SCIENCE OLYMPIAD

Exploring the World of Science

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

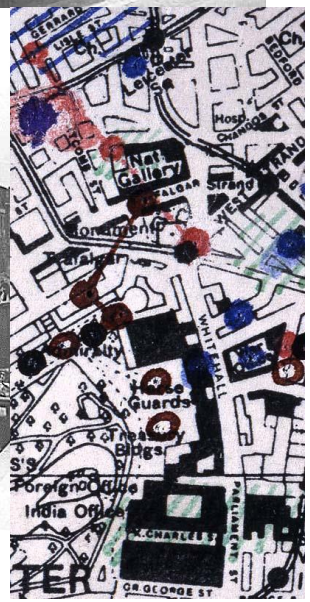
First Science Olympiad sponsor: US Army

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

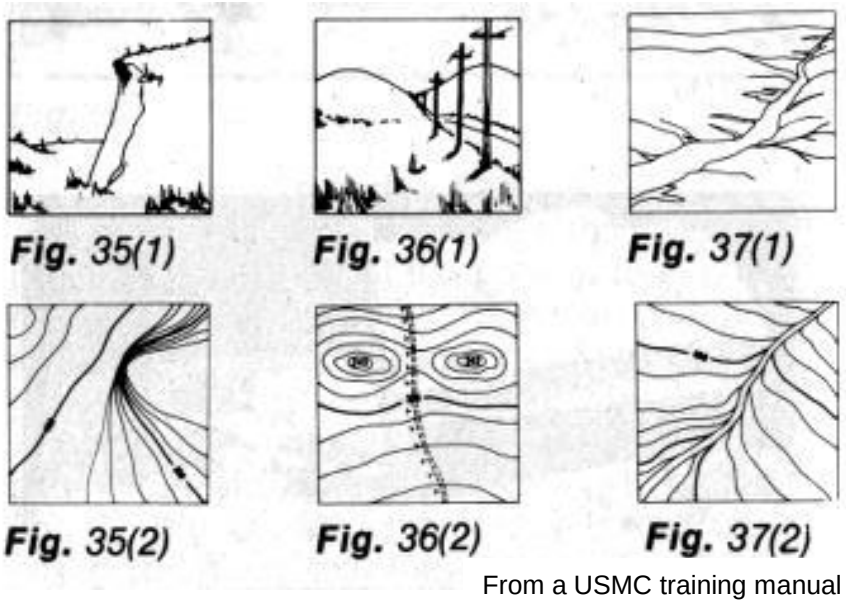
Topographic Map Tips

Heart of the event – mapping /modeling the physical world

Understand ‘up’ & ‘down’

- ‘V’s of stream valleys
- Contour lines

Margin information



From a USMC training manual

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

Topo Slope/Gradient

Gradient vs. Slope

GRADIENT	SLOPE
Streams	Land
Elev change per 1000 ft	Elev change per 100 ft
Bigger *word/value*	*Smaller word/value*

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)

