

Incident Management Team Collector / ArcGIS Online Pilot

Region 1 Fire, Aviation and Air, Missoula Technology & Development Center and NPS Region 2 GACC

12/12/2014

Pilot Team

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Pilot in Brief

The problem:

- Lack of common platform and the ability to preload specific base map tiles for mobile collection of spatial fire data
- Inability to seamlessly transmit fire data and updates into an established database in near-real-time, accessible to all end users

The pilot:

- Test a COTS data collection app that operates without connectivity and can sync data in near-real-time, with existing data infrastructure
- Utilize an experienced Type 1 IMT and GISSs/SITL to conduct operational tests during the 2014 fire season.

The results:

- Increased data collection, reduced printing, improved map production, increased C&G staff awareness
- IMT Requirements: A GISS and IMT experienced in mobile technology
- Recommendations: An interagency Fire AGOL account, create training and support documents

Summary

The Collector Application is a recently released commercial off-the-shelf mobile application developed by ESRI. The application has the most functionality when used with ArcGIS Online (AGOL). The combination of the mobile application and web portal offer the capability to collect and update data in the field. The Collector application also allows for off-line storage of collected data, which can be synced once the user returns to a data connection. This pilot focused on Collector and AGOL's ability to enhance current fire mapping procedures, improve situational awareness and real-time information transfer of fire spatial data during incidents.

The Wildland Mobile Technologies Working Group facilitated the pilot testing of the Collector app and AGOL in Incident Management Team operations during the 2014 fire season. Lessons learned from the pilot indicate that Collector and AGOL are very effective at improving fire line intelligence gathering and information transfer on incidents. Collector streamlined the workload for Geographic Information Systems Specialist (GISS) and Situation Unit personnel while also decreasing the workload and quantity of printed maps after initial setup of AGOL and Collector on incidents. The addition of digitally projected views of ArcGIS Online Dashboard in the Incident Command Post during operational periods supplemented the situational awareness of Incident Management Team's Command and General staff.

Key developments are required yet for national implementation and standard operating procedures for Collector/AGOL use on Incident Management Teams. An interagency fire specific AGOL account management structure is required to facilitate the access and sharing ability of all IMTs, regardless of agency. It is the Wildland Fire I&T Advisory Board's responsibility to address this need and if approved, assign a business owner to create and manage its development. The GIS Community and Geospatial Subcommittee will oversee development of training materials, standard procedures, and outreach, to ensure resources are available for incident personnel utilizing Collector/AGOL.

Pilot Process

Pilot Group

Two groups contributed to pilot testing the Collector application and AGOL – a group of GIS Specialists and an Incident Management Team (IMT). The Rocky Mountain Region National Park Service had two GIS Specialists prepared to test Collector and AGOL when assigned to large incidents. The NPS GIS Specialists also provided support and troubleshooting for the Incident Management Team's GIS Specialists if needed.

Poncin's Northern Rockies Type 1 Team tested the Collector application and AGOL portal on incidents during the 2014 fire season. This IMT was selected based on their previous experience testing mobile geospatial applications and the critical knowledge from their GIS Specialist in evaluating this application. Operational testing took place from June through September with preparations beginning in early spring.

Main objectives of the IMT Collector/AGOL pilot were to:

- Evaluate the ability to load user defined background maps into AGOL and the Collector application.
- Evaluate and troubleshoot Collector/AGOL functions within fire and aviation management operations.
- Evaluate ESRI hosted AGOL service to address credit usage and possible advantages to an interagency hosted AGOL service.
- Evaluate and develop workflow processes to integrate Collector and AGOL into existing geospatial incident workflows, Fire Incident Management Tool (FIMT) and non-FIMT processes.
- Evaluate how smoothly and effectively data created in Collector transitions to AGOL, then to a FIMT geodatabase in ArcMap.
- Determine how the use of Collector and AGOL can provide better incident information to the public and better situational awareness to the incident management team.

