GIS-intrinsic CAMA

Abstract

Intrinsic is defined by Webster as part of; part of the innermost nature of a thing; inwardly, within, belonging to the real nature of a thing; essential; inherent. Almost all of the assessor's data by its nature is geographically specific. For this reason, GIS has become critical for the effective management and disposition of most assessment activities and almost every assessment process benefits from GIS support. The need for this support and the geographic nature of the assessment data makes CAMA a natural or intrinsic function of a GIS system. This paper describes how building a GIS-intrinsic CAMA system to provide the CAMA functionality and maintain the assessment data would streamline work, eliminate or reduce duplicate information and create benefits that could be felt throughout the different departments in the assessment office, across the jurisdiction, and beyond. As an example, this paper explores the benefits of a GIS-intrinsic building sketching function which is used to take advantage of GIS technology and to streamline the process of gathering building information.

I. Introduction

The assessment and ultimately the property tax industry are embracing Geographic Information Systems (GIS) to better meet the needs of their diverse users which range from the general public to the highest levels of government. The demand to combine GIS data with assessment data to meet the statutory requirements and needs of the assessment office continues to soar. GIS is systemic to every assessment function and can therefore be used to improve operations and activities throughout the assessor's operations:

- Management
- Discovery & Listing
- Valuation
- Quality Control/Assurance
- Customer Service
- Defense of Values

A recent article, "Web-based GIS and Digital Oblique Imagery," by Lema Kebede in the *Journal of Property Tax Assessment & Administration,* Volume 4, Issue 2 gives us a better appreciation of the problem:

> "The labor intensive operational tasks of data collection, classification, appraisal, customer service, and legal appeal are handled by several functional divisions, each of which has specific data requirements and workflow. Accurate and multifaceted location information is a critical component of the work."

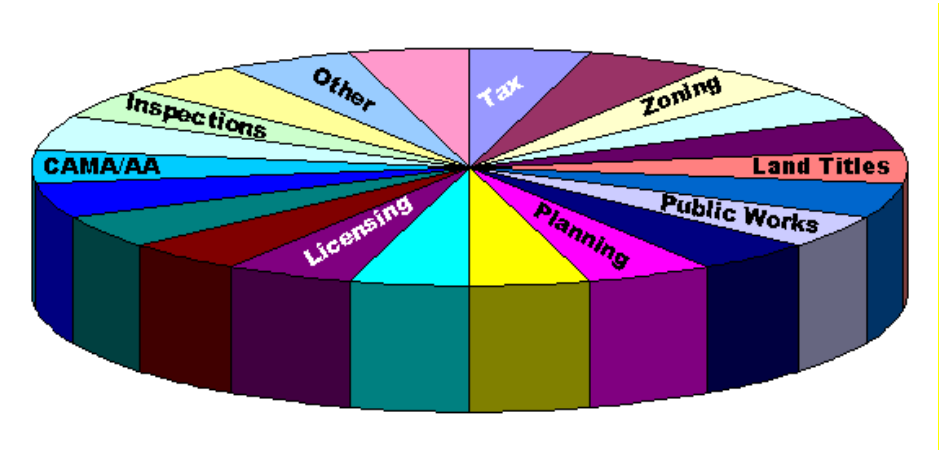
The assessor is being asked to provide information as never before. Initially the assessor could focus entirely on getting the assessment rolls prepared as required by law. However, more and more, the assessor is being required to make their GIS and assessment information available for other uses ranging from support for other local government agencies to homeland security and disaster preparedness. Simply put, demand for assessment and parcel level GIS data is skyrocketing.

The increase in demand has come as GIS has become more available to non-GIS users. GIS, like other computer technology has become less expensive while at the same time becoming more functionally rich and easier to use. The combination of increasing demand along with decreasing costs has resulted in the spread of GIS throughout government. This expansion combined with its expanded enterprise functionality and ease of use makes GIS an ideal vehicle for sharing information across departments and agencies.

