Arrivals tailored to cut fuel costs

Service providers see cost and environmental benefits of Tailored Arrivals

Air navigation service providers (ANSPs) are under pressure to raise performance. In addition to calls for greener operations, airlines want to decrease costs to offset lower traffic volume. Some ANSPs are responding with technical solutions designed to meet both demands.

In April 2009 Dutch service provider LVNL began trials of a new controller tool that calculates the optimum flight profile for aircraft on approach to Amsterdam Schiphol. Some 260 aircraft made use of the Speed and Route Advisor (SARA) tool during the trial period to fly low-power, continuous descent approaches that use less fuel than conventional step-down approaches.

SARA is the result of a six-year programme by LVNL and Boeing, in partnership with the Dutch Knowledge and Development Centre (KDC), a resource funded by LVNL, Amsterdam Schiphol and KLM Royal Dutch Airlines.

Project team members estimate that SARA could yield fuel savings of 3,000 tonnes a year for participating airlines, along with reduced noise and emissions. Just as important, the tool enables controllers to deliver aircraft with much greater accuracy without the need for vectoring in the terminal airspace. More than 80 per cent of participating aircraft arrived within 30 seconds of the planned time.

SARA is part of a suite of technologies used to support tailored arrivals (TAs) and improve flight efficiency in the terminal airspace. TAs already operate into San Francisco, where controllers uplink a flight profile prior to top of descent based on predetermined routes. Even without a dynamic ground tool, participating airlines reported fuel savings in excess of 500 tonnes during 2008.

San Francisco has completed more than 2,200 TAs since the programme started and this year both Los Angeles and Miami began trial flights using similar procedures.

TAs were tested at Amsterdam Schiphol partly to help meet stringent noise restrictions and partly to test the procedure in busy terminal airspace. LVNL's SARA project manager Fredrik Eriksson says: "We've taken the concept of tailored arrivals developed by Boeing and fitted it into Amsterdam's high-density airspace. We stick with standard routes, but we calculate the exact speed an aircraft should fly on a particular route to enter the terminal area within 30 seconds of planning. SARA calculates how fast to fly with high precision based on advanced prediction tools and weather data."

LVNL wants a predictable landing sequence and eventually to be able to use fixed routes in the terminal area. "Currently, controllers have to do a lot of level flight and vectoring at low altitude to meet the planning sequence. We need fixed routes to stop the vectoring at the lower levels and move the sequencing into higher airspace," explains Eriksson.

LVNL is in the process of evaluating the results of the April trial, but both KLM and Transavia have voiced support for the programme based on reduced track miles in the terminal area.

IHS Jane's/Patrick Allen: 1142324

KLM B-767 at Schiphol Airport, scene of trials for the Speed and Route Advisor (SARA) tool. SARA is the result of a six-year programme between Boeing and Netherlands air navigation service provider LVNL.

"We are trying to achieve an efficiency gain regardless of the number of aircraft," says Eriksson. "The tool can work at any airport and is designed to improve predictability for the airlines and greater precision at whatever co-ordination point you have. We also wanted to make sure the controllers have no large increase in workload." A simulation exercise carried out before the trial demonstrated that experienced controllers had the ability to provide high precision speed and route instructions sufficient to arrive within 30 seconds, but this was a lot of work. When supported by the SARA tool, they achieved this target without extra work.

Once the results have been evaluated, LVNL hopes to move to implementation within the next two years, depending on funding. The next phase involves system design, hardware production, development of procedures and training. In addition, LVNL needs agreements with neighbouring ANSPs as TAs offer arrival sequences well outside Dutch airspace.

'We've taken the concept of Tailored Arrivals developed by Boeing and fitted it into Amsterdam's high-density airspace'

At present SARA calculates TAs 14 minutes prior to TMA entry, which is the extent of LVNL's planning tool. "We realise that SARA is just one part of the picture," says Eriksson. "If we want efficient arrivals, we need to work with the SWIM network envisaged by SESAR, the CFMU [Central Flow Management Unit] and co-ordinated arrival and departure management systems. We need departures from all airports within an hour's radius from Amsterdam."

During the trial, controllers at the Maastricht Upper Area Centre (MUAC) issued the speed and route clearance calculated by SARA to aircraft on approach to Amsterdam. Many pilots then used the flight management system to make a smooth descent, still saving fuel burn below Flight Level 260.

Miami presents new challenges to the TA team, not least because oceanic arrivals pass through several radar sectors before reaching the terminal area. Unlike MUAC and US domestic control centres, US oceanic sectors offer integrated datalink communications capable of transmitting full route clearances. Inter-centre data transfer problems

brought the first TA trials at Miami to a halt at the end of 2008, but a software upgrade allowed trials to restart in the second quarter of 2009 with Air France, Lufthansa and American Airlines, followed by Air Europa flights.

TAs also began in Los Angeles earlier this year, where Air New Zealand, Qantas, United and other airlines are participating. Two single-day checks had been carried out at Los Angeles at the time of writing.

Rob Mead, Boeing Research & Technology lead engineer for Tailored Arrivals, says about 30 per cent of flights at Miami are flying more efficient profiles, a figure similar to early results at San Francisco. There is no ground automation tool at these centres, but controllers use a static set of profiles to uplink a lateral route with vertical and speed constraints at specific points to aircraft on the oceanic sector.

Common procedure

"We have developed a common procedure for San Francisco, Los Angeles and Miami. A landing clearance is given 45 minutes prior to exiting oceanic airspace, well ahead of top of descent. We use representative minimum and maximum head and tail wind combinations and we deliver the route advice to the aircraft." The profiles depend on airspace density, for example Los Angeles has only one at present, whereas four are in use at San Francisco. "Eventually we want to go to dynamic generation of profiles using the ground tool," says Mead. "The main limitation at present is the ability of the domestic ground system to uplink data as it is not built to do this."

Following the success of these projects, the FAA has announced plans to implement the static version of TAs at multiple sites over the next two years. It is initially considering west coast destinations including Honalulu, Anchorage, Seattle, Portland and San Diego, but East coast sites are also planned, notwithstanding multiple radar sectors.

Meanwhile, the FAA has started testing a prototype ground tool, first developed by NASA during very early trials at San Francisco. The En Route Descent Advisor (EDA) begins operating at Denver in mid-September under a joint NASA-FAA initiative. The EDA is linked to the flight data processor and, like SARA, generates speed and route advice for arrivals. The prototype is being used offline to calculate prescripted commands rather than dynamic advice and routes are relayed by voice to the aircraft in the absence of datalink communications. The FAA plans to integrate the tool into the en route environment in the 2015-16 timeframe.

"You do not need to shoot for 100 per cent success," explains Mead. "There are efficiency gains even when only a fraction of flights achieve TAs all the way down. If you can manage the sequencing further out, the real benefit is in the terminal area." He reports interest from 10 other sites around the world requesting Boeing's involvement. "We want a solution that goes from top of descent down to the runway."

LVNL expects to see benefits within three to five years without the need for fleet upgrades. "We can improve much quicker than the airlines can," says Eriksson. "SARA is one way for us to make a step towards development envisaged in SESAR. Before we get the equipage and support tools for complete trajectory-based operations, we can get some of the benefits by developing a tool such as SARA. While it will not allow the aircraft to do all the negotiations themselves, it will at least give them the opportunity to fly as efficiently as possible within restrictions we have as an ANSP." *Jenny Beechener*