Welcome To The Road Scholar Workshop

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THANK YOU

A special thank you to Bill Keiper, retired national event supervisor

Whom I have plagiarized shamelessly and mercilessly from his coaching clinic presentations
Outline For Today

Road Scholar Basics For New People
  Rules Review (Big Picture)
  Basic Skills
  Basic Tools
  Basic Coaching
  Resources

Road Scholar For Everyone
  Rules Review (Details)
  More Skills
  More Tools
  More Coaching Skills
  More Resources
The 'Original' Science Olympiad Event

First Science Olympiad sponsor: US Army
One mandatory requirement: map-reading skills event
WW I and WW II experience: Americans were not very good at reading maps compared to Europeans

*British damage control success during the ‘blitz’ due to detailed mapping/modeling*
Combination of topographic and other map skills
Road Scholar

1. Description: Teams will answer interpretive questions that may use one or more state highway maps, USGS topographic maps, Internet-generated maps, a road atlas or satellite/aerial images.

This event is more about skills than about memorization. This looks pretty broad but the skill sets needed are pretty well defined at the basic level. In general, a couple of maps of each type are sufficient to train the basic skills. Supplies needed to compete are minimal. Supplies needed to train are more expensive but still cheap in comparison to most events.
RS Rules

The basics

**Significant** updated rules this year
2 person team (you **really** want two)
Ruler, protractor, basic calculator, pencil is the minimum
No limits on reference materials except no computers

Don’t go crazy! The info needs to be in their heads
Paras 3.a., 3.b., 3.c., 3.d. are your lesson plan
Internet-generated maps and satellite/aerial images take
a little thought to plan training but skill sets are roughly
the same as topo or highway

Para 5 notes that some questions may be worth extra points
Odd note: para 3. a. viii. 3. Sector Reference System is an RS-
only thing. No public resources (Google, Wikipedia)
Basic Skills - 1

Read the map
Understand what the various parts of the map are telling you and where information is located
Comfortable looking at the map and finding your way around
Margin/legend info very important
Symbol sets for different types of maps
Reading contours on topo maps
Mileage charts/tables and markers on highway maps
Understand directions
Getting from one place to another

Be specific - Interstate, US, State, County highways, answers w/units, exact names if required (read the question)
Basic Skills - 2

Physical and math skills –

Write them correctly, they all have specific formats

See “Topographic Map Notes” on soinc.org
Latitude & longitude / PLSS / UTM location and coordinates
Sector Reference System (both number and direction formats)
Distances & scales
Azimuths & bearings
Slopes & gradients with sign (+ or -)
Apply magnetic declination
Map draws (know scale formats and computing)

New - Requires correct colors for the symbols
See “2019 Road Scholar Equipment” handout on sonic.org

Terrain profiles
Basic Skills - 3

Helpful hints

Computing lat/long, map scales and slopes are proportions
See the “Math in Road Scholar” handout on the sonic.org B/C Events tab
Read/write PLSS and bearings backwards
From/To are critical for slopes/gradients, azimuths/bearings
**Sectors** are **NOT** PLSS **Sections** and vice versa
Interstate-type highways with numbered exits are miles in most states
Topographic Map Tips

Heart of the event – mapping /modeling the physical world
Understand ‘up’ & ‘down’
‘V’ s of stream valleys
Contour lines
Margin information
Symbols - they’re standard; practice & learn them for speed
Remember most RS Lat/Long coordinates are “N” and “W”
Use the USGS on-line maps to see terrain variety for no $
New USGS topos (post-2010) incorporate satellite photos
Makes them harder to read in many cases

From a USMC training manual
Topo Slope/Gradient

Gradient vs. Slope

<table>
<thead>
<tr>
<th>GRADIENT</th>
<th>SLOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streams</td>
<td>Land</td>
</tr>
<tr>
<td>Elev change per 1000 ft</td>
<td>Elev change per 100 ft</td>
</tr>
<tr>
<td><strong>Bigger word/value</strong></td>
<td><strong>Smaller word/value</strong></td>
</tr>
</tbody>
</table>

Remember: either is positive or negative based on the direction [are we looking/going uphill (+) or downhill (-)]

Regional tests likely to address on simpler level (hill vs. valley, uphill vs. downhill, direction of stream flow, etc. without a calculation)

It will not always be per 1000’ or per 100’, read the question
PLSS - 1

Replaced the ‘metes and bounds’ system
Ohio territory was the proving ground (‘Seven Ranges’)
Keyed from 31 principal meridians and base lines in the contiguous USA
Townships
6 mi x 6 mi squares
North/South of base line
   (T) for Tier or Township
East/West of meridian
   (R) for Range

Sections
1 sq mile (not always)
*Bouystrophedonic* sequencing
640 acres
   (16 forty acre lots)
Reverse reference: the star ⭐
is in SE ¼, NE ¼, Sec 13, T2S, R2W

dnr.wi.gov/topic/forestmanagement/documents/plsstutorial.pdf
Basic Tools

Protractor, ruler, basic calculator, pencil is the minimum
USGS Topographic Map Symbols sheet

