Airport 3D Visualization Project Proposal

Prepared by Geo Solutions, Inc.

for

The City of New Braunfels Planning Department

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Introduction

The Geo Solutions team understands the key to an economically progressive and viable airport is protecting the land around it and especially the airspace. The safety of incoming planes as well as the people underneath is the number one concern. It is for this reason that the City of New Braunfels is in the process of adopting an ordinance to enforce Airport High Hazard Zoning Districts for the area around the New Braunfels Regional Airport. The Federal Aviation Administration created the Airport High Hazard Zoning Districts to limit the height of structures in critical areas around airports. Unfortunately, these zoning districts have a complex geometry making it difficult to calculate the maximum building height at a specified point, and even more difficult to visualize the zones in real life.

Summary

Our job at Geo Solutions is to solve this problem by providing services that aid in the city's efforts to better communicate with city staff, property owners, and the general public. We strongly believe that Geographic Information Systems (GIS) is the solution. With our skills and knowledge of physical geography, city planning, GIS, and other related software we will provide the City of New Braunfels with a quality product that will pay for itself many times over.

Purpose

Ultimately, our goal is to create visual representations of the restricted airspace zones so they may be easily understood by city staff and the public. We have broken this down into

three main objectives. First, we plan to create a 3D visualization of the restricted airspace zones to break down the barriers of complicated geometry. Secondly, we plan to integrate that model into the New Braunfels web-site so that the 3D visualization will be a web-based, interactive 3D model that can be accessed by the general public. Lastly, we will develop a mapping tool that will allow city staff to identify maximum building heights at any point within the Airport High Hazard Zoning Districts. With the mapping tool, city staff can quickly and accurately inform landowners and developers of any height restrictions they may need to abide by. Furthermore, we consider all of these approaches as ways the city can keep within its goal of being proactive as they move forward into the future.

Scope

The scope the 3D visualization and the raster map is the same as the Airport High Hazard Zones as specified by the FAA. These zones include all areas within approximately 3.5 miles of the airport and extend approximately 9.5 miles to the north toward San Marcos, 9.5 miles to the south toward Seguin, and 9.5 miles to the northwest toward Canyon Lake.

Proposal

Data

The data needed to produce a 3-dimensional model of airspace restrictions will be in vector and raster form. These will include a digital elevation model (DEM), airport boundary polygon, and polygons for the 3 runways with correlating zones. Our source for the runway polygons will be Benjamin Campbell, the New Braunfels Planning Technician. The DEM will come from the New Braunfels Data Extraction webpage. The city's Data Extraction page may also be used to obtain any other relevant data that may be useful for our raster map, such as city boundaries, place names (counties, cities), street lines, or land use polygons. The software program we will use for the raster map is ArcMap. For the 3-dimensional model, we will use some combination of ArcScene, Google Earth, and Google SketchUp.

Methodology

3-Dimensional Visualization

We have found two methods of 3-dimensional visualizations. The first involves creating a model of the elevation. In this case the digital elevation model (DEM) will need to be altered so the data format can be understood by ArcScene's 3D analyst, a process known as interpolation. Then, after it is added to ArcScene, a triangulated irregular network (TIN) of the DEM will be created. This process will triangulate the z-values, which is elevation, for the 3D shape. An aerial photograph can then be draped over the 3d figure.

The second method involves creating a model in Google Sketchup. Sketch Up allows users to create a 3D visualization that can be imported into ArcScene or shared in Google Earth.[1]

Interactive Model

The interactive model may be the most difficult part of our project. There are ways for creating an interactive web based model, but the methods we have encountered so far have required software that must be purchased, or downloaded for free like Google Earth. In order for Google Earth to work, the program must be downloaded to any computer the model will be viewed on. The Google Earth approach seems like the best way to make the visualization interactive. Before going live on the New Braunfels website, we will test the compatibility of our model by first uploading our interactive model onto the Geo Solutions web page first.

Raster Map

Various methods of classification and quantification will be used for this portion. The runway files, for instance, are in vector form, so we will need to convert them to raster in order to classify units within the polygons. Using the digital elevation model, raster calculator will be used to calculate the difference between the elevations of the surface to the zones of restricted airspace. Then, a graduated color scheme will be applied to show the zones of airspace restricted to development on the raster map. The Edit tool will be used to label, place markers, and add text if needed to the polygons representing the runways. Model builder will also be used to tracking the progress we make in creating the raster map. Once that model is created, it can be used as a reference for future models.

