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# *darts* – a major step towards optimised flight operations

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*The civil aviation industry has recently gone through some extremely difficult times, but it is now showing signs of recovery, and the expectations associated with this welcome turnaround are being confirmed in the form of increasing flight traffic figures.*

It appears that people are gradually beginning to place their confidence in air travel again, but at the same time they are becoming significantly more demanding when it comes to available routes, travel times, punctuality and product quality in



Apron Control, working position 'Apron South', coordinating traffic flow.

general. In order to meet these greater demands, the various service providers involved – in particular airlines, airports, air traffic control centres and handling agents – will need to take appropriate

action without delay. The measures taken will have to extend beyond merely improving the current situation over the short term as, ultimately, it is the survival of air travel in the struggle against other forms of transport that is at stake. We cannot afford to underestimate or overlook this aspect, especially here in Europe where there is such a dense, and thus attractive, railway network in place. It is therefore crucial that all service providers active in the area of civil aviation join forces in investing in product development that focuses on passengers.

An innovative planning and flight management system called *darts* (which stands for Departure and Arrival Traffic Management System) was handed over for operation at Zurich Airport in March 2003. As we shall see, *darts* is a good example of a creative and far-sighted solution for managing flight operations in a highly efficient, comprehensive manner on the basis of collaborative decision-making (CDM).

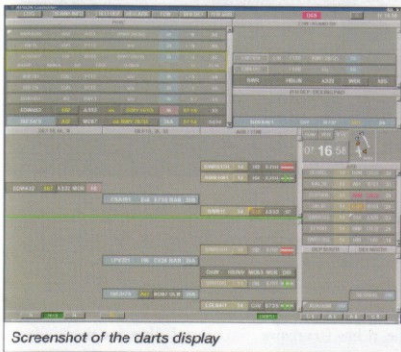
The *darts* project was initiated in the mid-1990s with the aim of optimising overall flight operations at Zurich Airport. The associated research activities were carried out at the DLR Institute for Flight Management in Braunschweig, Germany. These studies showed that alternative operating concepts were certainly feasible, but only if air traffic controllers were provided with an efficient support system for planning airport flight traffic. This finding set the development of *darts* in motion.

Management of flight operations at Zurich Airport is extremely complex. The airport's three runways are closely inter-dependent, the taxiway network contains a number of bottlenecks and intersections, space in the apron zones is very tight, and various other factors, such as meteorological conditions, additionally hamper flight operations, especially in winter. On top of this, the fact that the main runway (28-10) slices the apron zone into two

sections (north and south) means that a large number of aircraft have to cross it every day.

At Zurich Airport, air traffic management is shared between Skyguide (Tower) and Unique Flight Operations (Apron Control). Skyguide is responsible for giving ATC clearance and controlling take-offs and landings, while Unique Apron Control takes care of flight operations on the aprons and taxiways. Both organisations are located in the same tower, but they do not work in the same offices. Unique Apron Control is also responsible for operating the two remote de-icing pads.

The real-time simulations carried out by DLR involving the active participation of air traffic controllers clearly demonstrated that *darts* could greatly increase the overall capacity of the airport system and lead to a pronounced improvement in punctuality. As a striking example, it was possible to increase the number of take-offs and landings by as much as 30%. It quickly became apparent that *darts* would be the right solution to the problem of increasing the efficiency of Zurich Airport. The fact that Skyguide actively supported the efforts of the airport management board right from the start was a significant factor in the success of the *darts*



Screenshot of the *darts* display

project, as it would otherwise have been very difficult to integrate *darts* into the Skyguide environment and the three existing systems; 'calm', 'syc0' and 'taco'.

The mandate to develop and implement *darts* was awarded in 2000 to Delair, which is also domiciled in Braunschweig. This decision proved to be particularly advantageous since most of the employees of Delair had also been involved in the preliminary study carried out by DLR.

STD (scheduled time of departure) and ETD (estimated time of departure) both refer to the time by which the aircraft turnaround process or ground handling have to be completed. This is also the time

at which *darts* begins to plan the ideal take-off sequence. For this purpose it has to take a number of important factors into account, including location of aircraft stand, start-up and push-back times, type of aircraft, wake turbulence category, runway availability, taxiing time from stand to runway, ATC slot and exit gate. De-icing on the remote pads also has to be incorporated into the scheduling process as additional taxiing time. 40 minutes prior to STD, *darts* initially includes the

Aircraft crews are notified about their planned off-block and calculated take-off times via the dock guidance system, and are thus kept constantly up to date with respect to any changes in schedule that may occur.

As soon as air traffic control gives its ATC clearance, *darts* notifies the apron controller who then gives clearance for start-up and push-back. The main standard procedures applied here are incorporated into the system, so that the demands

Tower Building at Zurich Airport – top floor: Skyguide with TWR functions – floor underneath: Apron Control with ground movement functions



aircraft concerned in its planning process and, using the flight plan data provided by Skyguide and key data for the airport, it calculates a POBT (planned off-block time), a provisional ideal take-off sequence and finally a CTOT (calculated take-off time). *darts* takes full advantage of the maximum capacity of the overall airport system in its planning processes.