In the property tax industry integration has been the vehicle to bring GIS benefits to CAMA and CAMA data to GIS in order to better support the assessor, various divisions of the assessor's office and their GIS partners across outside departments and agencies. In a recent article by Jack Dangermond he said "As important as it is to describe the *actual* world using GIS and geography, I think it is far more important to use GIS to imagine a *better* world."

We think the time has come to create a better world. The time is right to create GIS-intrinsic CAMA. CAMA has always been a part of GIS. For over twenty years we have used something like the following figure to describe the relationship between CAMA and GIS:

Figure 1. GIS Application Overview



While CAMA has always been part of GIS they developed separately with CAMA coming first. Over time as GIS and CAMA have become more robust and with

advances in technology they have become less expensive, more powerful, easier to use, and integration has made it easier to share information. In a recent article in *Fair & Equitable,* Daniel Anzaldi said it well "Regardless of the level of technological integration, the greatest benefit occurs when the user's interaction with the GIS/DMS/CAMA system (or systems) is as seamless and effortless as possible." Since CAMA is a natural part of GIS, it is only natural that GIS should be used as the basis for building CAMA.

It is time to take a quantum leap from integration, embedding, fusing, combining, and other techniques for merging CAMA with GIS, to building CAMA with the GIS. All of the advances in GIS now make it possible to use the GIS to build a GIS-intrinsic CAMA system. That is a single system that uses a single database (geodatabase) and has the combined functionality of both GIS and CAMA. No longer will it be necessary to bring two systems together to get the job done.

What makes a GIS-intrinsic CAMA different from integration? It's simple, it is a single system. This eliminates the need for integration and its attendant costs in data synchronization and resource coordination to get work accomplished.

Why do we want to eliminate integration? Integration works reasonably well for simple query processes (e.g. geographic/map search). However:

1. Integration is inefficient for update and complex processes. Witness the following recent example describing the integration for updating GIS with a CAMA drawing after detecting an error from oblique imagery:

   > 'Once the perimeter and area of the building were determined with the Pictometry measurement tool, the resultant true floor-plan sketch was immediately edited, the new square footage was corrected in the CAMA database, and the change was reflected on the GIS Web site.' Kebede, Lema. 2007. "Web-based GIS and Digital Oblique Imagery." *Journal of Property Tax Assessment & Administration,* Volume 4, Issue 2.

   The above scenario describes a common problem with integration: The need to go from one system to another and the need to continually synchronize them.

2. Integration is unnatural and requires work and resources (synchronization and coordination) to accomplish. In the example described above, the user has to go from one system (CAMA) to another (GIS) to identify the problem, then back to another (CAMA) to fix the problem and then yet again to another (GIS) to make the fix widely available. They do not say if all of this was done manually or by passing data but it still gives you a feel for the need to move from one system to another and synchronize.

3. Further, integration costs more to maintain and support because you are constantly synchronizing two or more systems that are being updated at different times and each with their own agendas.

What is and is not GIS-intrinsic CAMA?

GIS-intrinsic CAMA is a single system which eliminates the need for integration and its resultant inefficiencies (e.g. data synchronization, staff process coordination, post process review, edit corrections, maintenance and support issues, etc.). Just sharing a common database is not GIS-intrinsic because the functionality of one system is not available to the other unless it is duplicated in some fashion in the other system. This is a big issue. The classic example is the CAMA building drawing.

GIS is well capable of drawing the building structures and calculating areas, perimeters, volumes, etc. as needed for CAMA. There is no need for a separate CAMA system drawing capability. With a GIS-intrinsic CAMA not only do you benefit by having the drawings in the GIS for both assessment and non-assessment users, but there is no need to move data back and forth to synchronize it. However, the real icing on the cake is that in addition, your drawings are now stored in an open database. This means no more conversion headaches when you want to change to another GIS-intrinsic CAMA system at some time in the future (you are already there)! You can take your building drawings (and all of your related parcel data) with you!

Finally, a GIS-intrinsic CAMA requires a completely new design from the ground up in order to take full advantage of the GIS geodatabase and functionality and to prevent any legacy development from preventing it from reaching its full potential.

