IN THIS ISSUE:

- BUILDING VIRTUAL SAN FRANCISCO: GROWING UP WITH GIS .......................................................... 3
- DPW USES LIDAR DEM AND A CUSTOM ALGORITHM FOR DELINEATING DRAINAGE CATCHMENTS AND HYDROLOGIC MODELING ..................................................... 5
- PREPARING HISTORICAL AERIAL IMAGERY OF SOUTHERN CALIFORNIA DESERTS FOR USE IN LADWP’S GIS .................................................. 7
- WHERE IN THE BAY AREA .................................................................................................................. 13
A MESSAGE FROM THE VICE PRESIDENT

Hope this message finds you all in a creative, can-do frame of mind. The creative and can-do capabilities
of our Bay Area GIS community featured at BAAMA educational sessions never cease to amaze me. My
message today is a public service appeal, challenge and offer to our GIS community. As it has most recently
in Japan, natural forces can cause unexpected havoc. With this event in mind, I ask you to consider making
some kind of improvement to the emergency preparation and response efforts going on in the Bay Area. In
the current climate of economic challenge, emergency training, preparation and related efforts often take a
back seat to other municipal and regional priorities. Make this month one in which you find at least one way
to help a local community improve their response capabilities. By finding a community preparedness group,
City, County, regional, or State agency you can help, there are a number of ways in which each of you can
move our Bay Area emergency preparedness status forward.

TYPES OF HELP

- Find a local Citizen Emergency Response Team and provide them some type of training or map prod-
  uct which may facilitate their training or response capabilities. There are many sources of data, GIS soft-
  ware and expertise that could be brought to bear to help these groups.

- Contact your local City or County Emergency Operation Group and ask if there is some way you can
  volunteer to help their preparedness efforts; maybe compile a dataset, make a map, or provide some
  GPS training.

- Find some colleagues, sit down with a few beers and generate some creative ideas on what you as a
  group might do in the Bay Area to help Emergency Preparation efforts somewhere. Come up with sev-
  eral ideas, choose one and make it happen.

This May BAAMA’s bimonthly educational session presentations at Oakland’s Metropolitan Transportation
Commission will focus on Public Safety. Several experts will share their most recent activities with the
BAAMA community on using GIS to enhance and enable emergency preparedness and response efforts.
The meeting will bring together many GIS-minded emergency professionals; some with ideas, some with
needs or questions. Help be part of the process of advancing our Bay Area’s emergency preparedness
and response efforts. Use the meeting as an opportunity to find at least one effort you can contribute to.

By assisting your community you’ll meet some new people and probably be challenged at some point, but
probably also have some fun and definitely know that you’ve enhanced the preparedness level of our Bay
Area community.

OTHER BAAMA ACTIVITIES

BAAMA board uses its website, BAAMA.org, as a primary means of compiling Bay Area GIS events, informa-

tion, connections, and opportunities. We hope you will take some time to check out the newly revised site.

Don’t see something you think it should have? Send an email to any of the BAAMA board members and tell
us what you think the site needs. Find something interesting you think we should know? Let us hear about that
too. Besides the website, our bi-monthly meetings are another of the primary ways we create opportunities
for our GIS community to network and learn from each other. Please join us at our next meeting.

Spatially yours,

Phil Beilin
2010-2011 BAAMA Vice President
The power of maps is something we all know and love. When I was a little girl, and I’ll age myself here, the Cold War was still hot and Regan hadn’t torn down the wall. With this in mind, I remember looking at a Mercator world map and thinking the U.S.S.R. was certainly something to fear because the country simply took up so much space on the map. Of course, what I saw was the distortion of land forms at the poles caused by the cylindrical projection.

A more recent and relevant example of the power of maps is Sarah Palin’s “Crosshairs Map.” I am not going to take a stand on either side of the controversy but would like to make the point that once again a map is at the center of a discussion. I use political map references because politics is a personal passion. Other examples of the power of maps include: water distribution for agriculture, deforestation, or railroad right-of-way land purchase maps. The projection, data, and/or symbology we choose to include or exclude can greatly impact decision makers.

