GPS Wisdom doc for Ian

# Module structure and key components:

The module will have roughly 7 units (Correct?). The module will have an instructor overview sheet (detailed below). The module will probably also have a field and data manual (potentially one for each type of GPS system).

General rule: references to time should be in hours, not “the morning” as this will make the module more adaptable to different settings (classroom vs. field).

## Each unit will need:

* Instructor overview sheet (detailed below)
* Student exercise (detailed below)
* Powerpoint presentation (optional)
* Supporting documents
* References/ resources

## Instructor overview sheet: one for each unit and one for the module as a whole

Make on the template for UNAVCO field education materials (Beth PS can send). Use headings and subheadings to make navigation easier.

* Introduces the material to an instructor and guides them on teaching the material
* Consist of a summary, learning outcomes, teaching objectives, context for use, detailed description, teaching materials list, teaching notes and tips, assessments (formative and summative), and a resources list.
	+ Summary: This section provides a compelling description of the activity. It should make it clear what the activity is without assuming the reader is familiar with the surrounding module. It should provide an overview of the things that students will do and the intended outcomes. The description should be concise and compelling: typically no more than 2-3 sentences. You will modify this to be included in the student exercise as well.
	+ Learning outcomes: show what students will be able to do after completing the unit. Write these at the beginning; then base the way you guide students through the student exercise on achieving these. You will also need to base the rubric on these learning outcomes. Beth will likely give you draft version of these to start; adapt them after writing the materials to ensure that they reflect what you’ve asked students to do.
	+ Teaching objectives: These show what the instructor needs to facilitate students to do; these will also likely be drafted by Beth for you and then modified. Cognitive objectives are for knowledge gain; behavioral are for skills acquisition.
	+ Context for use: this explains to instructors what audience should be chosen for these materials. What do students need to know/have already experienced? Write a form version of this and then modify for each individual unit. Things to keep in mind:
		- What level of students? How many students can be in a class teaching this material? What’s the ideal student to instructor ratio? Is there a way to modify this for larger classes? What type of course was intended (field course for this)? How could this be modified to a classroom environment? What classes should students be in prior to this material?
	+ Description and teaching materials: how should the instructor teach this? Describe in detail what the instructor will be doing. I would break this up into many sections, minimum of “in the field” and “in the lab.” In this section, you will refer to the student exercise and probably the field and data manuals. I found it easier to work on the field and data manuals BEFORE writing this section, so I could make sure that the description reflected the resources students would be using.
		- Also, include points to have a discussion as a class, to have students participate in the teaching process.
	+ Supporting materials: everything that will go in the folder of materials; this includes the powerpoint, the field and data manuals, student exercise, etc.
	+ Teaching notes and tips: this section is best written after you’ve written the student exercise. Then you can work through the materials (or have someone else do it) and see what tips may need to be included. Also look into general tips for working with GPS (ask field engineers, pull from personal experience) because instructors may have varying levels of experience with GPS. These should be extra pieces, not key components of teaching the material. Anything essential to teaching the material should be included in the description section.
		- These should also be specific to the unit that you’re writing. If they are general teaching tips for the material as a whole, they should be included in the teaching tips for the module overview sheet instead. This prevents repetition.
		- Tips could be about working with the eequipment (is it heavy, do you need a field site with proximal parking, etc?), how to keep students occupied, what should be present in the feature to survey, etc etc.
	+ Assessment: formative and summative. Formative assessment occurs while students are working; summative is the assessment you may be more familiar with – final assessment, like handing in an assignment or taking an exam.
		- Formative: asking students to hand in their notes from the field shows their work while they were learning the material.
		- Summative: asking students to hand in a write-up or report on their work from the day.
			* This is generally assessed with the rubric included in the student exercise.
	+ Resources: Things you pulled from to create the instructor overview; things that may help an instructor better understand the materials or concepts.

The module overview sheet will have these components, but include a brief description of each unit instead of the description section. You may also want to add module specific sections (for Analyzing High Res Topo, I included “Adapting this module to non-field courses” and “Using both TLS and SfM” for example).