Many assessors would like to have their CAMA building drawings in their GIS database to make them available to improve their field operations, valuation, quality control, and for public use. Therefore we decided to prove the GIS-intrinsic CAMA concept by first developing a GIS-intrinsic CAMA sketch tool. This initial step would show the promise of a GIS-intrinsic CAMA by leveraging GIS functionality as well as the geodatabase and provide assessors with new functionality to meet their growing needs.

II. GIS-intrinsic Architecture

The basic requirements of a GIS-intrinsic CAMA are:

1. It must be a single system (see figure 2. b., following):

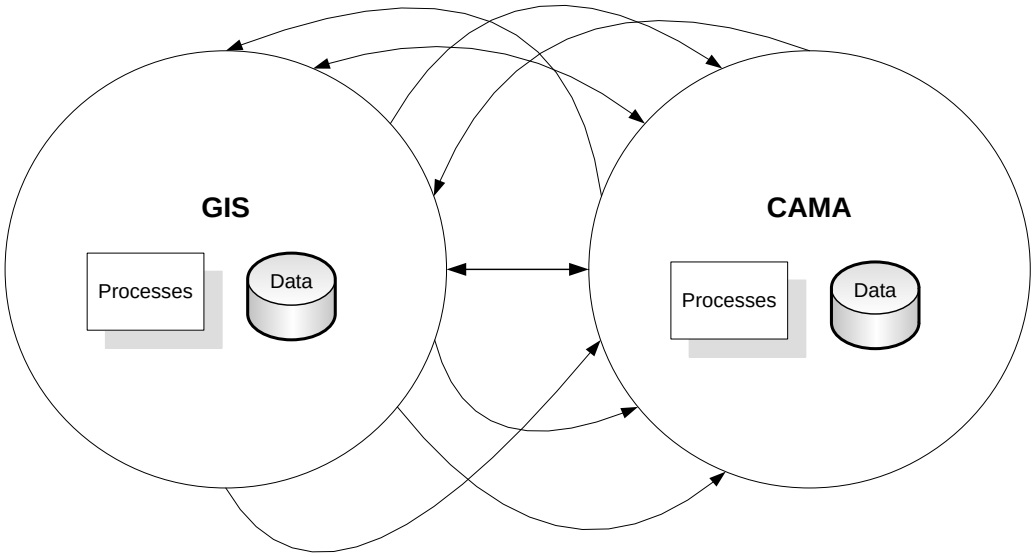
2. The system must be built using GIS technology:

    a. GIS functions are used to perform the work

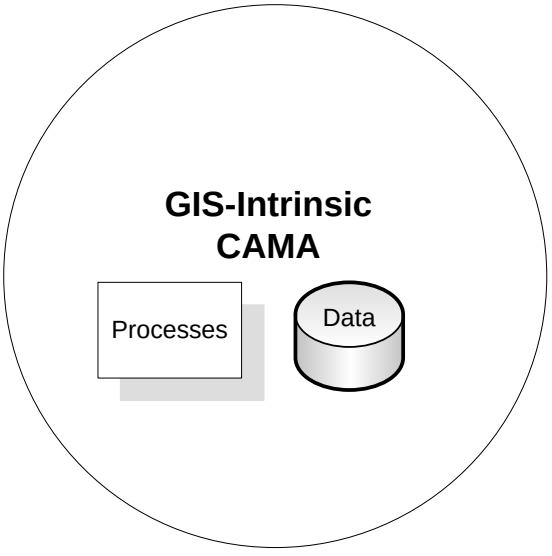
b. There is no separation of CAMA data
c. GIS and CAMA data need not be synchronized

Figure 2. Integration vs. GIS-intrinsic CAMA:

2. a. Integration:



2. b. GIS-intrinsic:



The following Figures 3 and 4 depict examples of a GIS-intrinsic CAMA architectures based on ESRI's ArcGIS® which is commonly used by assessors:

Figure 3. Basic GIS-intrinsic Architecture for Small Assessment Office:

