

# **OPUS-Projects for Managers Training – Transitioning from Mandatory Instructor-led to Online, Self-Paced**

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## **SUMMARY**

The National Geodetic Survey (NGS) released “OPUS-Projects” for public use in 2011. OPUS-Projects is a web-based application designed to process and adjust campaign-style GPS observations (geodetic networks). Since the time of its release, NGS has required that users take a multi-day (approximately 12-hour) instructor-led training course before they are given access to the application. This requirement was instituted due primarily to the complexity of the application and the lack of user resource documents. It was also the case that the application was flexible enough that the inexperienced user could inadvertently direct the software to do something that would likely have unintended consequences. So, for over a decade, the National Geodetic Survey has successfully worked to train thousands of people to use OPUS-Projects. However, this training (prior to the 2020 pandemic) was conducted primarily in person, by a small number of trainers, for small groups of thirty or less. Additionally, we often heard that many companies or individuals could not afford, or did not have time to travel in order to attend a multi-day course. To partially alleviate these affordability and structural barriers, NGS initiated online, instructor-led, training courses. While NGS increased the number of online classes, these often fill up months in advance. To adequately meet the demand of our constituents following this training model would require significantly more staff time committed to registering, preparing, and teaching courses. Additionally, this training requirement prevents people from trying out the software or self-training using available resources. It is felt that this requirement has presented a barrier for use of the software, and it can be a burden for NGS to provide the training in a timely manner. This paper discusses an ongoing project aimed to develop online, self-paced training materials designed to replace the required instructor-led training, while also supplementing it with additional details. Positive outcomes of this project will include increased usage of OPUS Projects by providing unrestricted access, and the creation of a uniform curriculum focused on how to use OPUS-Projects for processing, adjusting and submitting data to NGS.

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## **1. INTRODUCTION**

The National Geodetic Survey (NGS) has operated the Online Positioning User Service (OPUS) since March 2001, to provide end-users easy access to the National Spatial Reference System (NSRS) using GPS data. Over the last two decades, OPUS has evolved into a suite of web-based tools, each designed to accomplish a specific task, or accept data of different configurations. The primary purpose of OPUS is to provide end users easy, consistent access to the National Spatial Reference System (NSRS), as well as to the latest global reference frame (IGSxx/ITRFxx) by quickly, reliably, and accurately obtaining consistent geodetic positions with a precision of about 1 to 2 centimeters. OPUS-Projects was initially designed so all administrative and data processing tasks associated with a GPS campaign could be managed through a number of web pages and tools at NGS.

As development continued, OPUS-Projects became a highly integrated tool, including initial observation metadata and positions, session solution statistics, and network adjustments. Additionally, enhancements were made to include significant support for data visualization and project management aids. Training materials in the form of presentation slide decks were created, and the primary NGS training and outreach staff were educated in the use of the software. In 2011, NGS added OPUS-Projects as a new product available to the public.

Due to the complexity, flexibility, and lack of hard rule enforcement to keep users from selecting options that would likely produce unintended outcomes, it was decided that mandatory training would be required before new users could access the software. Since 2014 when training began to be tracked, NGS has conducted training for over 4,000 participants. This training has been conducted by a staff of less than 20 instructors, with an average class size of approximately 20 students. Also, it should be noted that none of these instructors are on staff for the sole purpose of providing this training, and that conducting OPUS-Projects classes are balanced with many other responsibilities.

As OPUS-Projects matured, discussions began relative to the possibility of removing the mandatory training requirement. The list below summarizes some of the reasons supporting the removal of the mandatory training requirement:

- Over the past decade, NGS trained thousands of people on how to use OPUS-Projects. At the same time, the OPUS Team has worked with the trainers, the team supporting data submittal to NGS (GPS Bluebooking Team), and with subject matter experts to make OPUS-Projects highly intuitive and has significantly streamlined the process.

OPUS-Projects now builds all of the important files for supporting data submittal, and it runs a number of quality control tests automatically, without requiring input or decisions from the user.

- NGS has developed a new User Guide including both a “quick start” portion and significant details on how to use the software. The User Guide explains much of the content that has previously been covered by an instructor.
- Requiring training makes NGS a gatekeeper and a barrier to the use of its own software. This can be burdensome. NGS would have to offer the training more frequently to enable access by new users.
- Currently, trainees must be manually registered and assigned training projects prior to the class. This takes additional NGS resources.
- Some companies state that they cannot afford to send their employees to a 2-day course to learn how to run software, or sometimes they are not interested in all of the facets of OPUS-Projects and just want basic information.
- The popularity of the instructor-led training has grown, apparent by classes frequently filling up, sometimes even months in advance. Additionally, it is anticipated that demand will likely continue to grow as OPUS-Projects adds the capability to ingest RTK data. To adequately meet the demand of our constituents would require significantly more NGS staff time.

## **2. PROJECT OVERVIEW**

In late 2021 and early 2022, meetings were convened by the “Future of OPUS Training” Committee to discuss the potential for removing the mandatory training. The meetings were attended by the OPUS Tech Team, the Regional Geodetic Advisors (primary instructors), and the Bluebooking Team. Criteria for removing the mandatory requirement was discussed and the group agreed on a path forward. A formal proposal was drafted and submitted to the NGS “Project Review Board”.