Many great philosophers throughout history have uttered some version of: “with great power comes great responsibility.” It can be argued that as professionals who use the map medium as our message, this power is our responsibility. It can also be argued that at the end of the day it is our clients who have the most power because they pay the bills. Either way we are lucky to be able to create fabulous maps that one way or another influence those to which they are exposed.

The Spring 2011 Journal features articles about visualizing virtual cities, preparing historical aerial imagery of a Southern California desert, and creating a process to model water drainage. The BAAMA board and I are grateful to the authors of these articles for their participation and support. The Letter from the Vice President encourages us to engage in GIS-related public service opportunities; to take this great skill set into our communities and lend a hand. The next time you build a map, process, or model that may serve your community consider my Cold War and the Mercator projection story. You might not be able to meet the people who see your map but its power may stay with them forever.

Thank you for your attention and support of BAAMA Journal.

Catherine Burton
Editor, BAAMA Journal
I’ll ask the reader in advance to forgive me if I reminisce as I relay the story of building a digital version of the San Francisco Bay Area. This story begins long ago.... before desktop computers... before ESRI, Autodesk, Bentley and well... GIS. I’ll take you through my earliest efforts with digital mapping, topography and 3D city building right through to today where we are using GIS products to build the next generation of consumer navigation systems, social networks and even computer games.

It was 1976, I had packed my bags for architecture school with all of the requisite tools for my new profession; t-square, rolls of vellum paper, pencils, French curves and my Texas Instruments SR51 pocket calculator (my only nod to the dawning digital age). In years prior, I had been introduced to computers and programming but they held little interest for me as the design of buildings had become my sole passion. As I began my studies at Cornell, in Upstate New York, I was unaware that my structural engineering professor, Don Greenberg (one of the founding fathers of 3D computer graphics) would infect me with a long lasting interest in using digital tools to simulate the design of buildings and cities.

In 1981, after graduating from architecture school I moved to San Francisco and began to work with the architecture firm, Whistler-Patri, designing large buildings. Four years later, I convinced my bosses to let me train on the McDonnell-Douglas GDS drafting system running on networked Mini VAX computers. Most thought me crazy because “computers were only useful for repetitive drafting tasks” and that “designing on a computer was science fiction.” That year, I built my first 3D building model by typing the xyz coordinates of each building corner into the complex system. A year later, I had my first computer and a copy of AutoCAD which I used to develop design studies for Hills Plaza in San Francisco.

In 1988, I moved to Stanton & Associates where I instituted their first CAD system. I remember having to write a cost to benefit analysis for the addition of mice to the computers. One by one, I trained the team in the use of CAD and we began to produce 3D rendered still images of our designs using a software package called Big D.

In 1991, I began my own firm, Colleen Architects. I was committed to the notion of a fully digital architecture firm so we never purchased drawing boards... an unheard of eccentricity at the time. My first 3D animation commission came when I convinced my Wife’s boss, at Rand McNally, to create an animated promotional video. With their down payment, I purchased a copy of 3D Studio, locked myself in my office and taught myself the ins and outs of the animation program. Amazingly, I produced a three minute animation with voice overs and music!

Next, to market my own architectural design studies, I made
the commitment to begin building an accurate 3D model of San Francisco. At the
time, building 3D city models was new. The only other model that I was aware of
was built for the San Francisco Planning Department to study building shadows. The
model was created by HJW in Oakland based on data from their stereo plotter sys-
tem. Our 3D San Francisco model was built very differently by using DPW road
maps, property boundary dimensions from the Tax Assessor, and building heights
from architects drawings and field estimates. I didn’t fully appreciate it at the time,
but our approach was and still is the most accurate way to build a city model.

Soon, I was adding DEM-based terrain, sourced from the USGS in Menlo Park, to
the San Francisco model. In one visit to the USGS, I asked the person at the counter
about how the DEMs were produced and why they seemed to have vertical inaccu-
racies relative to my San Francisco road network. He told me that he didn’t know
but that the head of the DEM program was in and could answer my questions. I
learned that the first digital DEMs were produced by manually running a 3D panto-
graph arm over cardboard topographic models!