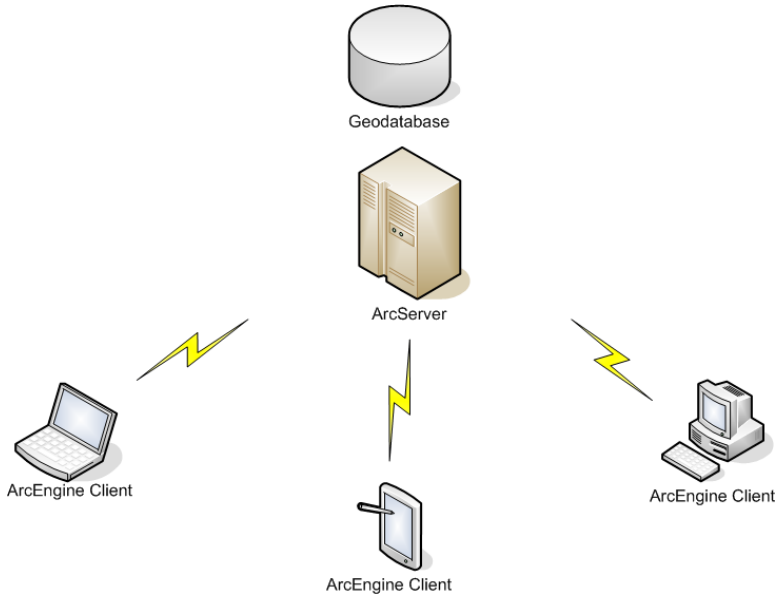
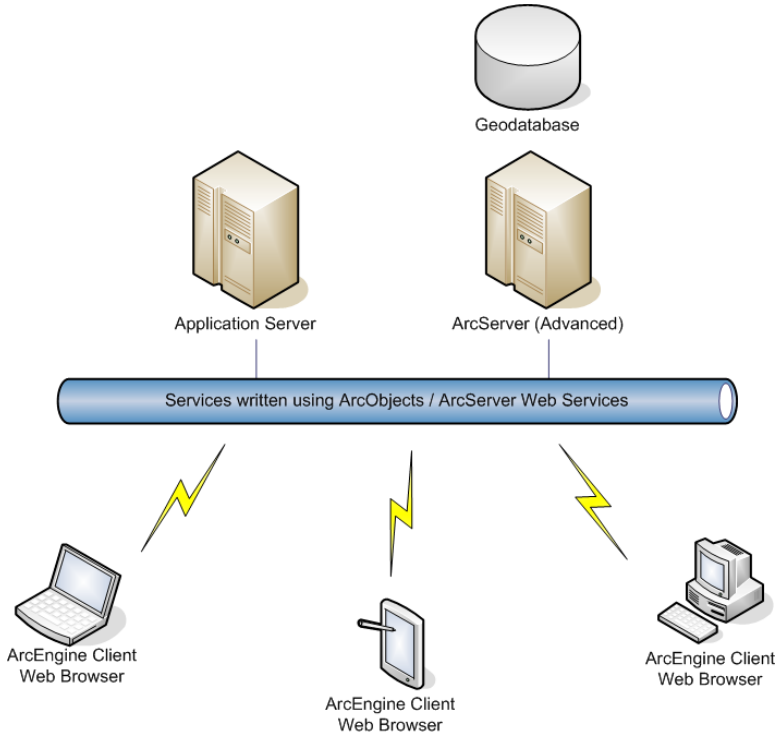


Figure 4. Basic GIS-intrinsic Architecture for a Large Assessment Office:



III. GIS-intrinsic Sketch Tool Demonstrated

We have done enough talking about GIS-intrinsic CAMA. It is now time to 'Walk the Walk' and build GIS-intrinsic CAMA software. We decided to develop a GIS-

intrinsic CAMA Sketch to prove the concept. The GIS-intrinsic sketch was then used to input typical CAMA sketches (see figure 5 and Figure 6, following):