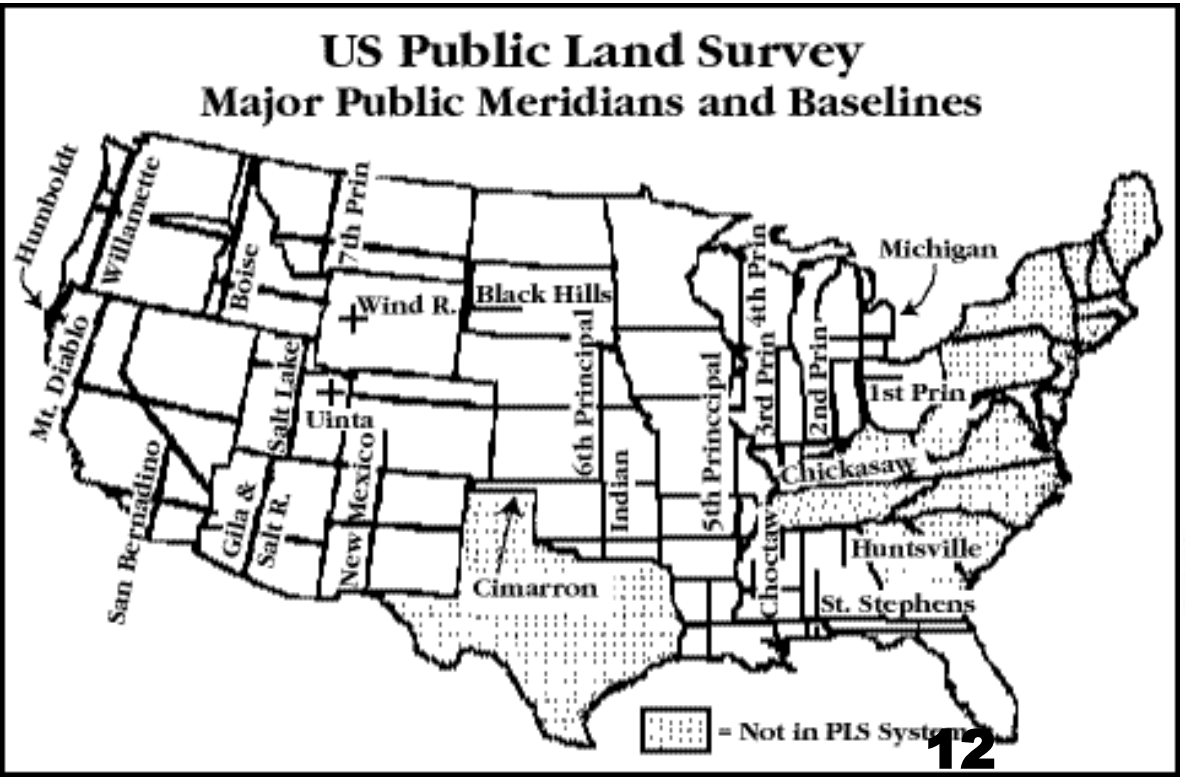
It will not always be per 1000' or per 100', read the question