Hardware and Software:

IMT personnel used a combination of cell-enabled agency provided iPads and Android tablets, as well as employee owned devices. Specific incoming resources in certain fireline positions, and without devices, were loaned agency provided iPads/Android tablets, to use with Collector. The Situation Unit also used two large flat monitors, with an additional laptop, to project the real time updates in the ICP.

The Collector Application, which is free to download, was preloaded on IMT personnel's tablets/smartphones prior to the start of the fire season, or immediately upon arrival at incident. AGOL accounts were set up for each personnel profile prior to the start of the season. Pre-season development of the accounts, specific map templates and IMT members training with the application occurred over period of 2 months approximately.

Connectivity Considerations for Collector and ICP

The need for broadband connectivity at an ICP must be considered for each incident where a team will utilize AGOL and Collector. AGOL is a web based application and requires consistent high speed connectivity for the GIS Specialists to publish data to the hosted service and perform quality control of the data synced from the field. Coordination is necessary between the Situation Unit, Computer Specialists and Logistics section to ensure that the GIS specialist managing the AGOL setup has adequate broadband connectivity. Interruption of connectivity can negatively affect publishing and syncing processes.

Account Structure

Prior to the fire season, the Incident Management Team, led primarily by the GIS specialist, completed key steps in order to facilitate the smooth implementation of Collector/AGOL within the IMT processes and personnel.

1. Define IMT positions which will be using Collector and AGOL
2. Create AGOL accounts based on user roles, access privileges for IMT positions and IMT user groups (Table 1)
3. Determine mobile device requirements and IMT capacity
4. Develop a directory structure template and upload to AGOL (GISS responsibility)
5. Build maps for IMT user groups and upload to AGOL (Table 2, Table 3, Table 4, Table 5)
6. Develop work processes: GISS specific and QA/QC within the IMT
7. Conduct training with IMT personnel

The GIS specialist and Incident Commander estimated that 40 – 50 AGOL accounts are needed to support a Type 1 IMT with all the benefits of Collector/AGOL. The GIS specialist, again with guidance from Command and General staff, prioritized positions requiring Collector use and assigned specific data access and privileges. The GIS Specialist held overall administrator privileges (Table 1). The GISS is the only one permitted to delete features, but editors will have a drop down choice of "Delete this point or line". Likewise, only the GISS can add or edit fire polygons as polygon editing is complicated in AGOL and best left to ArcMap manipulation.

Table 1 AGOL accounts and data access privileges.

Group	Position (#)	Role	Data Access		
			Fire Points	Fire Lines	Fire Polygons
Situation	GISS	Administrator	Add, Edit, Delete	Add, Edit, Delete	Add, Edit, Delete
Situation	SITL	Editor	Add, Edit	Add, Edit	View Only
Situation	FOBS (2)	Editor	Add, Edit	Add, Edit	View Only
Operations	OSC (3)	Editor	Add, Edit	Add, Edit	View Only
Operations	OPBD (2)	Editor	Add, Edit	Add, Edit	View Only
Operations	DIVS (8)	Editor	Add, Edit	Add, Edit	View Only
Operations	IHC Supt (4)	Editor	Add, Edit	Add, Edit	View Only

Operations	AOBD	Editor	Add, Edit	Add, Edit	View Only
Operations	ATGS	Editor	Add, Edit	Add, Edit	View Only
Operations	ASGS	Editor	Add, Edit	Add, Edit	View Only
Operations	Pilot (6)	Editor	Add, Edit	Add, Edit	View Only
Operations	STSP	Editor	Add, Edit	Add, Edit	View Only
Operations	SOF (2)	Editor	Add, Edit	Add, Edit	View Only
Information / Command	IC	Viewer	View Only	View Only	View Only
Information / Command	Deputy IC	Viewer	View Only	View Only	View Only
Information / Command	PIO (3)	Viewer	View Only	View Only	View Only
Information / Command	LOFR	Viewer	View Only	View Only	View Only
Ground Support	GSUL (5)	Viewer	View Only	View Only	View Only
Communications	COML	Viewer	View Only	View Only	View Only

Map Structure

The GIS Specialist created four different maps specific to predefined IMT groups: Line Operations Map (Table 2), Camp Operations Map (Table 3), Support Map (Table 4), and Public Map (Table 5). These maps were organized according to what information needed to be included, the access to those layers and the ability for viewers to see field changes to those layers.