Before long, news of our San Francisco model reached other architecture and engi-
eering companies who wanted us to simulate their designs. This prompted me to
form a sister company called 3D motion with Kate Gillespie. Our first commission
was the animation of the new International Terminal at SFO along with the new road
network, train and parking garages; little did we know that we were producing the
largest (2 million polygons) 3D computer model in existence. Later, Silicon Graphics
borrowed the model to test their new line of super computers.

The SFO model was my first introduction to geo-registration... they used multiple coor-
dinate systems (State Plane, San Francisco Datum, Lat. Long., SFO’s own local coordinate
system, etc.) to account for a wide range of users and registration approaches. Up until
that time, we had only used the San Francisco datum and our 0,0 origin was located
where we began the model, at Hills Plaza.

In 1994, I was introduced to Dave Nagle, the head of software at Apple Computers.
Through Dave, I met Apple’s early 3D and QuickTime VR teams. When Dave learned of
our Bay Area model, we were asked to produce a computer animation flying from San
Francisco to Candlestick Park for Steve Jobs’s keynote at the Apple Developers Conference
that year. This exposure to high technology would shape our future.

1995 was a pivotal year for us. On a backpack trip with Barb Singer (later to found
Intervista Software) I was challenged with the notion of placing San Francisco online as
the first virtual city using the newly conceived VRML (virtual reality modeling language).
The idea tantalized me and I could see much potential for an online city; we began work
at once. For the first time I began the painstaking work of editing 3D files by hand in a
text editor to produce the VRML files. By August 1st, the first 3D viewer was ready and the
first San Francisco neighborhood, which we called VirtualSOMA, was released with great
fanfare at the Siggraph computer graphics conference in Los Angeles. Days later, I was on
the cover of the LA Times with VRML co-inventor Mark Pesce. My life had changed forever.
I returned to San Francisco, completed our architectural projects and changed the com-
pany name to Planet 9 Studios in homage to Ed Wood’s movie Plan 9 from Outer Space.

Also during that time, I met David Coggeshall, the creator of the first 2D building informa-
tion model (BIM) for Genentech. David’s seminal work would inspire us to create the first
3D, VRML based BIM, in 1997, for the US Navy which we called “Navy - Virtual Earth”

continued on page 10
One of the uses of a Digital Elevation Model (DEM) is to automatically generate catchment areas for use in hydraulic modeling. This type of analysis is often used to model rivers and the horizontal resolution in such instances tends to be coarse, typically 30 meters or greater. Last year, San Francisco Department of Public Works (SF DPW) applied similar techniques at a fine resolution. The results are currently being used to study pipe hydraulics for San Francisco’s sewer system.

A 1-meter horizontal resolution LiDAR (Light Detection and Ranging) aerial survey of San Francisco was acquired in June 2007. The FBI ordered the survey prior to that year’s baseball All-Star game for use in security analysis, and provided the data to the City for free after the event. When studying urban storm water hydraulics, especially in a very hilly area like San Francisco, a high-resolution base layer is an ideal source for creating accurate models. SF DPW used the survey to delineate drainage areas across the entire city at the level of individual drain inlets, which were then aggregated to larger basins.

When creating a small scale catchment delineation of a large area, traditionally, an experienced engineer may review map contours, the sewer network, property lines, and other data. Then that engineer may draw the catchment boundaries based on the information at hand and his or her own subjective experience. If the engineer does not have time to review and delineate the entire area of interest, a team may finish the work. Since each team member would do delineation slightly differently and introduce unintended biases, this process introduces some uncertainty. A major benefit of delineating drainage boundaries using a DEM or LiDAR is the process can be replicated.

To automate the drainage catchment delineation process, the authors created a computer script in ArcGIS ModelBuilder called the “Urban Drainage Model.” Several GIS layers from SF DPW’s Sewer Information System are used as inputs to the script including manhole, drain inlet, and pipe layers. Using other tools developed in-house such as Oracle spatial based network tracing and import/export utilities, a complete hydrologic and hydraulic model can be created in the GIS on the fly.

