



Santa Clara Valley Water District

File No.: 20-0432

Agenda Date: 5/12/2020

Item No.: *6.1.

BOARD AGENDA MEMORANDUM

SUBJECT:

Report on Findings of the Pilot Program Using Unmanned Aerial Vehicles in Land Surveying and Mapping Activities, and Approval of Continued Use.

RECOMMENDATION:

Approve continued use of Unmanned Aerial Vehicles for land surveying and mapping activities.

SUMMARY:

On April 9, 2019, the Board approved a pilot program using Unmanned Aerial Vehicles (UVA) in land surveying and mapping activities. After acquisition of UVAs and accessories, staff implemented the pilot program from July through December 2019.

Program Startup

The initial startup time of April 2019 was hindered by the discontinuation of the model of UAV that we had researched to be the primary platform for the program. Staff was able to secure one of these UAVs after searching the internet. Staff then turned to the new recommended platform of UAV to build what would become the backbone of our program. This UAV was more expensive but was offset by providing a more stable airframe, better camera and more options for future requirements.

This led to a steep learning curve in finding the best technology to support the UAV. Staff was able to find the proper iPad and software that would support the controller for the UAVs and various data collection software, Federal Aviation Administration (FAA) flight profiles and logging programs.

Use Cases

A. Surveying & Mapping:

1. Alamitos Percolation Pond, Topographic Survey for Volume Calculations.

A field survey crew set ground control points (4 hours), separate flight crew performed three flights to cover the entire campus (2 hours). Data was registered the following day and set to post-process overnight. Volume calculations were run and a completed Volume Report was sent to the Raw Water Unit. Total time from start to finish was five days at a cost of 24 hours of staff time.

In comparison, this pond was surveyed conventionally (boots on the ground) six months earlier, requiring 72 hours of staff time.

2. Rancho San Antonio Flood Detention Basin Construction, Topographic Survey for Volume Calculations and Base Map.

A field crew set ground control and flew the site in a single mobilization (9 hours) for volume calculation of five separate stockpiles across the site. In addition to the volumes requested, the data also yielded and updated ortho-rectified aerial mosaic image of the site which was used by the design team as a background for the archaeological exhibits as well as a digital terrain model (DTM) to compare the as-built conditions to the design model for the site. Total time spent was from start to finish was four days at a cost of 32 hours of staff time.

In comparison, a conventional topographic survey would have taken three weeks to complete with approximately 120 hours of staff time. A conventional manned-aerial would have been a third alternative, but required additional outside costs and four weeks to complete.

B. Construction Documentation

1. Upper Llagas Flood Protection Project construction, Photo Documentation of Haul Routes

Prior to the start of any large construction project, Valley Water's construction inspectors document pavement conditions of the haul routes to be used for the project to determine if Valley Water is liable for any damage to the pavement with the increased heavy truck traffic. Previously this has been done by walking along the various routes, taking photos with a handheld camera.

Utilizing UAVs, staff was able to fly the 30+ miles of haul routes for the project and collect high resolution imagery in a fraction of the time with the added safety benefit of keeping staff away from walking along the roadways.

2. Upper Llagas Flood Protection Project Construction, Invasive Plant Removal

The project's contractor was tasked with the removal of approximately 12 acres of Himalayan Blackberry surrounding Lake Silveira. Staff performed multiple flights over this portion of the project to document the removal activities, delivering a series of rectified orthomosaic images to the Environmental Planning Unit. For ease of viewing, staff worked with the GIS group to develop a Story Map tool that allows users to compare different images over the site in a web browser platform.

C. Public Relations

1. Coyote Creek Cleanup, Photo Documentation

Staff captured a series of videos over a section of Coyote Creek that were used for a commercial including Director Santos and Mayor Liccardo to promote a cleanup effort of the creek. The video can be viewed using this link: <https://www.youtube.com/watch?v=eIMHsjHAA2w&feature=youtu.be>

2. X-Band Radar

Staff provided images from a unique perspective for the news release about this new technology. Pictures can be viewed using this link:

<https://www.valleywater.org/news-events/news-releases/celebrating-permanent-installation-first-x-band-radar>

Evaluation of Pilot Program

A. Challenges in Using UAVs

In support of the Upper Llagas Flood Protection Project, we found challenges in flying in controlled airspace around San Martin Airport because San Martin Airport does not have a control tower. This was overcome by having a 3-person crew monitoring an online aircraft tracking software with scanner/radios to listen for manned aircraft entering the area and alerting the flight team when necessary.

We found that using the FAA recommended programs to plan for flying in or near controlled airspace are different for each airport. San Jose Mineta Airport forbids any flights with the vicinity of the airport while Moffett Field allows the use of UAVs.

During the 6-month Pilot Program, the Land Surveying and Mapping Unit has seen a successful integration of this technology. Our interaction with the public, both through media outreach and time on the sites around the county was very positive. Residents who approached our staff working in their neighborhoods showed interest in how the data is captured, controlled and utilized, commenting that they were glad to see technology being utilized for saving public dollars.

B. Efficiency and Cost Effectiveness

Table 1 (Attachment 1) presents a summary of cost for implementation of the Pilot Program. For comparison purposes, the initial estimated cost for implementation is also included. The difference in initial cost estimate versus actual costs were attributed to having to purchase a different type of UAV. As mentioned above, the original UAV platform was discontinued. The new platform was significantly more expensive and requires more peripheral support in hardware and software. This cost difference is offset by the fact that we will not have to upgrade to a better platform for this level of data collection as the program continues to grow.

These experiences led us to the conclusions that there are situations where the UAVs will be more efficient, cost effective and safer than other surveying methods. Topographic mapping and quantity calculations on dirt surfaces with minimal vegetation proved to have about a 75% savings over conventional surveying. Visual inspections of facilities and photo documentation for construction projects provided better quality results in a more efficient and safer manner. The use of the UAVs for Public Information provided quality perspectives and capabilities not previously possible. We met with Security Services to discuss their needs and possibilities of uses for the UAVs. We researched and developed a method for live-streaming video footage from the UAV to Emergency Operations Center that would be crucial for keeping staff aware of the site conditions of facilities during any event. In preparation of supporting Security Services, two of our experienced pilots opted to attend a training given by the Los Angeles Sheriff Department. This training was to learn how to use the UAV in support of law enforcement ground teams inside dwellings and in urban environments.

UAV technology does not replace the need for traditional survey methods but rather adds another tool collect data. As demonstrated by some of the cases above, it has proven to cut lead time for project delivery, expand the usefulness of the data collected, cut staff time and costs while keeping data collection within Valley Water.

FINANCIAL IMPACT:

Land surveying and mapping activities are budgeted annually through various capital improvement projects or operational projects that require land surveying and mapping services.

CEQA:

The recommended action is a ministerial action and thus is not subject to the requirements of CEQA.

ATTACHMENTS:

- Attachment 1: UAV Pilot Program Cost
- Attachment 2: PowerPoint

UNCLASSIFIED MANAGER:

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