Table 2 Line Operations Map: Ops., Division Sup., Air Ops., Situation Unit Leader, Safety

Name	Popup viewable	Editable	Initially Viewable
Labels	No	No	Yes
Fire Points	Yes	Yes	Yes
Structures	Yes	Yes	Varies
Values @ Risk	Yes	No	Yes
Fire Lines	Yes	Yes	Yes
Mgmt Action Pts	Yes	No	Yes
Acct Prop	Yes	Yes	No
TFR	Yes	No	No
Roads	Yes	No	Yes
Closure Pts	Yes	No	No
Closure Area	Yes	No	No
Evacuation Area	Yes	No	No
IR Data	Yes	No	Yes
Fire Perimeter	Yes	No	Yes
Avoidance Area	Yes	No	Yes
Location Track	Yes	Yes	No
Topo Maps	NA	No	No

Table 4 Support Map: Medical, Ground Support Unit Leader, Communications

Name	Popup viewable	Editable	Initially Viewable
Labels	No	No	Yes
Fire Points	Yes	No	Yes
Fire Lines	Yes	No	Yes
Acct Prop	Yes	No	No
Roads	Yes	No	Yes
IR Data	Yes	No	No
Fire Perimeter	Yes	No	Yes
Location Track	Yes	Yes	No
Map Notes	Yes	Yes	Yes
Topo Maps	NA	No	No

Table 3 Camp Operations Map: Public Information Officer, IC, Liaison Officer

Name	Popup viewable	Editable	Initially Viewable
Labels	No	No	Yes
Fire Points	Yes	No	Yes
Structures	Yes	No	Varies
Values @ Risk	Yes	No	Yes
Fire Lines	Yes	No	Yes
Mgmt Action Pts	Yes	No	Yes
Acct Prop	Yes	No	No
TFR	Yes	No	No
Roads	Yes	No	Yes
Closure Pts	Yes	No	No
Closure Area	Yes	No	No
Evacuation Area	Yes	No	No
IR Data	Yes	No	Yes
Fire Perimeter	Yes	No	Yes
Avoidance Area	Yes	No	Yes
Location Track	Yes	Yes	No
Map Notes	Yes	Yes	Yes
Topo Maps	NA	No	No

Table 5 Public Map: public facing web map

Name	Popup viewable	Editable	Initially Viewable
Labels	No	No	Yes
Fire Points	Yes	No	Yes
Public Interest Points	Yes	No	Yes
Fire Lines	Yes	No	Varies
IR Data	Yes	No	Yes
Closure Pts	Yes	No	Yes
Closure Area	Yes	No	Yes
Evacuation Area	Yes	No	Yes
Fire Perimeter	Yes	No	Yes
World Trans Layer	NA	No	Yes
Topo Maps	NA	No	No

Incident Activation

Once ordered to an incident, the GISS acquired the relevant map information for the fire area to input into AGOL, using the predefined map templates. Once this is complete, the basemaps (topo, aerial imagery, street maps, etc.) are side-loaded onto IMT members' devices into the Collector application before the incident or at the incident during the inbriefing.

As resources check in, the GISS maintained coordination with Command and General staff to ensure that any incoming Field Observers, Division Supervisors and IHC Superintendents have devices and/or access to Collector. These positions were pre-determined as needing access to Collector/Devices because of the importance of their operational roles and fireline intelligence.

Quality assurance and quality control of incoming data follows an established process, defined pre-season with Command and General staff. Appropriate C&G staff approve the posting of sensitive data, such as aviation sites and medical evacuation sites before synchronizing. Quality assurance and control begins immediately on all submitted data.