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



PLSS - 2

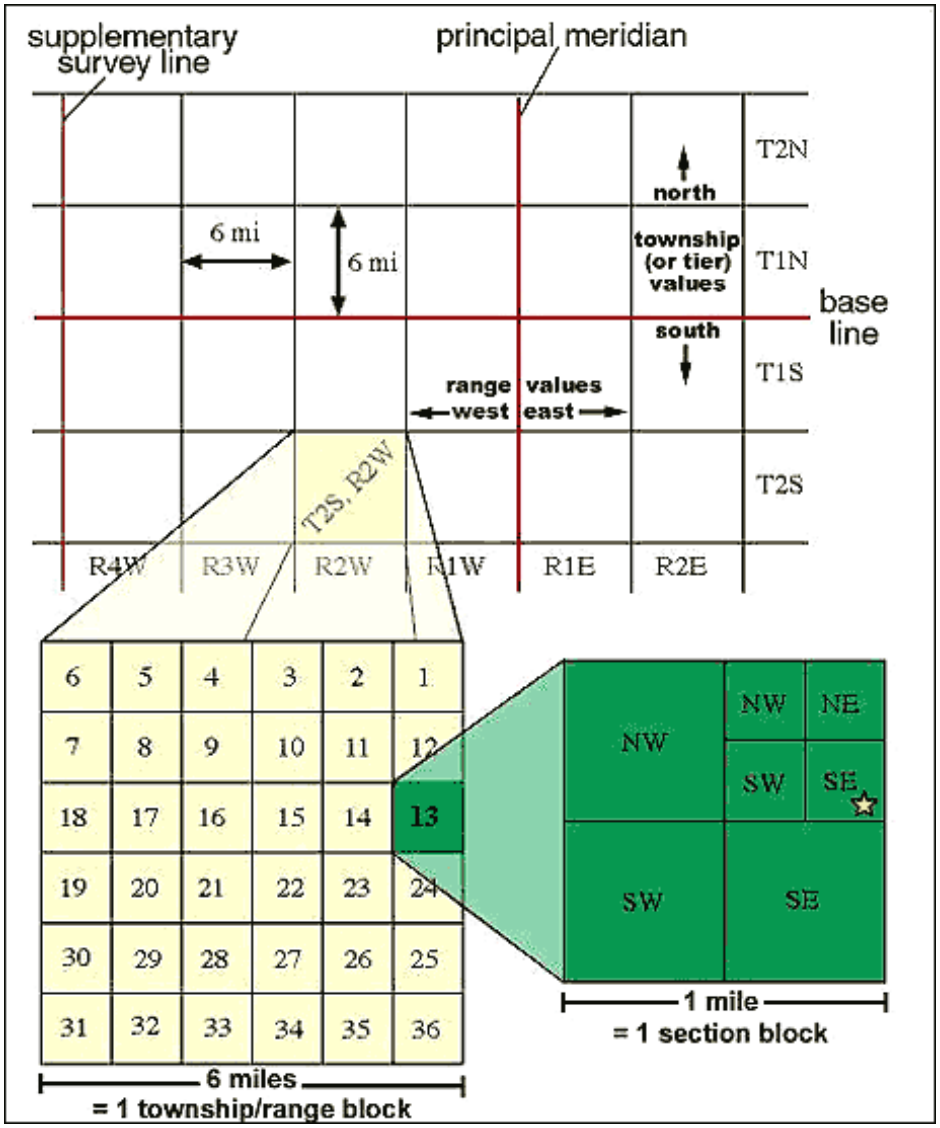
Townships

- 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)
- *Boustrophedonic* sequencing
- 640 acres
  - (16 forty acre lots)
- Reverse reference: the star ☆ is in SE ¼, NE ¼, Sec 13, T2S, R2W

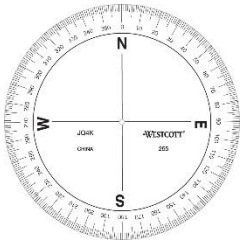
dnr.wi.gov/topic/forestmanagement/documents/plsstutorial.pdf



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

Basic Coaching - 1

- 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

Basic Coaching - 2

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

and now a very unpaid commercial announcement -

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/

and now another unpaid commercial announcement -

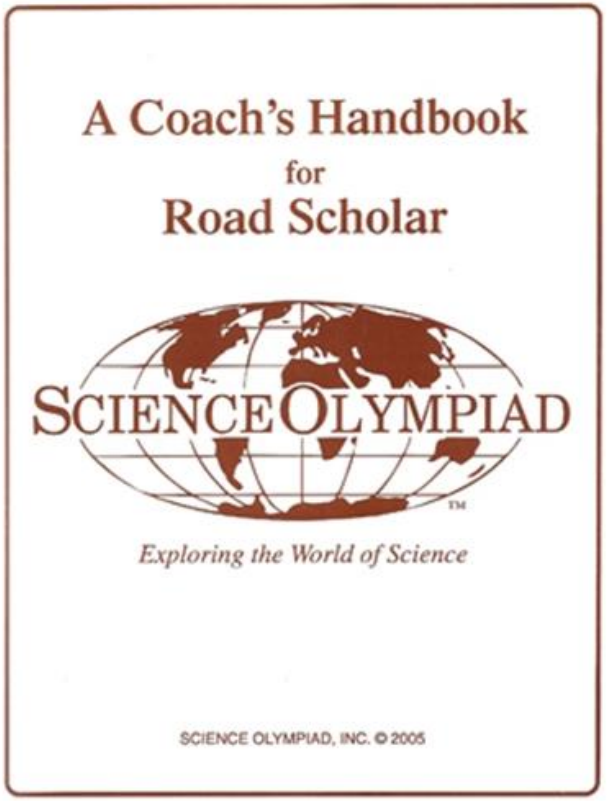
Science Olympiad Road Scholar Coaches Handbook

- 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**

Practice questions illustrating the concepts in each section/lesson

Sample Topo & Hwy maps (1 ea.)