DELINEATION OF SUBCATCHMENTS AND CREATION OF HYDRAULIC MODEL WITH A DEM: THE SF DPW “URBAN DRAINAGE” MODEL

The “Urban Drainage Model” is based on the commonly used “steepest path” approach, using a gridded elevation model. The algorithm is illustrated in the figures below:

1 – Digital Elevation Model: This is the source data used.
2 – Flow Direction: Direction of flow from each cell, based on steepest path
3 – Stream Network: Illustrates flow direction
4 – Location of drain inlet whose catchment area will be found
5 – Complete model with sewer pipes, manholes, and catchment area
STUDY AREA

Using the “Urban Drainage” model, catchment areas were delineated for the City of San Francisco (approximately 30,000 acres). A subcatchment was created for each drain in the area. Since the process is designed to be automated, revised catchments can be created whenever the source data changes. Amendments are made to the script based on feedback gathered after each revision.

SMOOTHING AND HYDRO ENFORCEMENT

Hydro enforcement is used to force the modeled surface flow to fit within known boundaries, or follow a known flow path. For example, the elevation model can be lowered along a river channel, to force the flow to stay in the channel. Similarly, known ridges can be represented by raising the elevation model along the ridge.

Property lines are used in the “Urban Drainage” model as high walls, forcing the flow path towards the nearest street. Street right-of-way is also used as a lower wall, so that any flow which enters the right-of-way is not allowed to re-enter a property. This simplified logic approximates the real-world conditions, where runoff from private property is piped to the sewer main. There are some cases where this logic is incorrect, such as when a street slope runs counter to the sewer slope. However these cases are rare enough that they can be neglected when the catchments are used for large-scale, basin-wide analysis. For detailed design of the smallest pipes, the automatically created catchments must be reviewed for these types of exceptions.

Drain inlets are also used as hydro enforcement features during the depression filling process. A depression is defined as any cell(s) where flow path reaches a dead end, rather than the edge of the map. Some depressions are artifacts of the aerial surveying process, and must be filled in. However, there are real depressions at each drain location. The ESRI grid hydrology tools treat null cells the same as the edge of the map, so a depression with a null cell at its bottom is not filled. By adding each drain to the DEM as a null cell, the surrounding depressions are left unfilled, which greatly improves the resulting catchment boundaries. The drain inlets become the loading point for the next downstream pipe segment in the model.

Some smoothing of the DEM must be done before it is used for delineation, such that the output catchments are smoother and easier to interpret. Elevation is averaged within a 3-meter circle radius using the Focal Statistics tool.

The LiDAR survey can be used to identify subcatchment parameters such as slope. SF DPW also uses multispectral imagery which can differentiate between pavement and vegetated surfaces. This data is used to estimate each catchment’s impervious area.

HYDRAULIC MODEL CREATION PROCESS FROM SEWER GIS

Part of the impetus for creating the catchment delineation tool was the availability of the Sewer GIS. The GIS includes every pipe and manhole in the City, and was developed with hydraulic modeling in mind. With the availability of a consistent set of small subcatchment, hydraulic models can be created quickly for any part of the City.

In the figure below, catchments created with the tool were used to create a basemap for use in a hydraulic study. All the pipes and catchments upstream of the “point of interest” were identified, and can be imported into the modeling software.

continued on page 9
Orthophotos with more and more frequent updates have become a common part of any GIS. This article describes a project in which 9,700 aerial images from 13 epochs ranging from 1929 to 1996 were catalogued, orthorectified and mosaicked for use by the Los Angeles Department of Water and Power (LADWP).

Like many agencies, LADWP has an extensive archive of historical imagery dating back many decades. As is often the case with organizations whose business is not aerial photography, this film had been accumulated over a period of years and stored casually in boxes and office filing cabinets without a written archive. In 2009 LADWP contracted with the Geomatics team at the Tetra Tech R&D office in Lafayette, CA to prepare for use in their GIS an estimated 9,700 aerial images taken in 13 epochs covering the Owens Valley and the Mono Lake Basin. The tapping of the water resources of Owens Valley and the Mono Lake basin by the City of Los Angeles, begun more than 100 years ago, is one of the epic tales of California history. The motivation for this study was the Department’s effort to understand and document the impact that the development has on local conditions.