[1] ESRI Website. Common Questions. "How can I share and distribute my work in 3D?". http://www.esri.com/software/arcgis/extensions/3danalyst/common-questions.html

Implications

Our final product will have two major implications for the City of New Braunfels Planning Department. More specifically, we hope the proposed project will result in the city's ability to communicate more effectively with the public and make decisions more efficiently in house.

First, the creation of an interactive 3-dimensional visualization will serve as a communication tool between the planning department and the general public. Because airspace restriction zones involve such complicated geometry, they are difficult to visualize and understand. The resources currently available to the public can be quite intimidating, as one would have to filter through documents full of confusing terminology and calculations to understand their building restrictions. On the other hand, access to an intuitive, online 3-D representation of restricted airspace zones will encourage more community involvement by providing a more intuitive approach.

Secondly, a 2-dimensional raster map displaying available building heights will facilitate a more efficient decision making process for city staff members. By simply clicking on an area to find the available building height, staff can quickly make decisions and assist property owners regarding permits and applications. Furthermore, making this map available online will allow the general public to access the information they need for themselves, possibly preventing the need to contact city staff at all. Finally, with a more accessible, intuitive, and user friendly system the department can make the best use of staff resources; ultimately saving valuable time and money.

Table 1: Project Budget

Project Budget

Data Acquisition and Analysis	
Analysts	
3 Analysts (*10 hours/wk over 10 weeks*)	300
1 Analyst (*5 hr/wk over 10 weeks*)	50
Hourly Rate	$28.00
Subtotal	$9,800.00
Project Management	
Project Manager	
Hours (*5 hr/wk over 10 weeks*)	50
Hourly Rate	$40.25
Subtotal	$2,012.50
Website Development	
Web Developer	
Hours (*2 hr/wk over 10 weeks*)	20
Hourly Rate	$32.00
Subtotal	$640.00
Equipment Costs	
Workstations (*4 units * $150/unit*)	$600.00
Technical Support and Maintenance (*4 * $100/unit*)	$400.00
Depreciation (*$8,000/36*2.5*)	$555.56
Poster Printing (*36"X48", gloss*)	$65.00
Subtotal	$1,620.56
Software Costs	
ArcGIS 10 (*$25,000 [ESRI Educational License fee]/12*2.5*)	$5,208.33
Total Cost	**$19,281.39**