The proposal outlined a route to eliminate training as a requirement, and to create and post new training resources online, wherein users could study on their own time. Instructor-led training (both In-person and Webinar) would continue to be delivered, but they would not be mandatory in order to access OPUS-Projects.

### **2.1 Criteria to Remove Mandatory Training Requirement**

The OPUS Tech Team, the Regional Geodetic Advisors, and the GPS Bluebooking Team came to a consensus that NGS should remove the 12 hours training course as a mandatory requirement for using OPUS-Projects, after certain steps are completed. These are listed below:

1. Make a series of short videos on how to use OPUS-Projects and post them to the web. The videos will be vetted by subject matter experts to ensure the content is correct. The videos can be viewed when convenient (aka “on-demand”), and this approach is

much in line with how people learn to use commercially available software, including other surveying software. A list of module topics can be found in 3.1.

2. Make another update or addendum to the User Guide to include content on OPUS-Projects 5 (in BETA at the time of this writing) and how to work with GNSS vectors processed outside OPUS-Projects.
3. Develop a tutorial lesson as well as a set of example data that can be downloaded by the user for self-training. Users will be able to work with the data in OPUS-Projects, and follow the tutorial to ensure they understand key concepts when performing baseline processing and adjustments.
4. Create or update a website where all users can create projects in OPUS-Projects. This website will implement appropriate security measures for ensuring the user is a human.
5. Provide a recurring internal “OPUS Trainers Forum” for attendance by NGS personnel conducting OP training. This would be an opportunity for the OPUS Integrated Product Team (IPT) developers to highlight their current activities, and for trainers (Regional Geodetic Advisors, NGS Testing and Training Center (TTC), etc.) to ask developers questions.
6. Create a 6 month follow up questionnaire for Trainers (Regional Geodetic Advisors, TTC, etc.) to gather their feedback on impacts of removing training requirements.

### **3. WORKING GROUPS**

Two Working Groups were formed. One group would undertake the creation of content for training videos and the second would concentrate on creating tutorial lessons. A third group was working independently to update the User Guide. One challenge that was identified was finding or creating a project that could be used by both groups (for consistency) that would contain all of the features that each group needed. After some investigation, it was determined that due to lack of resources in the near-term, creating a new project was not an option. An inquiry was made of the NGS Field Operations Branch (FOB) to determine if they had conducted a project that would be suitable. Fortunately, they had conducted a project in 2021 that appeared to contain the desired features. This project was adopted as the training data set for both groups.

#### **3.1 Video Modules Group**

The first step was to determine a list of topics for the video modules. These modules needed to cover each major step of the OPUS-Projects process, and provide enough explanation/background explaining why tasks were handled certain ways. At the same time, care was needed to not get too deep into supporting background material, leaving that to be addressed in the optional Instructor-led instruction. The desire was to also keep each video short to align with best practices in adult learning theory, so the target became 20 minutes or less, which turned out to be difficult to accomplish! If complicated topics needed more time, then the group should look for ways to break up the topic into smaller sub-topics. As the project evolved, the list expanded and changed to fit the content. Each topic would be

discussed by the group, then a Subject Matter Expert from the group would volunteer to build out the content. As modules were completed, they were presented to the OPUS Tech Team and trainers for feedback. Feedback was collected and modules were updated based on the feedback. Once each module was fully vetted and updated, the process for recording videos could begin. The format for the videos would be a screen recording of an instructor walking through the steps of a process, or in some cases a PowerPoint presentation, with both formats including narration by the creator. Below is the module list as it exists today:

**Table 1. Final List of Training Modules**

<b>Module Number</b>	<b>Topic</b>
1	Overview of the OPUS Projects Process
2	Using the “NGS Map
3	Describing Your Marks Windesc/Photo
4	Conducting Reconnaissance and Project Planning
5	Developing a Survey Schedule
6	Writing a Survey Proposal
7	Creating Field Logs/Logsheets
8	Understanding the Features and Functionality of the Manager's page
9	Creating a Project and Modifying Project Preferences
10	Uploading RINEX Files and QA the results
11	Incorporating GNSS Vectors, RTK and GVX
12	Uploading of WinDesc files, photos and logsheets
13	Preparing for session processing
14	Running the Session Processing
15	Analyzing the Session Solutions (results of session processing)
16	Analyzing the Preliminary Adjustment , Network Adjustments Analysis, and Determining Control
17	Writing the Project Report
18	Submitting your Project to NGS

### 3.2 Tutorial Group

The Tutorial Group's first challenge was to establish a format/method for the tutorials. After much discussion, it was decided that each lesson would consist of a set of steps/instructions to accomplish the task. The person creating the module would actually complete the tasks, record their steps and take screen shots. These would then be inserted into the training module document. In this way, the student can step through the process themselves, using the same data, and check their progress against the document. Below is an example of one step within "Module 9 – Creating a Project and Modifying Project Preferences". Module 9 consists of six individual steps in full.