## Student exercise:

Make on the template for UNAVCO field education materials (Beth PS can send). Use headings and subheadings to make navigation easier.

* Guides students through accomplishing their learning goals and contains the assignment for the unit.
* Similar in structure to the instructor overview: summary, introduction, project description (including a blurb about being gentle with the equipment), project report outline, and rubric. This may also include worksheets for students to work on in the field.
	+ Summary: like the summary in the instructor overview, this will outline what’s going to happen in the module
		- Format is italic with no heading; it’s the first thing on the page before author names.
	+ Introduction: introduces students to the equipment (intro units) or the science and research questions, as the unit may cover topics they are unfamiliar with
	+ Project description
		- Goes through the student workflow; like the description section of the instructor overview goes over the instructor workflow
		- Include an italicized note about treating the equipment well
		- Break into subheadings; probably will have a field section and a lab section
		- Also good to write this after writing the project report section; then the workflow can refer to specific parts of the assignment. Don’t be afraid of detail in this section; because these materials will not necessarily have a UNAVCO person teaching them, specificity is better to avoid confusion. Students generally seem to prefer specificity as well.
		- Remind students to take field notes and metadata like any normal field day; this is important! It will feel very different to them in the field, so they need to encouraged to take notes.
	+ Project report: the actual assignment questions
		- Introductory units will have questions about the equipment list, field workflow, metadata, and general steps for working in the lab.
		- Include questions about the societal issues associated with either the method of data collection or the research topic. This ties into GETSI (GEodesy Tools for Societal Issues).
		- Include questions about the data so students can reflect on what they collected. Also include questions on the exploration of the data (like what’s good and what’s noisy? Issues with working with the data?)
		- Include specific questions related to the research topic.
		- Include questions about metacognition. See <http://serc.carleton.edu/NAGTWorkshops/metacognition/teaching_metacognition.html>
		- This may also include a worksheet for students to work through in the field, calculating some parameter to help their survey design for example.
		- Also may include equipment list in the intro units.
	+ Rubric:
		- Base the rubric on the learning outcomes in the instructor overview. Make the rubric out of 20 points to be consistent with the Analyzing High Res Topo module. Include three categories: exemplary, basic, non-performance. Assign specific point values (like: for each missing component in the list below, subtract one point). Try to make this rubric usable for anyone, whether you’re there to explain it or not.

## Powerpoint, supporting documents

### PowerPoint

* Use this to create a general introduction to each unit (introductory may need more slides) with about 10 slides to make students familiar with the research topic. These will take more time than anticipated because you will need to make figures for the powerpoint for copyright reasons. See below section.
* Use UNAVCO templates! These are available from the unavco.org/internal site; go to branding materials. This is also a place to get the UNAVCO logo to put on the materials

### Supporting documents

These are going to be a whole range of things; anything students will need to reference or use to complete the assignment. Things to keep in mind:

* Academic papers are not copyright ok; you cannot download a pdf of a paper and publish it on the GETSI website
* Put things on a UNAVCO template to ensure that once they’re downloaded they’re still associated with UNAVCO.
* Include metadata if data are a supporting document.

# Module creation tips

## Writing materials

1. Read many examples of education materials
2. Work on field manual and data manual first; these figures can then be used in the rest of the materials and it helps to reference something once you’ve already created it and know what will be in it. These are also time consuming because they include many figures which take up more time.
3. Start with the learning goals and build the unit around that
4. Focus on writing either the instructor overview or the student exercise first; then base the other document on whatever one you started with for consistency.
5. Use the same rubric for each unit and modify the specific details
6. Use the same context for use for each and modify the specific details.
7. Decide early on what the names of units and documents will be (like “Data Processing and Exploration Manual”) and stick to it; this will mean less edits for consistency later.

## Copyright and figure creation

The most difficult thing about writing these materials is copyright. Because these will be digitally published on the UNAVCO website, all materials need to either be UNAVCO generated, have a Creative Commons license for commercial re-use, or written permission from the COPYRIGHT HOLDER for use. Most websites have a page detailing their copyright policy; anything funded by NSF, NASA, or USGS ok to use (and other .gov websites). Check the copyright policy every time, however. NASA only allows figures for reuse if there is no NASA logo, so it’s good to double check.

