Positioning systems improve airport logistics

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An airport apron bustles with traffic. The tow tractors, tankers and buses moving busily around an aircraft run the risk of colliding. An enhanced positioning system will increase safety and the efficiency of logistical operations in the future – available airport capacities will be utilized better.

Dense fog is hanging over an airport apron. Even when tow tractors, pushback tractors and tankers are moving at merely a snail's pace, collisions can always occur, be they with other vehicles or with aircraft. Tanking and loading of luggage, air cargo, and catering takes significantly longer in fog or driving rain than when visibility is clear. Passengers end up sitting at departure gates longer than planned, and the schedule for cargo containers is jeopardized, too. Poor weather conditions will impede work on the apron far less in the future. Researchers at the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg are establishing the basis for this in the EU project e-Airport together with various European partners. This project is receiving funding from the European GNSS Agency under the European Union's Horizon 2020 research and innovation programme.

"We are developing a positioning system that will increase safety on the apron," explains Olaf Poenicke, research manager at the Fraunhofer IFF. "It will additionally make it possible to utilize airport capacities more efficiently because the system allows logistical operations to run in a significantly more structured way than before." One important aspect: The steady increase of air traffic is compelling airports either to build new runways and terminals or to utilize the existing infrastructure's

capacities more efficiently.

The European Galileo satellite system is the basis of the novel positioning system in the e-Airport project. The principle is similar to that of an automotive navigation system: Tow tractors, pushback tractors and other vehicles have onboard receivers for global navigation satellite systems, GNSS for short, which are powered by the vehicle's power system. They receive signals from the Galileo satellites and other systems such as GPS and use them to establish their exact location. Positioning data are sent by WLAN or cellular radio, for instance, to the control center where all data converge. The control system, in turn, sends messages back to the drivers: A display warns when a vehicle is getting too close to another, driving too close to restricted areas or leaving a specified route. "We at the Fraunhofer IFF are contributing our expertise in air cargo to this control center, modeling the processes, and specifying the job orders received by a tow tractor driver," explains Poenicke. The process models help define ideal target processes. They are compared in the control center with actual data sent from the apron by sensors. Discrepancies can thus be identified, and instructions derived from them can be sent to tow tractor drivers.

Although positioning systems that determine vehicle locations exist, they are based on GPS. This entails problems, especially in the vicinity of buildings. Shadowing occurs; positioning data are imprecise or break off completely. This doesn't happen in e-Airport: Additional signals from the Galileo satellites and other correction signals from the European EGNOS D-GPS system increase accuracy and reliability substantially.

Getting containers and pallets to their destinations faster

Up to now, tow tractor drivers have usually received printed work

assignments. Where do they have to hitch which dollies, i.e. trailers loaded with air cargo pallets or containers? Where should they deliver them? Errors occur time and again. Dollies are parked on the airport premises and forgotten, for instance, and have to be hunted laboriously later. "Our system eliminates such errors. It knows both the desired and actual status and gives the driver pertinent work instructions," says Poenicke.

The researchers are additionally developing special wireless sensors, which are attached to dollies. They use an energy-saving wireless protocol to send their data, e.g. a trailer's identification number and load, to a receiver unit in the tow tractor. The unit automatically analyzes which dollies are hitched and relays the dolly data together with the tow tractor's positioning data to the control center. The latest status data keeps the e-Airport system always in the know, even about the location of a dolly parked on the apron. In short, the control center has aggregated data not only on vehicles but also on their dollies and the cargo loaded on them.

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