Figure 5. Basic CAMA building drawing

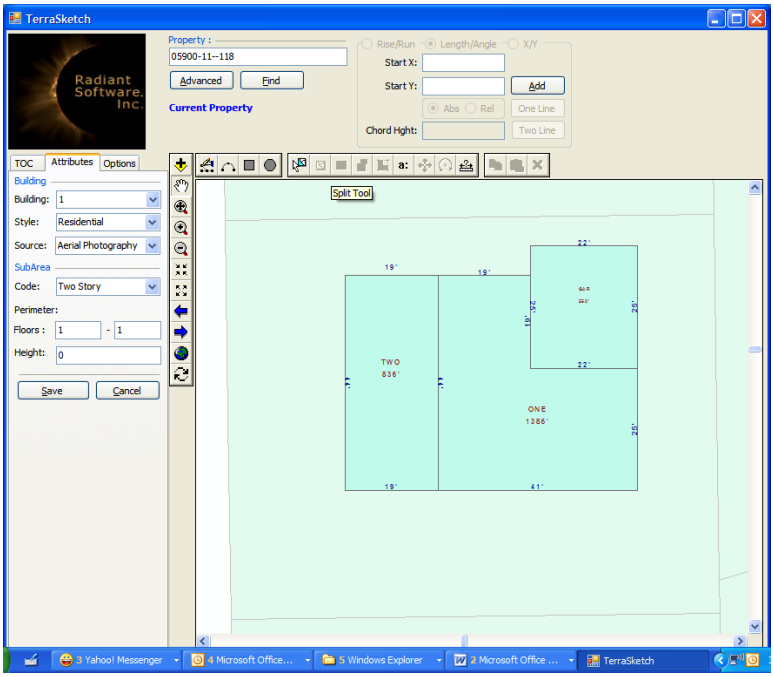
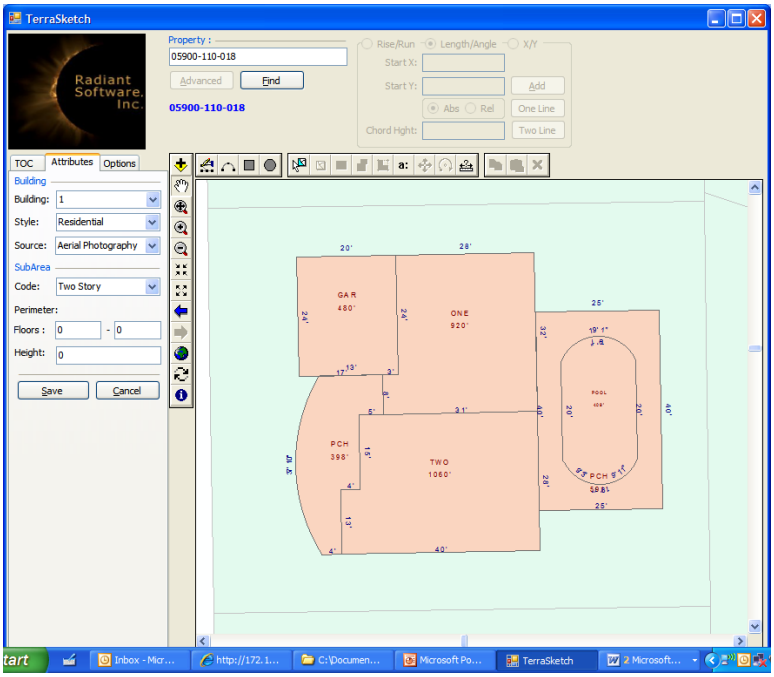