Other stuff

New – Colored pencils for map draw
Recommend clear 360° protractor and 305 mm/12” ruler
Two pencils with erasers and sharpened better than one
Standard function solar calculator
  No math beyond + - × ÷
Long (18-24”) paper strip or two
2-3 feet waxed dental floss for not-straight-line distances
Handouts as desired
Manila envelope to carry them in
Total cost – About $10
Coaching Tips – NOT COMPLETE, but as cheap as possible
Always start with a rules review with the students
Two basic map types used to train – topo & highway
  1-2 examples of each
  Internet maps and satellite photos later
    Highway map skills transfer well to Internet maps
    Satellite – time of day, interpreting shadows, distance from scale
Handouts and Internet resources
Things to practice
  Physical and math skills
  Reading the map
  Storyline vs straight questions
Coaching activities

Plan a lesson sequence in priority order
Free stuff – USGS digital, MDOT state highway
USGS digital maps can be printed in sections
  They’re PDFs, take a snapshot
  7.5’ quads will fit on four 11” × 17” or 8 8.5” × 11” sheets
  Single sheet will require large color plotter
  Engineering, surveyors and/or architectural firms
UTM lessons & handouts from USGS and Maptools
Maptools lessons require print & page settings
Save money by building your own skills exercises
May be able to get older topo maps free from a library
State highway maps from county road commission and AAA
Basic Coaching - 3

Coaching activities - cont

Buy training materials

Recommend NSO Road Scholar CD ($20 + ship)
Recommend one set of Other Worlds exercises like Maps and Robbers or Double Trouble ($20 + shipping)

http://www.otherworlds-edu.net/
Science Olympiad
Road Scholar Coaches Handbook

- Topo Maps
  - Marginal Info
  - Coordinates, Sectors
  - Symbols
  - Elevation, Control Data
  - Distances
  - Gradients
  - Directions
  - PLSS
  - Profiling
- Highway Maps
  - Features and Symbols
  - Mileage
- Appendices
  - Answers to questions
  - Sample Test
Coaching activities – cont

Tournament Day

Students need to know how and what questions to ask of the event supervisor
An adult needs to be responsible for equipment delivery
Send two even if one is a pencil carrier
What kind of test to expect
Don’t get bogged down on one question
Prioritize the questions, esp. difficult questions or high value
Debrief
Esp. things they hadn’t seen before
Resources

Internet
usgs.gov – very good maps, handouts, training help
soinc.org - NSO – fair-to-good, esp. for basics
scioly.org – good for students and the wiki for coaches
wikipedia.org.org – good some topics
maptools.com – very good on UTM, tools available
otherworlds-edu.net – good practice materials
Google Maps & Earth, Mapquest

Other resources
Centerville Coaching Clinic – generally very good
NSO CDs – Bio/Earth CD so-so for RS, all CDs very good
for some events, so-so on others; national tests useful
Invitational tests
Road Scholar Details For Everyone
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Rules Review

**Significant updated rules this year!**


2. b. - Relaxed container requirement

3. a. iii. – Metric topo maps exist

3. a. v. – Answer in ranges if between contours, do not include the contour values if not on the line

3. a. viii. 1. – Know what aliquot parts are

3. a. x. – Be able to apply declination to azimuth or opposite

3. a. xii. – L/L values at tick marks incomplete: missing degrees, sometimes seconds. UTM values can be missing
3. c. i. - You may be asked to determine the scale and write it.
   Verbal or representative fraction
   Verbal: 1 inch equals approximately 2.3 miles
   Representative fraction: 1:24000
   May have to measure the square, check both inches and millimeters
3. c. ii. - Added requirement for correct colors as well as symbols
3. d. ii. – Know where to find distance scales
3. d. iii. – The shadows show time. Where’s North?
3. d. v. – Smart way to drive? Watch for the one-way streets
4. b. - May have to figure out correct lines
More Skills

Things top competitors have learned

Test skills

TLAR – “That Looks About Right” allows you to spot your mistakes, e.g., Lat/Long

Read the WHOLE question

Don’t get hung up on one question

Check for point values; do hard, low points questions last

Check question number against answer sheet number

OFTEN!

Be specific

Interstate, US, State, County highways with number

Complete answers w/units, exact names if required

(read the question)
More Skills - 2

Things top competitors have learned - cont

Test skills
  If finished early, RECHECK!
  Team management – specialists, reader/mapper, TLAR checker, NO bickering
  Map draws by best PLSS person
  You need a plan and clear assignments for storyline tests
  Talk very quietly, use hand signals if possible
  Ask the event supervisor for clarifications and about possible errors
  Practice together
More Skills - 3

Things top competitors have learned - cont

Map skills
- Practice enough to be able to analyze what’s being asked and how to do it
- Use and understand different map scales (1:100000)
- Internet maps and photos
  - Where to find the scale, symbology, leaf on/leaf off, determine time of day, standard terrain and man-made structures
- Know alternate North references for azimuths/bearings
- Slopes & gradients based on other than 100’/1000’
- PLSS sections not necessarily square or 1 mi²
- Do some timed practices
Things top competitors have learned - cont

