IMPROVED FLIGHT DATA MANAGEMENT FOR US AIRPORTS

Electronic flight strips will be installed at US airports to provide improved situational awareness to air traffic controllers and increase surface efficiency

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Leidos, partnered with Saab North America, has developed a solution for the Federal Aviation Administration that will replace the paper flight progress strips used by air traffic controllers to document and coordinate the flow of air traffic at US airports.

Electronic Flight Strips (EFS) are part of the Federal Aviation Administration (FAA) NextGen solution called Terminal Flight Data Manager (TFDM), which replaces legacy systems with new technology designed to make the surface movement of aircraft more efficient and predictable.

The EFS system enables controllers to more easily facilitate aircraft arrivals and departures. Populated with flight data from other air traffic control automation systems, EFS can also be integrated with traffic alternative management tools that give controllers the very latest information on traffic flow constraints. This can also aid in decision making.

Designed for any airport

The FAA will roll out the EFS system at 89 airports over the next several years. It will start with Phoenix International Airport, where Leidos and the FAA have been testing the technology. The rollout list includes 15 of the busiest airports in world, such as Chicago O'Hare, Dallas/Ft. Worth, and Los Angeles International Airport, as well as smaller regional airports were EFS will help to replace legacy systems.

One of the challenges Leidos faced when developing the system is that each airport differs geospatially in surface size, number of runways (parallel and crossing), terminal layouts, and in a small number of airports, the number of control towers. Beyond geospatial variety, airports will also vary in terms of the mix of commercial and general aviation. Within commercial traffic, there are also variances in terms of a dominate air carrier (hub) or if it has an equitable mix of many air carriers.

To accommodate such variety, the Leidos team and the FAA designed the EFS system so that it would work for every possible airport operating environment the system would be installed in. The goal wasn't to change the way air traffic controllers did their jobs, but instead make the tool work for them. That meant the tool had to be flexible and scalable.

Controller workflow

To design the EFS, Leidos examined the workflow that the new system would replace. The workflow involves different controller positions in the air traffic control tower: the clearance delivery controller, the ground controller, and the local controller.

In its print iteration, each flight progress strip is contained in a plastic or metal holder and is passed from one team member to the next to annotate as the workflow proceeds. For example, delivery clearance controllers have the strip when they are verifying flight

information with the pilot at the gate. The strip is then passed to the ground controller when it's time for the plane to depart the gate and taxi toward the runway. Then it's passed to the local controller, who manages what happens on the runway: departures, arrivals, and cross traffic.

With multiple flights in play all at the same time, each controller manages multiple strips, which are kept in a bay. As a plane moves through the departure or arrival sequence, the strip moves from one bay to the next.

Flexible and intuitive

Based on FAA requirements, Leidos designed the electronic version of the strip to look just like its paper counterpart. The layout is the same for two reasons. First, it follows FAA standards on what information is included — such as aircraft identification, departure time, and point of origin — and how it is presented. Second, by looking just like a paper strip it will ease the transition for the controller to learn the new system.

However, unlike paper strips the EFS system offers controller more flexibility, both within the user interface and workflow. For example, the EFS system can be configured to apply different colours for strips to differentiate between departures and arrivals. Controllers can apply the same action to multiple strips, such as assigning the departure radio frequency for a number of departure flights. They can choose which quick action buttons — from runway assignments to frequencies — to make readily available depending on what they use most often at their particular tower and specific controller position.

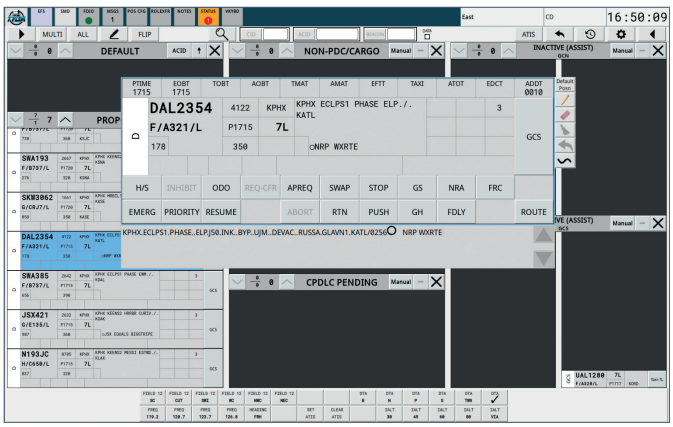
The strips are organized into different strip boards that contain any number of bays with customizable headers. For situations where a position might need a larger strip board, EFS will work with larger size and higher resolution displays to provide increased displayable area and adjust the resolution scale of the strips so the result is the same size strip between varying displays.