Figure 1. Example Module instructions

## Create a new Project

- Go to [www.geodesy.noaa.gov](http://www.geodesy.noaa.gov) and select the link to OPUS Projects



The screenshot shows the National Geodetic Survey (NGS) website. The header includes the NOAA logo and the text "National Geodetic Survey Positioning America for the Future". Below the header is a navigation menu with links for "NGS Home", "About NGS", "Data & Imagery", "Tools", "Webinars", "Science & Education", and a search bar. A secondary navigation bar contains a link for "View Hurricane Ian Damage Assessment Imagery". The main content area features several sections: "Process GPS Data (OPUS)", "NGS Data Explorer", "Looking for Bench Marks", "Conversion & Transformation (NCAT)", "NOAA CORS Network", and "New Datums". A "Popular Links" section includes "Storm Imagery", "Antenna Calibration", "OPUS Projects" (highlighted with a red box and a red arrow), "GEOID Models", "State Plane Coordinates", "Geodetic Toolkit", "UFCORS", and "GPS on Bench Marks". A "News Bulletins" section lists "Important Updates" (NCAT new version release, HTDP new version release) and "Beta Release" (NGS Map, OPUS Projects 5.1, Leveling Projects Page, Passive Mark Page). A "NGS Weekly" section lists updates from September 30, 2022, September 23, 2022, and September 16, 2022. The footer contains links for "NGS Home", "NGS Employees", "Privacy Policy", "Disclaimer", "USA.gov", "Ready.gov", "Site Map", and "Contact Webmaster".

- The OPUS Projects main page is now displayed. There are three options:  
"Create" a new project, enter an existing project as a Session Processor, or enter an existing project as a Manager
  - Click "Create"

## 4. OTHER SUPPORTING ACTIVITIES

A new “Create a Project Page” has been developed and tested. This page will eventually replace the current page which verifies the user’s email against the list of trained Managers.

Figure 2. Existing Create Project Page showing invalid email entry

The screenshot displays the 'Create Project' form on the NGS OPUS website. A modal error message is shown at the top, stating: 'geodesy.noaa.gov says Error: your email is not on the NGS-trained project manager list.' The form fields include:

- \* Email address:** bad\_email@nowhere.com (with a link to the Privacy Act Statement and a note: 'Refers to Project Manager who must be registered with OPUS-Projects')
- NGS-supplied project tracking ID:** (empty text box)
- Data code:** AA (with a note: '(if uncertain, leave as is)')
- \* Project title:** (empty text box)
- \* Project type:** Radio buttons for HttMod, COMM\_MARKS, FAA, and Other (selected).
- \* Agency:** NONE (with a dropdown menu showing NONE DEFINED)
- \* Approx. location:** Latitude: Ndd:mm and Longitude: Wdd:mm (with an Update Map button)
- \* Anticipated start:** (empty text box)
- \* Approx. size:** Stations: 0 and Duration: 0 days (with increment/decrement buttons)

Buttons for 'Create' and 'Reset' are at the bottom of the form. The footer includes 'Website Owner: National Geodetic Survey / Last modified by NGS.OPUS Feb 09 2023' and a navigation bar with links like 'NOS Home', 'NGS Employees', 'Privacy Policy', etc.

The new page will simply allow a project to be created without any verification procedure, aside from the aforementioned security to confirm the request has been submitted by a human.

## 5. CONCLUSION

Since its release in 2011, OPUS-Projects has continued to be a popular tool. Due to the initial complexity, flexibility, and lack of hard rule enforcement to keep users from selecting options that would likely produce unintended outcomes, NGS required mandatory training before users could gain access to the software. OPUS-Projects has matured significantly in the past decade, and recent improvements have rendered it highly intuitive while also significantly streamlining the processes required of the user if they plan to submit their GPS data to NGS. At the same time, these improvements

and new features have begun to garner more interest from the surveying community. It is recognized that the current model for providing instructor led training is not sustainable as the required level of staff resources would need to continue to grow to adequately meet the demand of our constituents. Supplementing our traditional instructor-led training with an online, on-demand, self-paced training model will allow NGS to disseminate access to a more diverse set of constituents while minimizing the staff resources required.

## **BIOGRAPHICAL NOTES**

Daniel J. Martin is a Physical Scientist with NOAA's National Geodetic Survey. He serves as the Northeast Regional Geodetic Advisor where he instructs local surveyors, state and municipal agencies, and the geospatial community at large, on how to use and preserve the National Spatial Reference System.

Erika Little is the Training Coordinator for NOAA's National Geodetic Survey (NGS). She coordinates in-person and virtual training and educational opportunities, which are available to all of NGS' customers.

Jeff Jalbrzikowski serves as the Appalachian Regional Geodetic Advisor for NOAA's National Geodetic Survey. He has worked as a surveyor or geodesist for three different US Government agencies, also the US Armed Forces, and is one of the Advisor team who is a licensed Professional Surveyor (P.S.) via National Council of Examiners for Engineering and Surveying (NCEES) Model Law requirements.

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