Our plan from the start was to identify blocks of stereo photography and tie them tightly together by analytical aerotriangulation before attempting to build a mosaic from the individual images. Several inputs are required when generating an orthophoto mosaic from a set of aerial photographic images. Besides the block of overlapping aerial imagery, the rigorous process requires a calibration model of the camera used for the photography and surveyed ground control points (GCPs); in most cases GCPs have been targeted before the flight mission so as to be visible in the images and a good digital terrain model. For modern projects, location coordinates and rotational angles for each exposure are usually available. When we began work with the historical imagery of the Eastern Sierra we enjoyed few of these advantages.

The film we worked with came from several sources; most of it was in the possession of LADWP. It came to us as standard 9” color aerial film rolls with a few epochs of their holdings being individual cut negatives on clear film base. All but one epoch of photography had been flown by IK Curtis, a venerable Los Angeles area aerial photography firm, a fact that proved useful in chasing down camera calibration reports. The three oldest epochs of photography had been flown by the Fairchild Aerial Mapping Company, a pioneering aerial photography firm. These photographs were held in the Fairchild archive at Whittier College (now closed) and at the Map Information Library at UC Santa Barbara. The Whittier photos, taken in 1929 and 1930 of Mono Lake and the surrounding basin, used an unusual 7”x9” film format. The photography from UCSB was an extensive set of 854 images taken in 1944 extending from Little Lake in the
southern end of the Owens Valley to Crowley Lake in Long Valley.

The first step in creating a mosaic was to develop an inventory of the film resource. We were fortunate that the film had been labeled by the original photographer. Mounting the rolls of film on a light table with a reel to reel transport mechanism allowed us to build a spreadsheet with a record of 16 fields for each exposure including date and time, flight line, project area, camera ID and any instructions for scanning. Within the 13 epochs of photography we identified 50 separate blocks of stereo images, some with as many as 1350 exposures, some with as few as 4.

The next task was to convert the analog film images to digital format. With so many exposures to convert we turned to the scanning specialists at Geoscans of Tucson, AZ. Their work would be critical to our process and was not without its challenges. The film we sent them had been stored for decades under less than optimal conditions and had suffered discoloration and even physical damage as a result. Nevertheless, we sent them the film with notes detailing a name and scan density for each exposure and they returned the scans to us on hard drives, ready for us to introduce into our aerotriangulation adjustment.

Aerotriangulation is the process whereby overlapping exposures are tied to one another through the measurement of tie points in the overlapping parts of the images. The procedure also makes it possible to register the adjusted set of photographs to a map coordinate system using a relatively sparse set of ground points. Knitting the exposures together before orthorectification was a key to ensuring that the orthophotos generated from adjacent exposures would mosaic accurately. Since we were working with digital images we used softcopy methods to do the aerotriangulation. We began by developing fairly accurate estimates for the location of each exposure in a block of photography. With over 9000 images to locate we developed software that allowed us to at least partly automate the procedure by locating the first and last exposure in a flight line and then interpolate estimates for the intermediate exposures on the flight line. Another required input for aerotriangulation is camera calibration data. We were fortunate to be able to obtain calibration reports for photography back to 1981. For the older imagery the situation was more challenging. We had to construct our own camera data from what little information we could gather from the sources of the imagery and our own internet searches.

The introduction of a standard projection was critical to preparing the photography for use in GIS. To accomplish this, ground control points had to be identified and measured on the photography. Not having the convenience of paneled ground control points, we had to pick natural features such as intersections of dirt roads that were found to exist in the historical imagery and were still identifiable in today’s reference imagery of known projection. We were often surprised at how little some features had changed over the years while other locations were barely recognizable as the same place. To derive the horizontal location we used NAIP, DOQQ and rectified Ikonos imagery provided by the client. Elevations were interpolated from an IFSAR DTM provided by the client or from USGS NED where the photography extended beyond the IFSAR data.