### Copyright spreadsheet

The easiest way to keep track of the copyright permissions is to use a spreadsheet (I like one per unit and then one for general module materials) with the figure, the document that contains it, and then information about the copyright. If it’s UNAVCO generated, write UNAVCO. Creative commons, include a link to the original material. Permissions, print the written permission and then refer to it within the document. This will take out a lot of problems later in the process!

### Checking copyright

Google images has a reverse image search. You can upload images you’ve found (like from the UNAVCO Knowledgebase discussed below) and google will search if the image has appeared anywhere else. If the image is anywhere else on the internet, it’s generally not going to be copyright ok and you will need to find an alternative or make an alternative. DO check all materials on the UNAVCO website; many people have pulled figures from the internet without attribution or images of equipment from the manufacturer without permission.

### UNAVCO-generated materials

UNAVCO has a webpage called Knowledgebase that has information about GPS ([http://facility.unavco.org/kb/questions/617/Trimble+4700%7B47%7D5700%7B47%7DR7+-+How+to+execute+a+real-time+kinematic+%28RTK%29+survey+from+start+to+finish](http://facility.unavco.org/kb/questions/617/Trimble%2B4700%7B47%7D5700%7B47%7DR7%2B-%2BHow%2Bto%2Bexecute%2Ba%2Breal-time%2Bkinematic%2B%28RTK%29%2Bsurvey%2Bfrom%2Bstart%2Bto%2Bfinish)). Follow links within this page to access other Knowledgebase pages about GPS. The one issue with Knowledgebase pages are that figures are not always copyright ok, reverse google search!

### Creative commons

If you can’t find figures from UNAVCO or the material is not copyright ok, use the creative commons search (<https://search.creativecommons.org/>) with the option “use for commercial purposes.” Images or clipart can be found pretty easily this way. I use the clip art search to find materials to help speed up the process of making my own figures, as well.

### Permission from copyright holder

Email! Two examples of emails you could send are below. You can ask for permission to use materials you’ve already found, or to ask if someone has the materials you need. After this, they need to be attributed next to the figure and likely made into an author on the material (depending on the scale of the contribution). I’ve never had a person say no!

Example 1:

Hello Nicholas

I work for UNAVCO’s Education and Community Engagement office. We are

currently developing teaching materials to help undergraduate field courses

teach using TLS and Structure from Motion. One of the units we are doing

features surveying a fault scarp in order to analyze the profile and offset. We

are interested in including a more involved fault diffusion modeling component

and we know of the exercise 8 from your 1995 book. Is there any chance of

being able to use the backbone of your exercise as part of the UNAVCO

materials? We see that the pdf is up on your website, does this mean that

Prentice Hall might allow it for nonprofit

use? Is there any chance? The

materials would be available from the UNAVCO and SERC (Science

Education Resource Center) websites.

Thank you for your advice and consideration

—Beth

Example 2:

Hi James,

I work for UNAVCO's Education and Community Engagement office (www.unavco.org; UNAVCO manages theNSF geodetic facility). We are currently developing teaching materials to help undergraduate field coursesintegrate TLS and SfM. I'm in the process of writing the data processing and exploration manual for Agisoft.

We're interested in including some of the material in your blog post on Agisoft in the manual. Is there anychance we may include some of these materials (specifically the section on integrating GCPs, as it is moreintuitive than the Agisoft guidelines)? The materials will be available from the UNAVCO and SERC (ScienceEducation Resource Center) websites. An example of the current material is here.

thanks,

Kate Shervais

### Make the figure

If the figure you need is impossible to find or bad, make the figure using Adobe Illustrator or a similar program. I generally use clip art from creative commons searches as a background to speed up the time to make figures. Another easy thing to do is photoshop out the thing you need (a GPS base station, for example) from a UNAVCO photograph and then use that in the figure.

### Alt-text

These materials need to be accessible. Use alt text to describe images that do not have detailed captions to describe what the image is showing in Microsoft Word and PowerPoint.