NO UTM!



Basic Coaching - 4

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 – 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 for All

Road Scholar Details For Everyone

- Rules Review (Details)
- More Skills
- More Tools
- More Coaching Skills
- More Resources

Rules Review

<u>Significant updated rules this year</u>!

2. a. Calculator requirement change reflects language in new "Calculator Guide" (see Policies tab at sonic.org).

Added colored marking devices (pencils) for para 3. c. ii.. See "2019 Road Scholar Equipment" on B/C Events tab.

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

Rules Review - 2

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 mi^2
  - Do some timed practices

More Skills - 4

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

$$\frac{\text{mm to object}}{\text{mm to known dist (e.g., 2.5'/150")}} = \frac{\text{sec to object}}{\text{sec to known dist (150)}}$$

Distance/Scales

$$\frac{\text{measured mm}}{\text{mm to known dist (scale, e.g., 2 mi)}} = \frac{\text{measured mi/ft/km}}{\text{known dist (scale, e.g., 2)}}$$

Slope/Gradient

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

For miles, use 5280 w/ft; for km, use 1000 w/m

Slope/gradient run distances converted to ft/m

Proportions -2

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:

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

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.)

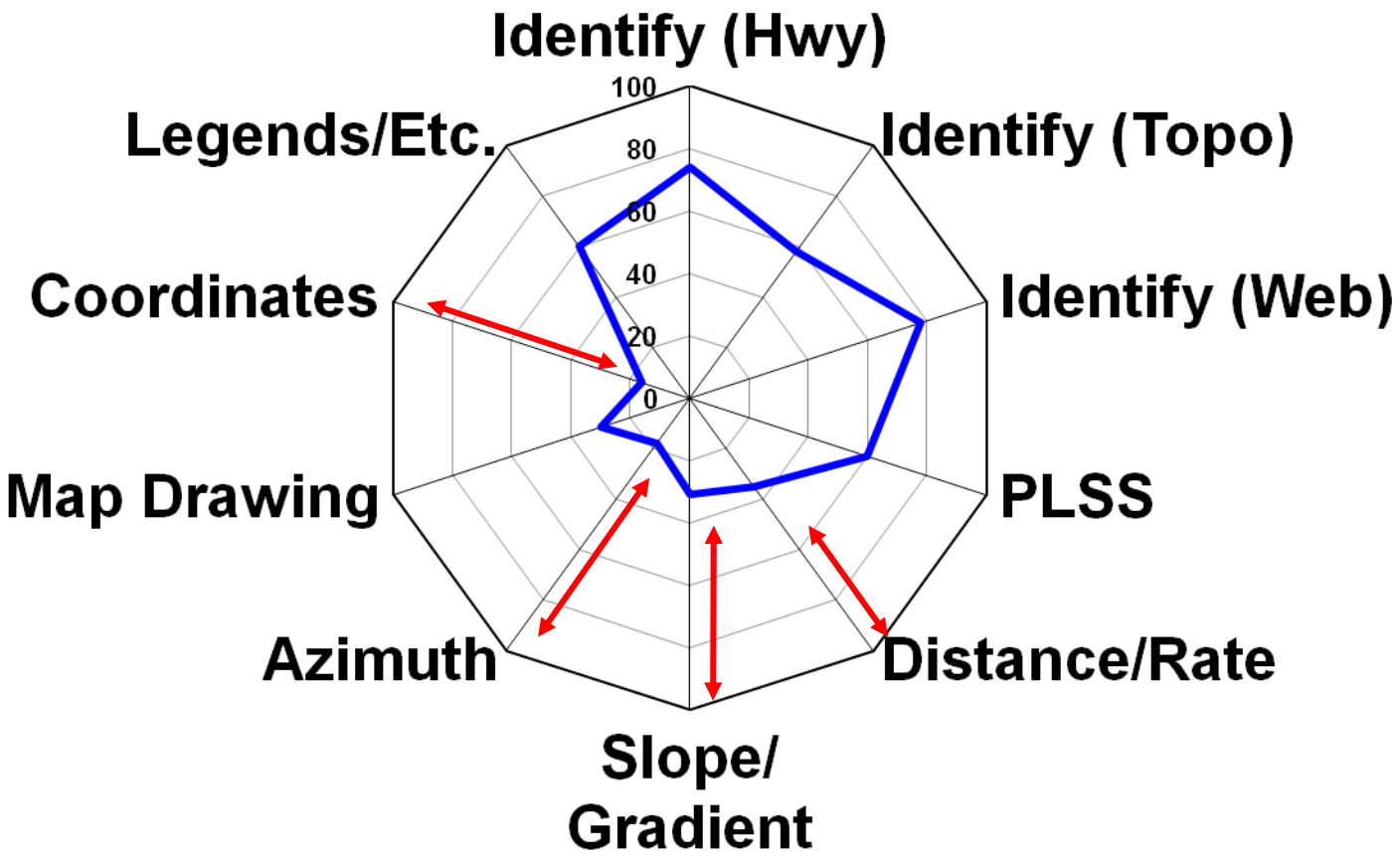
Prep your help if possible – amateurs willing but dangerous