With estimates, camera models, and a selection of ground control points we continued on page 11
CONCLUSIONS
This has been an example of replacing older style engineering tasks with GIS automation. Automated GIS tools can streamline time consuming processes as well as help improve model quality and resolution. SF-DPW staff continues to refine this model to help improve the reliability and resolution, as well as to add new features to allocate surface flows separately from individual house flows which will increase the model resolution even further. The sub-catchments delineated using these tools are also consolidated for use in lower resolution City Wide models which are used for large project planning.

Sonoma County and evolved into helping manage 1,000 miles of very old sewers in San Francisco.

Nick Birth is a Junior Engineer at SF DPW, and a recent graduate of San Francisco State University. He was initially exposed to GIS through an internship at DPW, which inspired him study the field further at SFSU.

ABOUT THE AUTHORS
Greg Braswell is sewer information manager for San Francisco’s sewer system. His GIS background started with fire department mapping in

BECOME A BAAMA MEMBER OR VOLUNTEER TODAY!
INDIVIDUAL MEMBERSHIP BENEFITS
($25 ANNUAL FEE)
- Free admission to bi-monthly educational meetings
- Free admission to Technical Tours
- BAAMA Journal subscription via email
- E-mail announcements & reminders for Bay Area GIS activities

BAAMA SPONSOR BENEFITS
($150 ANNUAL FEE)
- Up to 10 individuals from the organization receive all individual membership benefits listed above
- Listing as sponsor on BAAMA web site and in the BAAMA Journal
- Link to organization web site from BAAMA web site
- Once/year opportunity to send an informational or advertising announcement to all BAAMA members
- Opportunities to conduct Technical Tours

INTERESTED IN VOLUNTEERING?
Are you already a BAAMA member who’d like to get a little more involved? BAAMA welcomes members to take volunteer roles in the organization’s activities!

There are many reasons to be a BAAMA volunteer. Volunteering will increase your professional toolbox and enhance your resume. And, you will get to better know your fellow BAAMA members and board members.

Download an application form from BAAMA.org/application.pdf.
(NVE). Today, NVE is in its third generation and is used by a wide range of Navy users for facilities management, design studies, security and even flight training.

In 1997, our work was discovered by the GIS community after speaking at CalGIS and appearing in GIS Magazine. Before long we were cooperating with ESRI (who had just released 3D Analyst), Map Info and Hansen. I have to admit that local GIS users were not very focused on 3D in these years as strong tools and use cases had yet to emerge. Where we did find interest was with Government GIS users at NIMA (now NGA) in Washington DC. They realized that our open standards approach to geo-registered 3D was very applicable to their users and would eventually eclipse proprietary defense contractor solutions.

In 1998, we were asked by NASA’s Mars Pathfinder team to work with them on the laser scanning of cities. Through NASA, I was introduced to Avideh Zakhor’s group at UC Berkeley’s who was building 3D models from video. I convinced Avideh that the laser scanning of cities was viable so she went on to build the first vehicle based laser scanning system. Today, vehicle based laser scanning has become the norm and companies like Google, Navteq and Teleatlas are scanning all major cities.

In 1999, I gave the first DOD briefing on Keyhole’s soon to be released Earth globe platform (now Google Earth) with our own Virtual San Francisco displayed in it. A year later, the Keyhole globe was on thousands of Government computers. In my opinion, Google Earth has done more to bring GIS into the mainstream than any other software platform. That year, we also began working with SRI on the DARPA funded, Al Gore inspired, Digital Earth project. Digital Earth would lay the groundwork for open, standards based GIS and Earth globe systems such as X3D Earth (www.web3d.org).

Today, Virtual San Francisco is alive and well (along with about 150 other virtual places) and it’s used by architects, engineers, game developers, movie producers, GPS navigation companies and even TV news & weather. We are big supporters of open standards and participate actively in OGC and the Web3D Consortium. Through our work in 3D soldier tracking with the US Army, we developed a 3D GIS / BIM platform called RayGun accompanied by a geographic streaming server called GeoFeeder. In 2009, RayGun was released on iPhone and Android and became the first mobile, 3D, social, geo-located game called Dark Design.