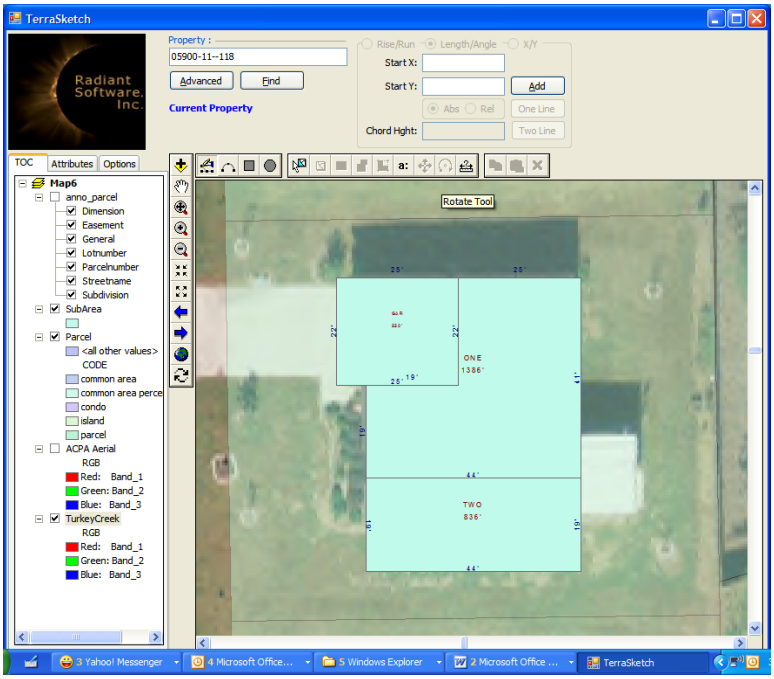
Figure 6. GIS can be used to easily draw more complex structures:



The GIS-intrinsic sketch easily generates a building sketch with all of the required CAMA attributes including areas, perimeters, heights, stories using the GIS drawing tools and stores all of the information in the geodatabase. The sketch itself and the areas and perimeters for all of the various subareas are all generated naturally and easily by the GIS.

Next, the GIS-intrinsic Sketch was used to locate and align the sketches to improve field operations and create potential useful building sketches for other agencies. With sketches properly aligned and located (see example in figure 7 following), the field staff could better manage their time on large agricultural, multifamily, commercial, and industrial properties where locating the correct building(s) among many and/or distant buildings is necessary.

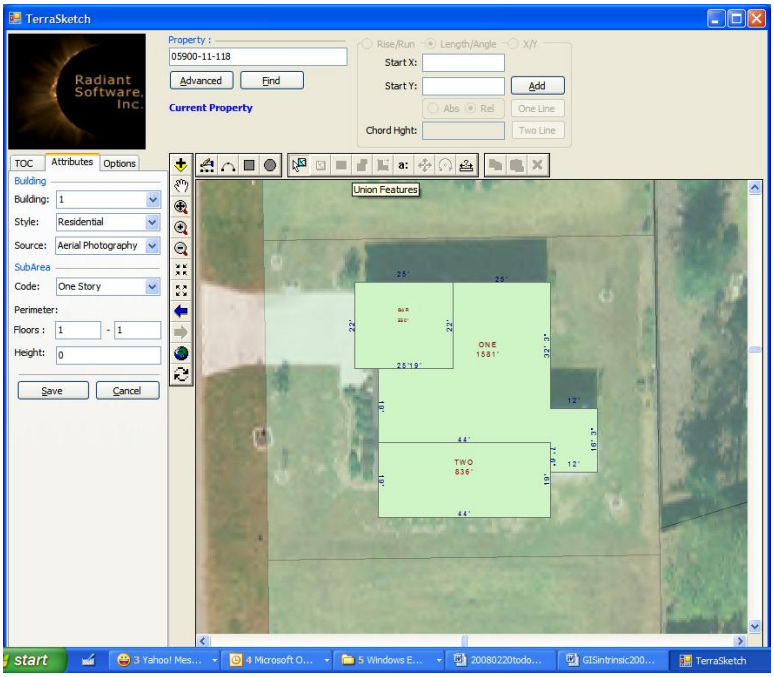
Figure 7. Buildings are easily located and aligned



Again, unlike in a CAMA system, location and alignment are a natural function of the GIS. The input not only allows for directions/angles and distances/lengths, as are commonly found in CAMA systems but X/Y coordinates may also be directly input, if they are available from surveys or GPS information, which will allow for even more natural, faster, and easier entry, location, and alignment.