Check, recheck and rerecheck!!! You WILL make mistakes!!!

Competition Statistics

Percent of questions answered correctly (blue)

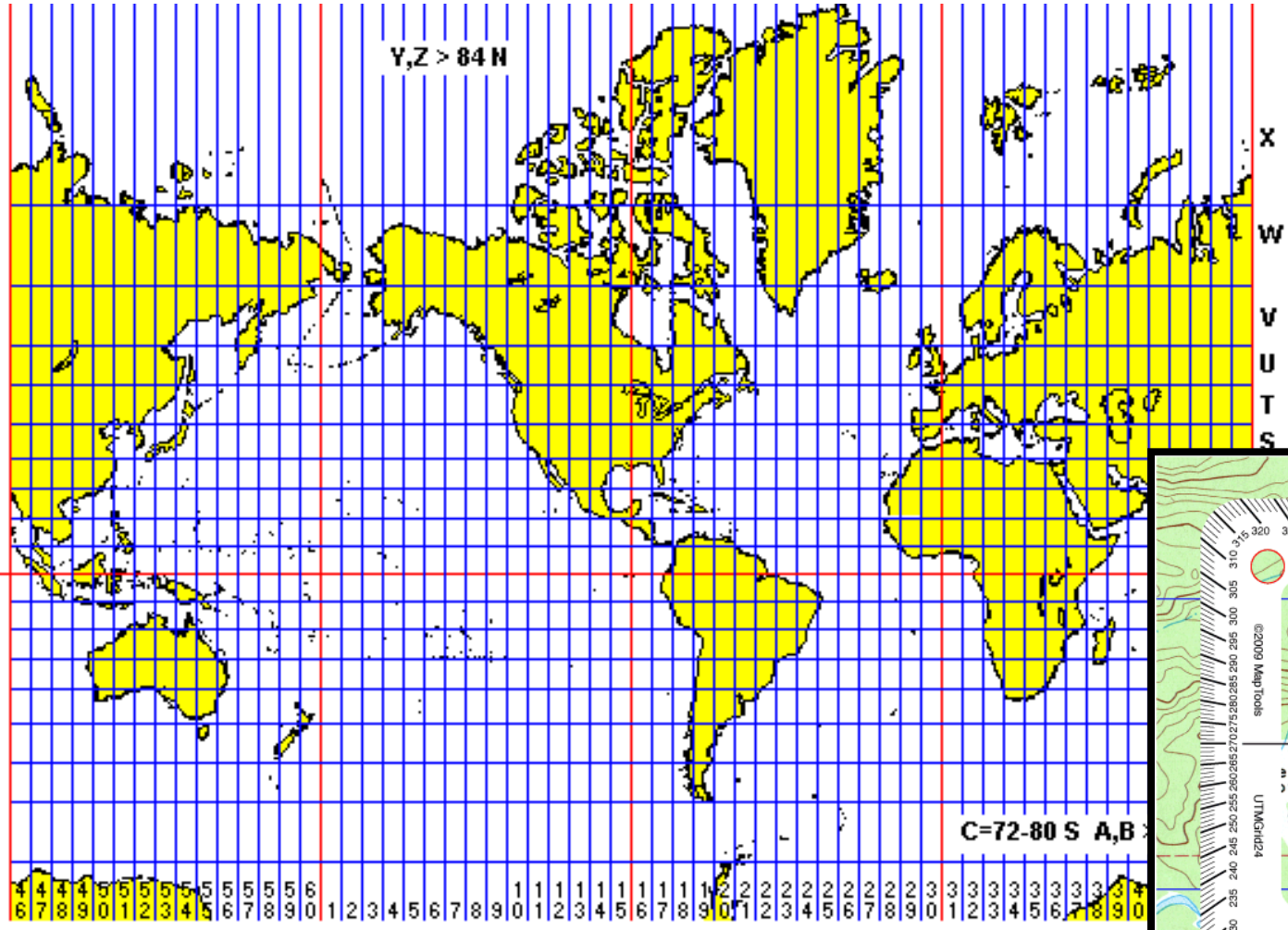
Data from 2008-12 Cinc/Piqua Regional & OH State Competitions