I’m very bullish about the future of 3D cities and look forward to fully open GIS running free, community sourced 3D data. I have watched dozens of proprietary 3D platforms come and go over the years so I feel great that the standards based, 3D systems that we supplied to our oldest customer, the US Navy, still run after

continued on page 13
tied the individual blocks of photographs together with image measurements of automatically generated tie points. To overcome deficiencies in the photography including gaps between flight lines, inadequate endlap between sequential photos in a flight line, flight lines apparently deflected by strong winds, poor image quality or even the quite unconventional circular flight lines flown around Mono Lake in 1930, we found it necessary to stabilize a block by the introduction of manual points.

When we were satisfied with the quality of the adjustment of a block of photos we orthorectified the imagery based on either a DTM from USGS or, where the terrain had changed, an autocorrelated DTM. The images were then color balanced, mosaicked with automatic and manual seamlines, and cut into rectangular tiles for delivery. At the start of the project we had developed a tiling scheme with the client that was based on the USGS 7.5’ quadrangles for the area each divided into nine tiles.

The overall accuracy of our results was related directly to the quality of the control points we used in aerotriangulation. Because we did not have the benefit of surveyed and targeted points and had been forced to use photo-identified points we had results on the order of a meter or two for most epochs of photography. As expected we had more difficulty identifying common points on the older epochs of photography, but we and our client were pleased with the way that the orthophotos from different years overlaid one another.

Along the way, several other technologies were used during the project. A Microsoft ‘Sharepoint site’ allowed us to update and share documents with the client so they could keep current with the progress being made. Also, during the course of the project...
Tetra Tech’s ‘GeoManager’ was used to provide the client with access to thumbnails of the high resolution scans. GeoManager is a Google Maps API that provides a mashup between Google Maps and the client’s project data. Before the triangulation and orthorectification was complete and the results delivered, the client could locate any photograph in their archive by year and by geographic location and download a 300 dpi scan of the negative for reference.

ABOUT TERA TECH
Tetra Tech is a leading provider of consulting, engineering, and technical services worldwide. With a full suite of services, Tetra Tech utilizes a wide range of the latest technologically advanced tools to produce LiDAR digital terrain models, planimetric maps, engineering scale contour maps, digital orthoimagery, custom LiDAR feature extracted datasets, volume calculations, multi & hyperspectral data, thermal infrared imagery, GIS, data management and hydrographic survey services. Our ASPRS-Certified Photogrammetrists have worked together for more than a decade and bring a wealth of industry experience to our team of remote sensing, mapping and IT professionals.

ABOUT THE AUTHORS
Dr. Loecherbach’s education is in land surveying and geodesy with emphasis in photogrammetry and adjustment theory. He has been continuously involved in photogrammetry since 1985. Throughout his career he has been instrumental in implementing ABGPS, INS technology, LiDAR, digital camera systems and other remote sensing applications into the photogrammetric workflow. As Geomatics Director, he is responsible for aerotriangulation, which is at the heart of each project’s geometric accuracy. In this role he has also introduced automatic terrain extraction by image matching and developed custom C-programs in support of orthorectification, image mosaicking, seamline feathering, etc. Thomas also lends his professional guidance to the area of data fusion; merging datasets from varying data types, formats, sources and accuracies, which are inherent in our industry. Dr. Loecherbach holds a Ph.D. in Photogrammetry (Geodesy & Surveying) from the University of Bonn, Germany.

Mr. Ashley is a senior level professional with more than 23 years of project experience that is supplemented with a strong academic background in surveying and photogrammetry. Mr. Ashley has skills at every aspect of the mapping process, from...
HISTORICAL AERIAL IMAGERY  Continued from pg. 12

aerotriangulation design and computation, to digital map translation. Because of the breadth of his capabilities, he is a vital consultant for our clients on project design and best technical approach for photogrammetry, airborne LiDAR, and orthophotography. Uniquely, Mr. Ashley’s has worked extensively with historical aerial imagery archives, some of which date back to the 1930s. Frequently client projects required that he use archival imagery to develop maps of historical conditions that could be documented in no other way. Often his results were used as evidence in state and in federal court where he was called to testify as an expert witness and discuss his methods. Over the years, Mr. Ashley has managed hundreds of major mapping projects for public agencies and private clients. Mr. Ashley is a member of California Land Surveyors Association and frequently conducts photogrammetry and LiDAR workshops for the Land Surveyor review classes. He holds an M.S., Civil Engineering-Photogrammetry and Surveying from UC Berkeley and a B.S. in Mathematics. ☞

WHERE IN THE BAY AREA?

