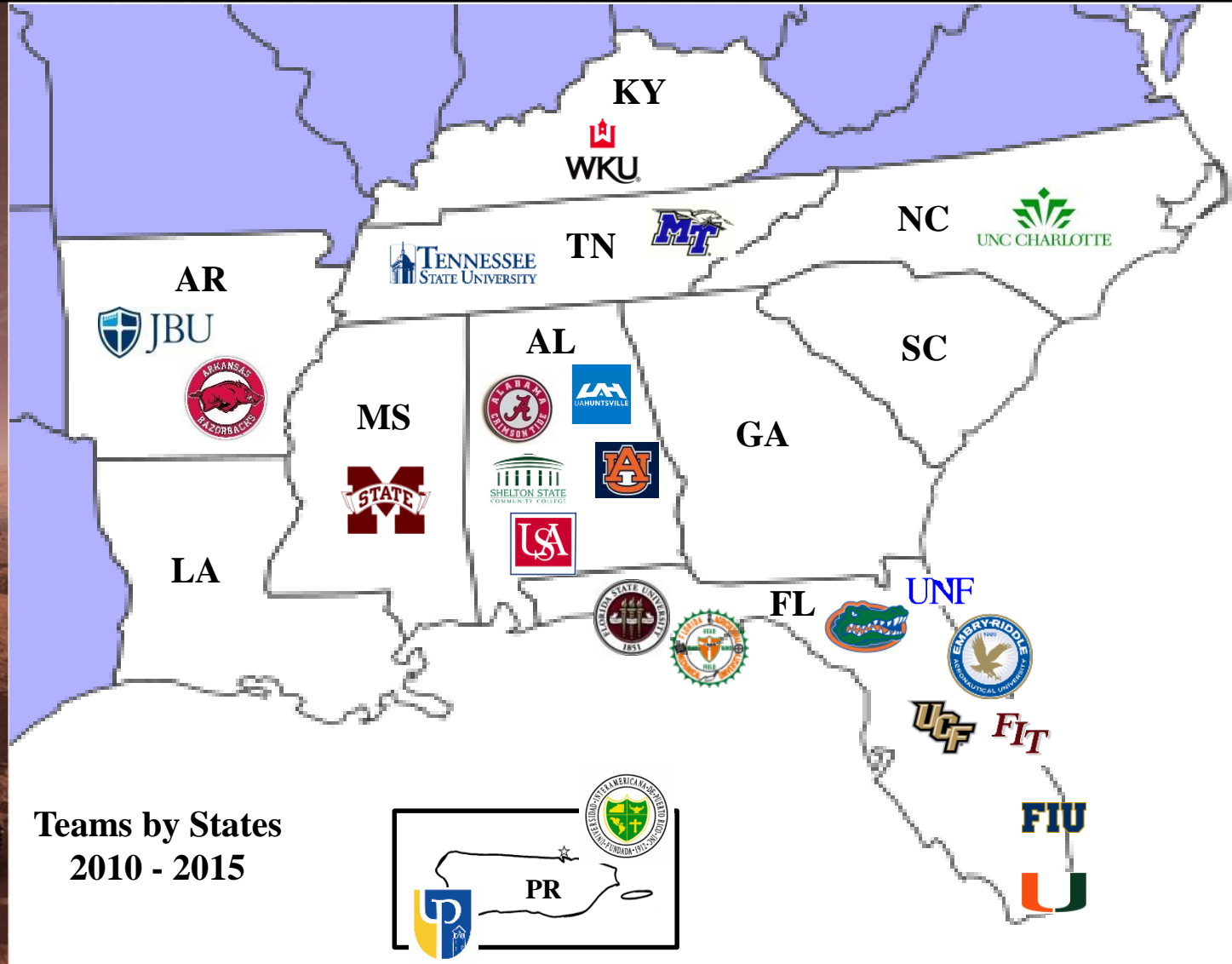
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List of US States that have participated in the RMC from 2010 - 2014

Region	No. of States	No. of States Sent Teams	Participation Rate
GREAT MIDWESTERN REGION	9	7	78%
MID-ATLANTIC REGION	7	3	43%
NORTHEAST REGION	7	3	43%
SOUTHEASTERN REGION	11	7	64%
WESTERN REGION	18	13	72%
Total	52	33	63%

Includes District of Columbia, Mid-Atlantic Region and Commonwealth of Puerto Rico, Southeast Region