Lessons Learned: 2014 Fire Season

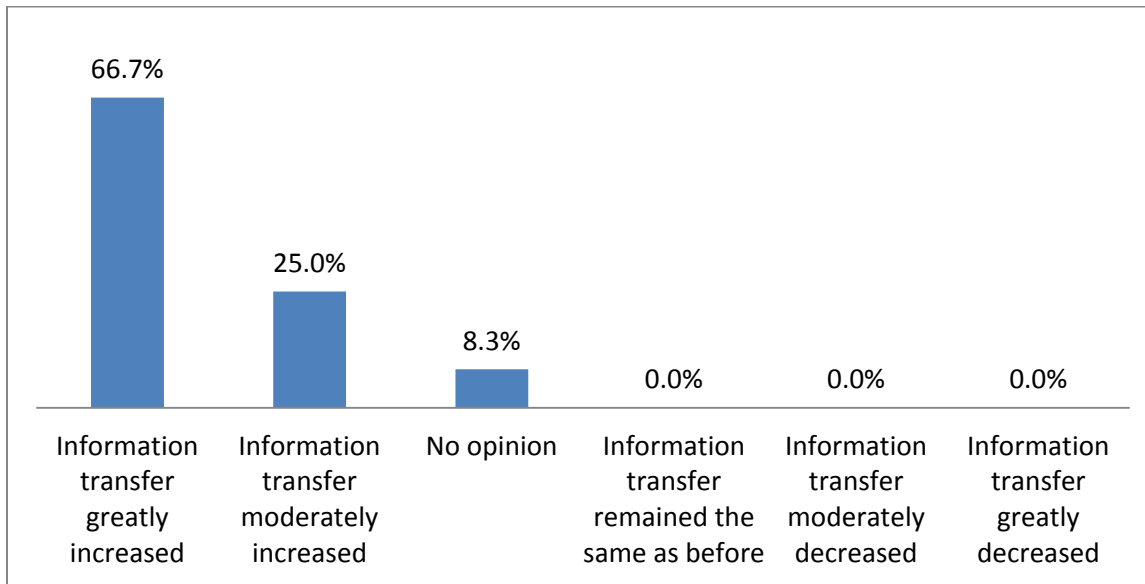
The 2014 Fire Season presented limited opportunities to pilot the Collector app and AGOL on incidents. NPS GIS specialists piloted Collector on one IMT deployment in late season and documented lessons learned and workflows as well continual testing throughout the fire season, which provided excellent feedback. Poncin's T1 Team not only did extensive pre-season testing, but also used the Collector app and AGOL on two incident assignments. Pilot participants and involved incident resources submitted extremely valuable feedback and lessons learned from the training simulations and incidents.

Operational Feedback

Each IMT member and incident resource who utilized Collector/AGOL completed an assessment following the incident. Assessments were specific for each user group, Operational users and GISS/SITL users. The majority of users utilized the Collector App on iOS devices, although a few did use AGOL on laptops.