After locating and aligning buildings, the assessor may find other benefits such as for discovery and quality control. The new information may then be directly used to identify the structural difference and the change(s) required and/or a field person may be dispatched to verify and correct the data (see figure 8, following).

Figure 8. Identify and resolve discrepancies

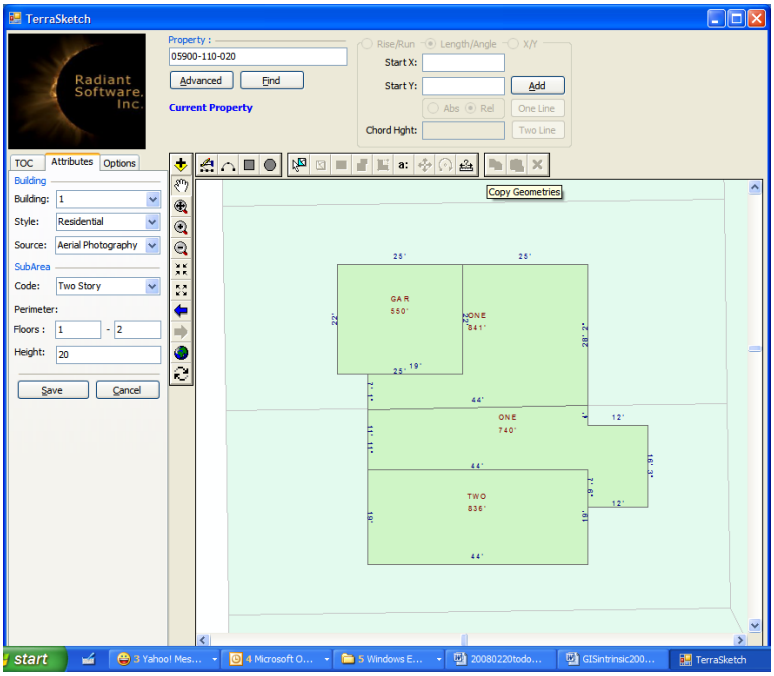


Again, using GIS with aerial photos, LIDAR, or oblique imagery, naturally supports quality control to detect errors, allocate resources, and correct the errors.

This demonstrates the power of a GIS-intrinsic CAMA sketch to leverage both the GIS functionality and the geodatabase to handle routine day-to-day CAMA tasks and solve common and complex CAMA drawing problems naturally and without integration.

However, once we begin to use the GIS-intrinsic CAMA sketch we begin to see how more complex problems can be naturally dealt with in GIS. For example, assessors often need to deal with buildings that cross parcel, municipal, and/or tax district boundaries (see figure 9, following).

Figure 9. Building split along parcel, municipal and/or tax district line:



This demonstrates the ease with which a GIS-intrinsic CAMA sketch can be used to naturally solve the more complex CAMA problem of how to handle a building on multiple parcels or even across a boundary such as a city or district boundary. And, again without integration!

The GIS-intrinsic CAMA Sketch demonstrates its effectiveness at handling all of the critical CAMA requirements. With use, we know that assessors will discover many other problems that will be more easily and naturally handled by a GIS-intrinsic CAMA Sketch.

IV. GIS-intrinsic CAMA Sketch – What we have proven:

The GIS-intrinsic CAMA Sketch has proved the concept. It easily meets all of the assessor's drawing requirements while providing significant improved benefits:

1. The GIS-intrinsic CAMA Sketch draws the buildings as needed by the assessor;

2. The GIS-intrinsic CAMA Sketch calculates all of the areas, perimeters, and volumes needed for valuation;

3. The GIS-intrinsic CAMA Sketch is stored in an open database format that can be moved from one CAMA to another without conversion – no more sketch conversion;

4. The GIS-intrinsic CAMA Sketch does not require special skills to operate;

5. The GIS-intrinsic CAMA Sketch facilitates and simplifies a number of common CAMA problems:

    - Buildings are positioned for ease of location in the field for large tracks and multiple building parcels;

    - Buildings which cross parcel or jurisdiction boundaries are easily handled;

    - Buildings are positioned for location and proximity analysis as needed to determine the affects of positive or negative influence factors such as flood plains, golf courses, etc.;

    - Buildings are positioned for spatial and tabular analysis;

    - Buildings are positioned for public inquiry and defense of values.