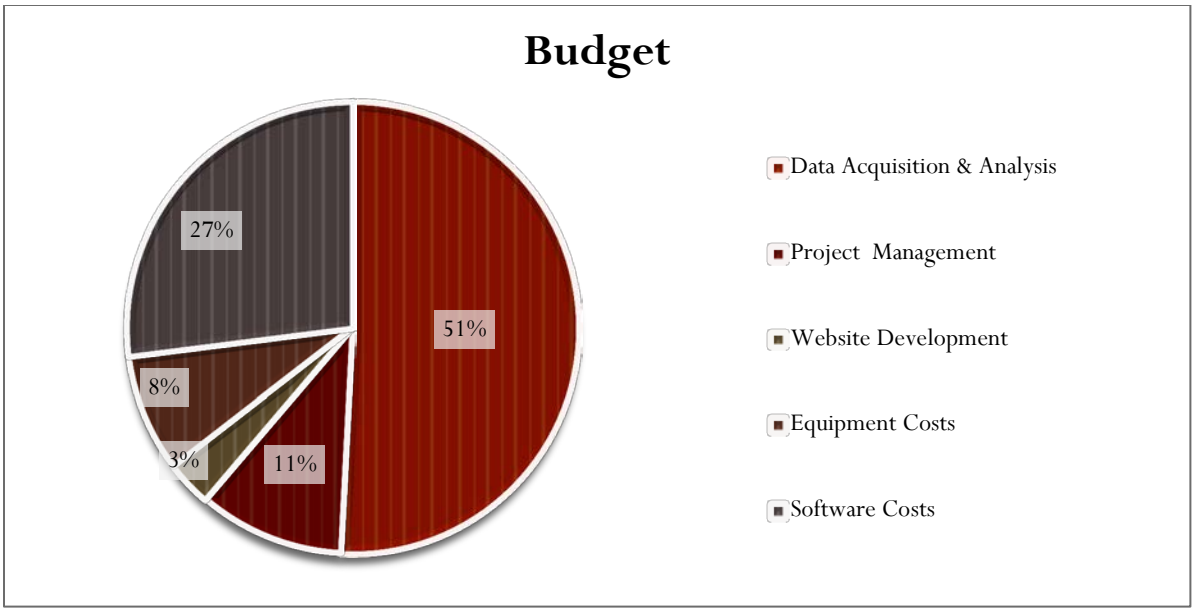

Figure 1: Pie chart showing the project budget

Timetable

February

S	M	T	W	TH	F	S
			1	2	3	4
5	6	7 Data Acquisition	8	9	10	11
12	13	14	15	16	17	18
19	20	21 Data Processing	22	23	24	25
26	27	28	29			

March

S	M	T	W	TH	F	S
				1	2	3
4	5	6 Data Analysis	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

April

S	M	T	W	TH	F	S
1	2 Progress Report	3	4	5	6	7
8	9	10 Website Integration	11	12	13	14
15	16	17	18	19	20	21
22	23	24 Final Deliverables	25	26	27	28
29	30					

May

S	M	T	W	TH	F	S
		1	2 Final Presentation	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

The project timeline is broken down into 5 phases:

I. Data Acquisition

II. Data Processing

III. Data Analysis

IV. Website Integration

V. Preparation of Final Deliverables

We estimate that the initial data acquisition phase will take approximately two weeks from our first meeting. We will spend the following two weeks on pre-processing the data. In the processing phase we will be making sure that the data formats are compatible with the software and checking for data quality. Two weeks for pre-processing is the maximum amount of time we want to spend on preparing the data for analysis. Once we begin with data analysis, it should take no more than 4 weeks to have completed all aspects of the raster maps and the 3D visualization. Once we accomplish that, we have dedicated about two weeks to integrating the 3D model onto the New Braunfels website so that it is interactive. After we have completed the website integration phase, we will start assembling the final presentation deliverables and preparing our presentation. We plan to have the final presentation and the deliverables ready a week before the final due date which would be April 26, so we will have time to tweak any part of the project if needed so as to provide the best quality product to the City of New Braunfels.

Final Deliverables

For the final deliverables we will have a poster so that we can present to the City of New Braunfels and the Texas State University Geography Department. We will also have a website that will include everything that was discussed in the first meeting. And we will have a CD that will include the data and information of the project which will include:

- Metadata
- Final Report
- Copy of the poster
- PowerPoint with description of our findings
- Readme File

Conclusion

As the City of New Braunfels grows, there is great potential for economic growth near the New Braunfels Regional Airport. The adoption of an ordinance that enforces FAA regulated height restrictions near airports will help promote such economic growth. We will create a visual representation to inform the public of building height restrictions. We will also create a GIS tool that will make enforcement of building height regulations easy for city staff.

For our analysis we will use data from the City of New Braunfels and DEM data from TNRIS. We will use this data to create a raster map that compares the building height restrictions with the elevation. This map will show maximum building heights. The visual 3D model with be created in ArcScene or Google Sketchup. The model will be

exported as a Google Earth. The public can interact with the 3D model by downloading Google Earth.

We hope to have completed this project by late April. We expect the project to cost approximately $19,000. This price includes work hours, equipment, website development and software.

Thank you for considering Geo Solutions for your 3D visualization needs. We hope to be able to work with the City of New Braunfels on this project.

Participation

Crystal May Project Manager GIS Analyst	Authored *Implications* and *Project Budget* Prepared initial PowerPoint for proposal presentation Organized documents final draft of the Proposal
Nate Stanley GIS Analyst Web Master	Authored *Data & Methodology* sections of Proposal Prepared final draft of PowerPoint presentation Designed team logo
Tory Carpenter GIS Analyst	Authored *Introduction* and *Conclusion* Prepared SketchUp sample for presentation
Cameron Frere GIS Analyst	Authored *Timetable* and *Final Deliverables* Responsible for select visuals in PowerPoint presentation