'Identify' = identification of a feature, symbol, route, direction, location, etc.

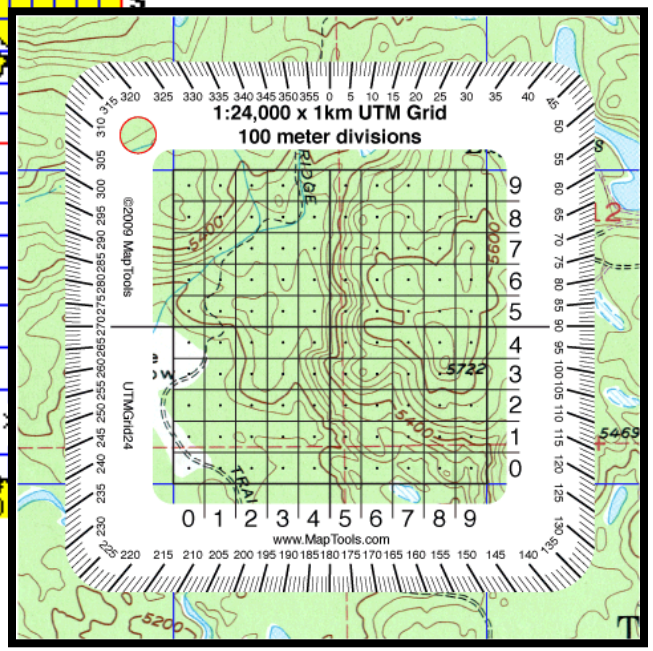
Common theme of weak areas: ***math***

UTM



24 Horizontal Zones

- no “I” or “O”
- A/B south of 80ºS
- Y/Z north of 84ºN
- X = 12º of latitude
- Others = 8º