The EFS system can be configured to display how strips appear in each bay. They can see a standard or normal-sized strip, which looks like a traditional paper flight progress strip or a mix of smaller and condensed size formatted strips that take up less display space. If the controllers need to see more information or zoom in to see the information more clearly, they can simply double tap the strip on the touchscreen to enlarge it. Controllers can also choose to flip a strip over, to reveal a virtual back of the strip with limited information specific to that controller position's requirements.

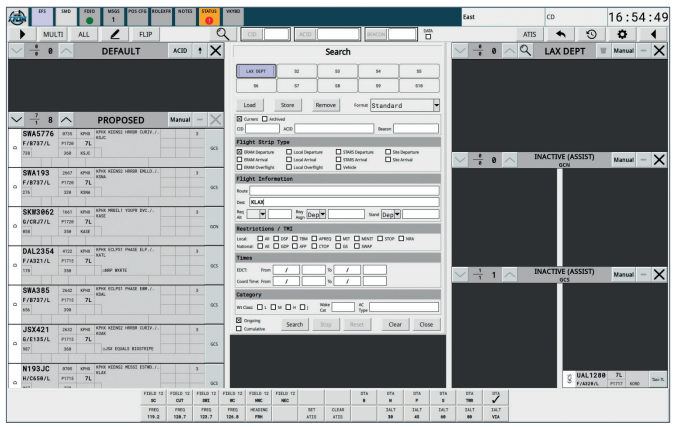
Moving strips from bay to bay is seamless. The controller simply drags and drops a strip from one bay to the next or taps the Next Logical Action(NLA) button within the strip. Whenever a controller moves a strip on the screen, it becomes semi-transparent so it doesn't cover up information behind it.

In addition to drag and drop, controllers can tap, tap and hold, double tap, swipe up and down, and swipe to the left or right. With these gestures, the controller can quickly open and close strips, enlarge a view, reorder them, move them from bay to bay, and more. Gestures commonly used with smartphones and tablets weren't part of the original design but were incorporated after observing controllers to make the system more intuitive to use.

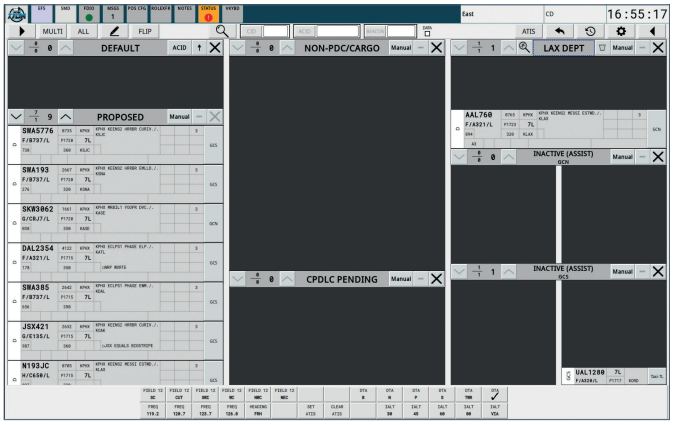
Driven by FAA operational team feedback, another design choice was to minimize user interaction with the EFS in the first place, since most controllers are consistently looking out of the control tower to see how traffic is moving around the surface. Therefore, the new system avoids multi-step