Think you know slough? Try this one on for size. If you can’t identify it immediately, you’ll have fun cruising around the Bay searching for its name and location. This 2005 San Mateo County Orthoimagery via Seamless Server image was provided to BAAMA Journal by David Medeiros, GIS Assistant Branner Earth Sciences Library - Stanford University.

Name the slough and reserve in this picture and send your answer to editor@baama.org. One lucky winner will be randomly selected from all correct entries received by September 1, 2011. If you give the latitude-longitude coordinates that fall in the image, you definitely get bragging rights at the next BAAMA educational session! The winner will be announced in the next issue due out GIS Day 2011.

BUILDING VIRTUAL SF  Continued from pg. 10

14 years! We are tracking important technology developments relative to 3D city models used as interfaces including augmented reality, crowd sourced 3D modeling and plugin-less 3D available in HTML 5 (check out www.x3dom.org).

I’m always on the lookout for the next great tool, technology or partner. If you have an idea, please drop me a line at dcolleen@planet9.com.

ABOUT THE AUTHOR

David Colleen is an architect, 3D artist and software designer. In 1981, David graduated from Cornell’s School of Architecture and made his way to San Francisco to design high-rise buildings. In 1995, circumstances prevailed and he became one of the founders of virtual reality on the Internet leading to his forming of Planet 9 Studios. Today, he is focused on developing the next generation of navigation, tracking and social networking applications that feature 3D city interfaces. ☞
The winner of the Fall 2010 Where in the Bay Area? contest is Daniel Lutz from MechLabs in San Carlos. Daniel’s answer: “It looks like the “Where in the Bay Area?” photo in the Fall 2010 issue is a portion of the northwest end of Ryer Island between Suisun Bay & Grizzly Bay. Coordinates: N 38 5.594’ W 122 2.228’”

BAAMA received four responses, all of which were correct. The winner was chosen by random drawing.

BAAMA EXTENDS SPECIAL APPRECIATION TO ITS CORPORATE SPONSORS 2011

- 3D Visions
- AMS Consulting
- Autodesk, Inc.
- Ellis Geospatial
- Endpoint Environmental LLC
- ESRI
- Farallon Geographics, Inc.
- Geocadd Aerial Surveys
- GeoSyntec Consultants
- HJW GeoSpatial, Inc.
- Lohnes & Wright
- Metropolis New Media, Inc.
- Michael Baker Jr., Inc.
- MoosePoint Technology
- PSOMAS
- Towill, Inc.
- URS Corporation
- ValueCAD
- Weston Solutions, Inc.

EDUCATION/RESEARCH INSTITUTIONS
- Foothill College
- Stanford University

GOVERNMENT
- AC Transit
- Bay Area Air Quality Management District
- Bay Area Rapid Transit (BART)
- Caltrans
- City and County of San Francisco
- City of Berkeley
- City of Fremont
- City of Oakland
- City of Palo Alto
- City of Pleasanton
- City of San Rafael, Dept. of Public Works
- County of Alameda, Public Works Agency
- County of Marin, Community Development Dept
- County of Santa Clara, ISD
- East Bay Regional Park District
- San Mateo County ISD
- Vallejo Sanitation & Flood Control

NON-PROFIT ORGANIZATIONS
- GreenInfo Network
- San Francisco Estuary Institute

UTILITIES
- California Water Service Co.
- Central Contra Costa Sanitary District
- Contra Costa Water District
- Marin Municipal Water District
- Pacific Gas & Electric (PG&E)
- San Jose Water Company
- Santa Clara Valley Water District