60 Vertical Zones (6º Longitude)

Student Profiles

Profiles

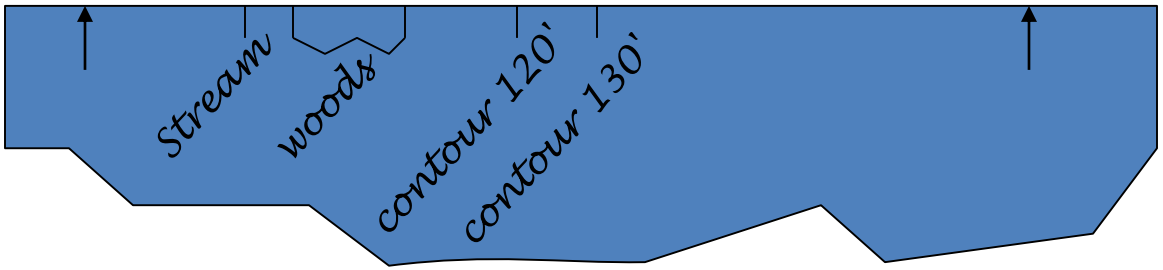
Two common methods:

Make a list (*12 mm: stream / 14-18mm: 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



Student Profiles - 2

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)

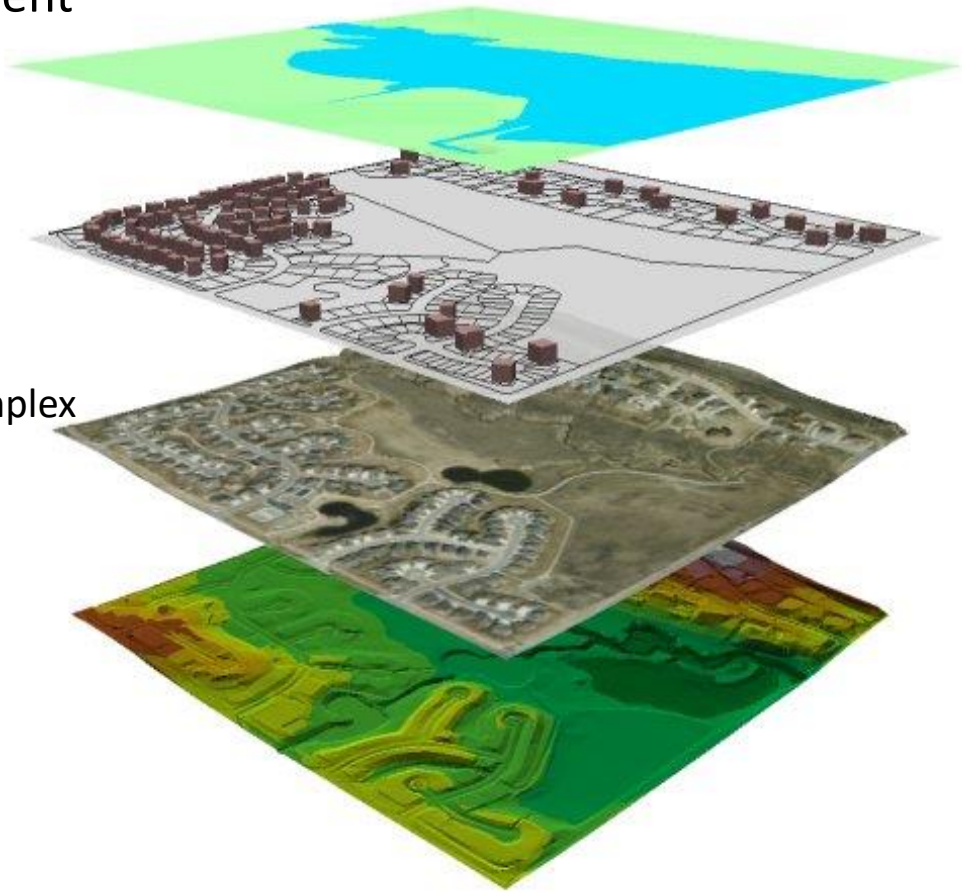
Implement with care!

- **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?