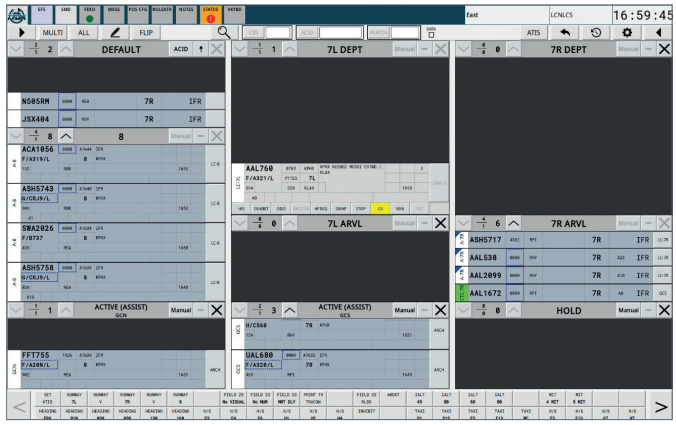
Left: Strip Board with Enlarged Strip



Right: On-going Search for KLAX Departures



Left: Results of Search in LAX DEPT Bay



Right: LAX Departure on 7L with Ground Stop Indicator – NLA disabled as result

interactions and instead ensures that controllers can access the data they need with one touch.

To further aid the reduction of heads-down time, EFS has powerful search capabilities that will locate all strips meeting the desired search criteria or query and display the results in a one time or ongoing manner within a special search bay. The search criteria can also be stored away for quick access to restore when needed. With up to 10 search bays available per position and an easy means to store searches for future use, the right strips are easily accessible at the controllers' fingertips.

The flexibility to configure the EFS system and the intuitive nature to interact with it makes for easier transition from a paper-based system to an electronic version.

Integration with other tools

The EFS system can be integrated with various ATC and traffic flow management tools, thereby increasing its value and utility. The EFS system accomplishes this through a comprehensive flight data management infrastructure that is capable of fusing data from a variety of sources and types. This allows a complete and comprehensive set of up-to-the-second data to be displayed within the EFS, thereby increasing controllers' situational awareness. This will also help them alleviate aircraft congestion on the airport surface. As part of the TFDM solution. In addition to the EFS, TFDM includes surface scheduling and surface metering tools previously developed by Saab North America that predicts how much time an aircraft spends on the airport's surface, such as the time it takes to taxi or the estimated take off time. Where necessary, metering aircraft movements on the surface is done to eliminate surface congestion and possible surface gridlock. The marriage with an EFS systems allows controllers to have the option of displaying the predicted surface time estimates or surface metering times on the EFS strips. Of the 89 airports on the list for TFDM implementation, the 27 busiest ones will have a full complement of surface scheduling and metering tools.

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Safety impact

Integrating data from other tools into the EFS system will have a positive impact on air traffic controllers as they help pilots navigate aircraft around the airport. Not only does it improve controllers' situational awareness, but it also helps them work more efficiently when traffic conditions change. In particular, it provides an additional level of safety when planes are grounded or runways are closed.

For example, if the FAA's Traffic Flow Management System indicates a ground stop program for aircraft bound to Salt Lake City due to bad weather, controllers using EFS will have all departures to Salt Lake indicated with a ground stop indicator on the applicable flights from their airport.

In the days of paper flight progress strips, controllers who learned of a ground stop would have to either verbally communicate the stop throughout the tower or go to each of the controller's paper bays to find strips with flights headed to Salt Lake City, and amend them.

With improved situational awareness, controllers using EFS will have the option of easily requesting changes to an aircraft's flight plan, such as amending a planes route to avoid weather near the departure. In the past this task was complicated enough that it was typically delegated to others in the tower or an En Route Center to accomplish.

EFS integration with other tools enhances safety in other ways. Additional data ensures controllers are in sync with pilots as the two parties communicate flight and routing information. And it provides more oversight. With a paper flight progress strip, typically only one controller uses it at a time. Now supervisors and other controllers will be able to view any EFS and provide any necessary assistants or help crosscheck decisions.

Additional benefits

The EFS system will benefit controllers in other ways. It will save the controller time, whether by eliminating repeatable tasks or providing easy access to information. It also makes communications more efficient. Instead of passing paper strips across desks from one controller to the next and regular conversation about other specific aircraft or traffic flow conditions, controllers have access to all necessary data at their fingertips.

The impact of the EFS system will be felt well beyond the control tower. With EFS, the FAA is able to replace an outdated paper-based system and continue its NextGen mission of improving airport surface management, reducing fuel burn, and making air travel more efficient. ❖