Map Skills – cont

Where do highways start and end on highway maps
Understand L/L, distance scales and slopes are proportions so you can solve for other variables
Fast with contours, recognize uphill/downhill
Bearings always start or end as azimuths
Profiles require both people
Proportions - 1

Lat/Long

\[
\text{mm to object} = \text{sec to object}
\]

\[
\text{mm to known dist (e.g., 2.5’/150’’)} = \text{sec to known dist (150)}
\]

Distance/Scales

\[
\text{measured mm} = \text{measured mi/ft/km}
\]

\[
\text{mm to known dist (scale, e.g., 2 mi)} = \text{known dist (scale, e.g., 2)}
\]

Slope/Gradient

\[
\text{actual elev change (ft/m)} = \text{elev change (ft/m) per actual run dist (same units)} = \text{some std dist (same units, e.g., 100)}
\]

For miles, use 5280 w/ft; for km, use 1000 w/m
Slope/gradient run distances converted to ft/m
Notes

Standard RS formulas move RH denominator to LH numerator by cross multiplication.

If you know how this is done and any three elements, you can solve for any unknown.

E.g., you can get L/L mm to convert a L/L to a point on the map by:

$$\frac{\text{mm of L/L}}{\text{mm of measured sec}} = \frac{\text{Sec of L/L}}{\text{Measured seconds (e.g., 150)}}$$

*Cross multiply to get:*

$$\text{mm of L/L} = \frac{\text{Sec of L/L} \times \text{mm of measured sec}}{\text{Measured sec (e.g., 150)}}$$
More Tools List

Fan of Maptools products

- Land Sectioning (PLSS) template is crucial ($8)
- UTM grid card is very good, close to crucial ($3)
- UTM slot card is very accurate but requires practice ($3)
- Map ruler is very good but has limits ($5)

These are all set up for 1:24000
They are good for reducing time and improving accuracy with practice

Magnifying glass is crucial with some tools and on some maps, esp. in mountainous areas

Total cost including basic tools - $30
More Coaching Skills

Coaching tips
Measuring not-straight-line distances is hard, practice!
IF you get a MapWheel, requires a lot of care to use right
Easy to DIY map draw exercises, use different size squares to
get scale practice. Also, L/L, slopes, az/brgs, UTM, PLSS
Picking a compatible pair is very close second to good skills
If you have enough students, may have to test on to the
competitive team
Topo maps 2010 and later are missing numerous features
that are on earlier maps
Check USGS Maps and Mapping FAQs or see handout
More Resources

Stuff available electronically from me
  Assorted handouts
  Invitational tests
  RS event scoring spreadsheet & ES guide
Running An RS Event

Plan ahead!

Very time-consuming to do it right
See the “Event Supervisor Tips” handout at B/C Events tab at sonic.org

Decide on test type – storyline vs questions only
In depth or pretty easy, what topics to cover

Pick your maps and procure, start selecting questions
All one point questions or some multi-point and scoring rubric
Plan out your tie breakers – you will need them
Build separate answer key

Transparency to grade profiles and map draws

At tournament, you WILL need help to run and score (esp.)
Prep your help if possible – amateurs willing but dangerous
Check, recheck and rerecheck!!! You WILL make mistakes!!!
Competition Statistics

Data from 2008-12 Cinc/Piqua Regional & OH State Competitions

Percent of questions answered correctly (blue)

Common theme of weak areas: **math**
UTM

24 Horizontal Zones
- no "I" or "O"
- A/B south of 80°S
- Y/Z north of 84°N
- X = 12° of latitude
- Others = 8°

60 Vertical Zones (6° Longitude)

35
Student Profiles

Profiles

Two common methods:

Make a list (12 mm: stream / 14-18 mm: woods / 22 mm: contour = 120° / etc.)

OR

Scrap paper ruler (don't start at an edge for easier measuring)

Annotate each contour/feature crossed at the specific distance
Profiles - cont

On the answer grid, leave a contour line above and below the extreme points to be graphed
Assess the horizontal scale difference between map and graph space
Transfer the points to the profile graph
Okay to provide natural curves – just intercept the elevation lines at the right spot (mark the dots, connect the dots); some judges may want hilltops not ‘mesas’, and stream channels.
Remotely Sensed Imagery

Transition to Div C Remote Sensing event
Introduces Geographic Information System (GIS) technology

Uses:
- Color of the landscape
- Details of vegetation (trees vs. fields)
- Details of development (parking lots, complex buildings)

Implement with care!

Satellite image or aerial photo ≠ orthoimage/orthophoto

What is the difference?
Effects of tilt & relief require rectification

- Image and media quality issues
- Standardization (lack thereof)
- Subjectivity and interpretation

Examples: WSU - Troy OH – Norden
Some General Notes

SO is as much about the preparation as the competition
Moderation in all things
Students in control as much as possible
Coaches are there to allow students to learn
    Coaches do provide resources
A little fun now and then is not fatal
It’s about the science; this is cool stuff
This is a cheap event compared to most others
Only The Beginning

QUESTIONS, COMMENTS, SNIDE REMARKS?