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Southeastern Results

- **ALABAMA**
- **The University of Alabama in collaboration with Shelton State Community College**
- 5th Year Veteran and registered for 2015
- Joe Kosmo Award for Excellence
- 3x 1st Place Team Spirit
- 2nd & 3rd Place On-Site Mining
- 4x 1st Place Presentation and Demonstration
- 2x 1st Place Systems Engineering Paper
- 2nd Place Pit Pride Challenge

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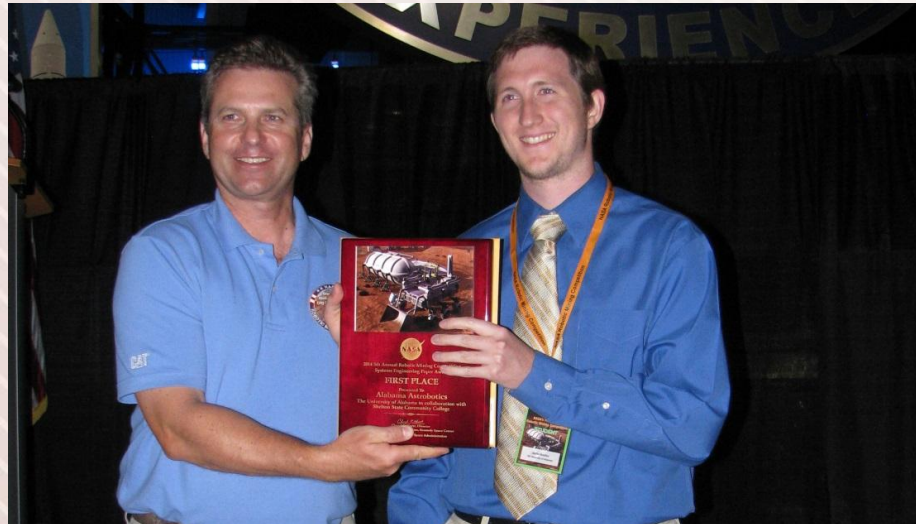


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Southeastern Results

- **Auburn University**
- 3rd Year Veteran and registered for 2015
- **University of Alabama, Huntsville**
- 2013 Rookie Team



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Southeastern Results

- **ARKANSAS**
- **John Brown University**
- 5th Year Veteran and Registered for 2015
- 1st, 2nd & 3rd Place Systems Engineering Paper
- 3rd Place Outreach Project Report
- 2nd Place Slide Presentation and Demonstration
- **University of Arkansas**
- 5th Year Veteran and registered for 2015

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Southeastern Results

- **FLORIDA**
 - **Embry-Riddle Aeronautical University**
 - 5th Year Veteran and registered for 2015
 - 1st Place Outreach
 - 1st Place Slide Presentation and Demonstration
 - **Florida Institute of Technology**
 - 5th Year Veteran and registered for 2015
 - Previous 1st Place Team Spirit
 - 2nd Place On-Site Mining

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Southeastern Results

- **Florida State University/FAMU**
 - 2nd Year Veteran
- **Florida International University**
 - 2nd Year Veteran and registered for 2015
- **University of North Florida**
 - 2012 Rookie Team
- **University of Florida**
 - 2nd Year Veteran and registered for 2015

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Southeastern Results

- **FLORIDA**
 - **University of Central Florida**
 - 1st Year Veteran and registered for 2015
- **KENTUCKY**
 - **Western Kentucky University**
 - 2nd Year Veteran
- **MISSISSIPPI**
 - **Mississippi State University**
 - 2014 Rookie Team

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Southeastern Results

- **NORTH CAROLINA**
 - **University of North Carolina at Charlotte**
 - 5th Year Veteran and registered for 2015
 - 3rd Place Presentation and Demonstration Award
- **TENNESSEE**
 - **Middle Tennessee State University** in collaboration with **Tennessee State University**
 - 4th Year Veteran and registered for 2015
 - 1st Place Mining Award Winner

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Minority Serving Institutions RMC Grant

Grants Available to MSI's

Two (2) Grants

Each Grant is \$25,000

Grant is designed to encourage and fund teams that otherwise would not have the opportunity

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DO YOU WANT TO KNOW MORE?

TYPE IN *“NASA Robotic Mining Competition”*

The Google logo, with each letter in a different color: G (blue), o (red), o (yellow), g (green), l (blue), e (red).

The Facebook logo, consisting of the word "facebook" in white lowercase letters on a dark blue rounded rectangular background.

The Twitter logo, featuring the word "twitter" in white lowercase letters and a white bird icon on a light blue rectangular background.

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For Complete Rules,
Rubrics,
FAQs &
Other Resources

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