In the event that a given aircraft is unable to comply with the existing STD or the ETD entered by the handling agent, it is removed from the ongoing scheduling process and placed on standby. Airlines and handling agents automatically receive information concerning planned off-block time from the system, and they are then expected to actively manage the estimated time of departure. The aircraft concerned is then fed back into the ongoing schedule after a new, realistic ETD has been determined. The benefit of this procedure is that unused take-off slots can be allocated to other aircraft that are ready to depart.

on the controller are kept to a minimum. Special procedures can also be activated at any time via a pull-down menu.

*darts* defines the most suitable take-off sequence in keeping with the requirements of Apron Control, i.e. it has to ensure that aircraft that are ready for take-off are directed to the right runway at the right time and in the prescribed sequence. Apron Control can still override and adjust the scheduled sequence as may be required by the current situation. Thus, the final decision-making and ultimate responsibility for apron operations still remain in the hands of Apron Control, where they belong. Upon handover to Skyguide TWR, the corresponding electronic confirmation and flight number appear in the departures window. Likewise, *darts* also displays details of incoming flights before the aircraft has landed and entered the jurisdiction of Apron Control. This permits ground traffic controllers to prepare the apron zones for the scheduled activities well in advance.

*darts* can easily be modified to incorporate changing requirements by adjusting the corresponding parameters. Zurich Airport was able to benefit from this feature when it handed over the new terminal (Dock E) for operation, together with its aprons and taxiways. Thanks to the well-structured, modular design of *darts* it is extremely flexible and adaptable – an essential characteristic of any advanced planning and management tool.

Practical experience to date also confirms that *darts* is capable of communicating faultlessly with AIMS (the neighbouring IT systems of Zurich Airport), as well as with the systems operated by our business partners.

In view of the radical new approach to airport operations this change represented, a great deal of attention was paid to the training of apron controllers. The training process took place in three stages. To begin with, controllers received a personal PC-based introduction to the system. This was followed by intensive training on the reactivated simulator in Braunschweig, where learning was greatly enhanced thanks to the fact that the simulator environment not only included apron control activities, but also genuine tower operations supervised by personnel from Skyguide. During instruction in Braunschweig, the apron controllers had no difficulty in grasping the

functions of the new system, which is undoubtedly attributable in part to their close involvement in the project right from the start. The third and final



Screenshot of the *darts* display with the new A340 aircraft of Swiss International Airlines

stage of training took place on the job under the supervision of experienced coaches. The training concept proved to be very effective and the participating apron controllers found they were quickly able to work with *darts* at a high level of proficiency. This is all the more important as the planning functions performed by *darts* have significantly changed the tasks to be carried out by apron controllers.

*darts* has been in operation more than a year now: what impacts has the new system had on flight operations at Zurich Airport? Aircraft crews have grown accustomed to the fact that a single system now plans and implements all processes relating to flight operations. The focus is no longer on one aircraft at a time. Thanks to the display of planned

what is actually taking place on the aprons and taxiways. For controllers it is essential that the procedures that are applied on the ground are accurately depicted in the system.

Thanks to *darts*, the new Airport Steering section at Zurich Airport is able to maintain an up-to-date overview of everything that is happening in the



Apron Control, working position 'Apron North': controller and assisting coordinator guiding the ground traffic

off-block time and calculated take-off time via the terminal management system, aircraft crews are now kept constantly up to date with the flight schedule. The new 'gate hold' procedure means that queues on taxiways have grown significantly shorter, which not only relieves congestion in apron zones, it also eases the burden on the environment. And last but not least, it means lower fuel bills for the airlines!

Handling agents were involved at a very early stage of the project, and they have, therefore, easily adjusted to working with *darts*, especially as their own processes have not been affected. In fact, the binding nature of STD/ETD represents an advantage for handling agents, as they stand to benefit from helping to meet the specified deadlines, thus making sure their clients receive efficient and punctual services. This attitude, however, is not yet shared equally by all agents and airlines.

For apron controllers, the introduction of *darts* has meant quite a number of changes, starting with the switch from paper control strips to electronic display. Apron controllers act as the all-important link between the planning functions within *darts* and

apron zones, on the remote de-icing pads and on the taxiways. The availability of up-to-the-minute data permits smooth and efficient operations right across the board, even in the most adverse weather conditions, as we have recently been able to discover for ourselves. *darts* therefore represents a major step forward in the area of collaborative decision making.

*darts* is currently in its first stage of implementation, in which it functions as a departures manager. Fine tuning of the existing system will be implemented autumn of this year, to optimise the system communication between Skyguide and apron control, and from then on *darts* will also manage arrivals. The necessary programming work for this task has already been completed. ■

**Unique Flight Operations would be happy to give a live demonstration of *darts* in Zurich to interested representatives of ANS providers or airports. Enquiries should be addressed to the project management ([peter.frei@uniqueairport.com](mailto:peter.frei@uniqueairport.com))**