    - Buildings are created, stored, and maintained in the GIS and geodatabase so they are readily available for use by GIS and non-CAMA functions including viewing and analysis (e.g. flood analysis, 911, building permits, planning, zoning, special assessments, etc.).

At the same time the GIS-intrinsic CAMA Sketch provides us with a hint of what we might gain from an entirely GIS-intrinsic CAMA system. The GIS-intrinsic CAMA has the potential for significant (as opposed to incremental) advances in CAMA technology. Because it will be easier to involve GIS in more appraisal and assessment operations, the potential benefits are enormous. Many of these benefits may not even be discovered until after the software has been in operation and people have an opportunity to imagine the possibilities.

We also learned a couple of important lessons as a result of creating the GIS-intrinsic CAMA Sketch. First, to maximize the benefits requires starting with a clean slate.

This approach prevents handicapping the new software with legacy system constraints. In addition, we did not experience any issues relative to whether assessment operations might need to be changed to deal with whether the parcels or the drawings needed to come first. It doesn't matter. If parcels come first, just draw buildings and position them when you complete the drawing and you are done. If buildings come first, you can still draw them all on the parent parcel and position when you complete the drawing. When the parcel is split in the GIS, you are done. The only thing that is important is that they both get done before the rolls are finished.

Finally, buildings should be positioned based on best available information. They can be easily moved when better information becomes available.

V. Where do we go from here?

Jeff Spelman in a recent article said it best:

> 'The information on an individual parcel is the Holy Grail of GIS, and it is local governments responsibility to map it, keep it up to date, and preserve its accuracy and validity for tax records, water and sewer information, E911 applications, law enforcement, economic development, and scores of other uses.' Spelman, Jeff. 2007. "The Rise of the Amateur Mappers: The Effect of Mashups, Map Hackers, and Google Earth on Traditional GIS." *Fair & Equitable,* July.

Most assessors have more data about each parcel as well as data on every piece of real property in the jurisdiction. This makes the assessor the single largest source for the creation and maintenance of parcel data in most local governments. Assessors are responsible for parcel data maintenance in order to properly determine the property taxes for their jurisdictions. In addition, this parcel information is being used by more departments, agencies, and organizations inside and outside of government. Pressure will continue to grow for this information from outside of the office for everything from E911 to disaster preparedness to homeland security. This pressure will include pressure for real estate and assessment data standards.

We see more and more conferences, seminars, and articles discussing current and desired standards as evidenced by the recent article "The Emergence of Real Estate Data Standards: Opportunities for Public and Private Sector Collaboration" by Mark Linne in *Fair & Equitable*. Mark rightfully describes the connection between data standards and GIS.

However, there is much more to it. Not only is GIS the key to location in the appraisal process, as described by Mark, but it may also be the key to developing the 'open, transparent, and vendor-neutral environment' he describes as the mission of many standards organizations. GIS systems and databases are already common throughout government and the private sector and attempts to share data across these agencies and organizations through integration are equally as common. It would seem only natural to take advantage of the proliferation and synergy of GIS to advance cause of parcel data standards.

We believe that we have shown that a GIS-intrinsic CAMA Sketch is ideally suited to meet the sketching and drawing needs of assessors. At the same time, we have shown that a GIS-intrinsic CAMA Sketch is well suited to expanding CAMA drawings and sketches to better meet the needs of the governmental and

non-governmental organizations and the public at large. We feel this more than proves the concept of a GIS-intrinsic CAMA system and as a result:

It is not only possible to use GIS to *imagine* a better assessment world…..

it is now possible to use GIS-intrinsic CAMA to *create* a better assessment world.