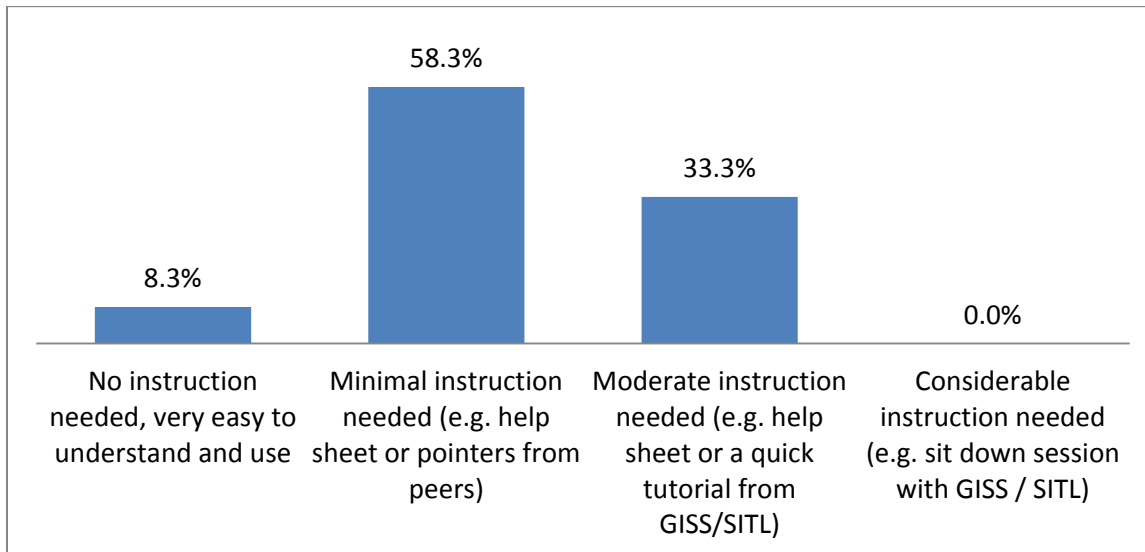
The vast majority of testers rated information transfer as increasing compared to previous operations (Figure 1) and none rated it as decreasing. All users rated the use of Collector/AGOL as positively influencing their position performance. Open comments included recounts of using it without connectivity and being impressed with the ease of use. One commenter admitted to be initially hesitant and preferring "GPS and paper" but changed opinion after seeing it in action on incidents.

Figure 1 Operational feedback of Collector's impact on information transfer



The assessment also asked operational users to rate their opinion of training needs for the Collector application (Figure 2). During the pilot, the GISS generally provided a brief overview of the application, approximately 5 minutes, for each new user but only as needed.

Figure 2 IMT Operational user rating of Collector/AGOL instruction needs



The GISSs also provided assessments after utilizing Collector and AGOL. The initial use of Collector and AGOL did increase the amount of time upfront, before incidents, however saved “enormous energy and time” during incidents. The Situation Unit found that the demand for paper maps decreased by at least 75% with the use of Collector/AGOL, subsequently reducing the need and use of expensive plotters. Additionally, GIS specialists found that Collector almost eliminated GPS downloads and hand transferring spatial data, reducing typical errors in interpretation and data identification.

The GIS specialists responded to a series of questions designed to determine how Collector/AGOL affected their work and in what stages. Compared to their previous experience, they rated the level of effort pre-incident, in uploading base maps and managing user accounts as ‘moderate’. However they rated their level of effort as minimal for all other tasks; managing government tablets, training IMT members and incoming resources, updating map information, providing QA/QC on data, managing user accounts during incidents and troubleshooting. They also rated the performance of Collector/AGOL in meeting the requirements of the IMT (Table 6) as excellent-to-good in all performance areas.

Table 6 IMT requirements for Collector/AGOL

IMT Requirements
User friendly interface for GIS Specialists
User friendly interface for end users
Ability to pre-load specific base map tiles
Ability to seamlessly transmit collected information to an established database
Ability to transmit field data in near/real-time
Ability to meet information demands of IMT members (e.g. PIO)
Performance in disconnected environments (Collector only)

ESRI mobile developers, the Collector Mobile Team and the Pilot team coordinated frequently during the course of the pilot exchanging feedback and suggested improvements for Collector and AGOL within the Fire and Aviation Management environment. Suggestions included the ability to populate the latitude/longitude fields with different formats, type in latitude/longitude fields, editor tracking fields, and other changes to make the user interface more intuitive for firefighters. A two-day workshop in December between the project teams further refined processes and defined improvement areas.

Considerations

Implementation of Collector and AGOL into an IMT’s processes requires thorough research, training and preparation. Primary items to consider before deciding to integrate Collector /AGOL into IMT operations are:

1. IMT Member Skills
 - a. GIS Specialists will need to be familiar with AGOL and Collector. They will need to fine tune work processes that will work the best for them and their IMT.
 - b. The Situation Unit Leader and GIS Specialist will need to develop a process for quality assurance and quality control of data with the Command and General Staff.
 - c. In order to benefit the most from Collector and AGOL, users must be well versed in mobile device use (tablets/smartphones).
 - d. IMTs will need to consider the additional workload that AGOL will add throughout the incident lifecycle. Depending on the skill set of the GIS Specialists assigned to the team, additional personnel may be required.
2. Mobile Devices

- a. Teams must have access to enough mobile devices to enable field data collection with Collector. A Type 1 Team needs an estimated 40 to 50 devices based off the pilot findings. Devices can include personally owned, government owned, incident rentals or government loaned devices.
3. Incident Connectivity
 - a. Strong connectivity is a requirement for side loading data and synchronizing data.
 - b. Field going users will be able to cache data collected in the field. An ICP wireless network for synchronizing data may be required on incidents where cellular connectivity is not available for field going users.
 4. Activation for non-IMT members
 - a. Incident process for incoming resources, such as DIVS, FOBS and IHC Supts, requiring Collector access must be developed. These users can be guided to check-in immediately with the Situation Unit and be briefed on how Collector is being used in team operations.

GISS Workflow Guidance

GIS specialists developed workflows for Collector/AGOL, both FIMT and non-FIMT, through this pilot. These workflow processes were tested and refined to develop a secure and seamless way to share maps with the different types of viewers & users (IMT personnel vs. Public). Processes were also developed to allow the GISS to organize and manage incoming data (QA/QC), the FIMT geodatabase, users, and permissions. The GIS community, led by the GSC (Geospatial Subcommittee), are refining these workflows and creating a recommended standard process for GIS specialists. The committee is developing training and outreach materials for the GIS user community as well.

Costs

The 2014 pilot project utilized an agency enterprise license to create an organizational account for the National Interagency Fire Center. This account allowed for over 100 users. The credit usage was minimal throughout actual incidents, totaling less than 100 credits including pre-season training and incident use. Account administrators can limit credit usage by disabling geocoding and tiling ability from users, which consume the most credits.

Next Steps

The pilot team is sharing results and future considerations from the Collector/AGOL pilot with established groups to further the use of Collector/AGOL within interagency fire and aviation management operations.

The pilot team is assisting and coordinating with the GIS community as they work to:

- Develop standard work processes for GISS use on incidents as part of the GSTOP and GTU
 - Identify sensitive map information that should not be published (e.g. archeology)
- Develop training materials and outreach to GISS personnel
- Improve FIMT to facilitate AGOL and Collector use

- Identify critical components for agency applications to improve upon before the next fire season
- Identify the time available for changes to occur and develop a phased approach to improving FIMT

The Pilot Team will present the final considerations from the pilot for approval and recommended implementation to the Wildland Fire I&T Board, ITAB. Final considerations for interagency, national deployment and use of the Collector Application and ArcGIS Online include:

- Creation and funding of a separate interagency Fire and Aviation Management account
 - An ESRI Managed Service with hosting provided thru the DOI Cloud Services contract.
 - Recommended account structure includes:
 - 10 AGOL Organizational Accounts to include all GACCs and NIFC
 - Identified GACC points of contact to include geographic area GIS representatives and geographic area fire IT representatives
 - ESRI will be providing a proposal of account options under current agency ELAs to address identified needs of the Fire and Aviation Management community and IMTs.
- Designated national business owner of proposed interagency Collector/AGOL account operation and maintenance, determined from the ITAB.
- Support of GSC and other related working groups as they create the training materials and outreach needed to establish Collector/AGOL use at a national level.
 - Given the current use and knowledge of AGOL/Collector, it is imperative that outreach and training is available before the recommended account solution is in place. This ensures a framework of standardization exists for GIS professionals to follow.
- Identify and proceed with an interim solution for the 2015 Fire season. This includes determining if a separate account can be established under the DOI ELA for use in the 2015 Fire Season and promoting a phased approach for use based on the Fire GIS community's recommendations.

Acknowledgements

Greg Poncin's Type 1 Incident Management Team

Mark Slaten – MT DNRC

ESRI's Disaster Response Program