

An innovative Airbus  
risk management service

# Runway Overrun Prevention System (ROPS)



Article by (left to right)

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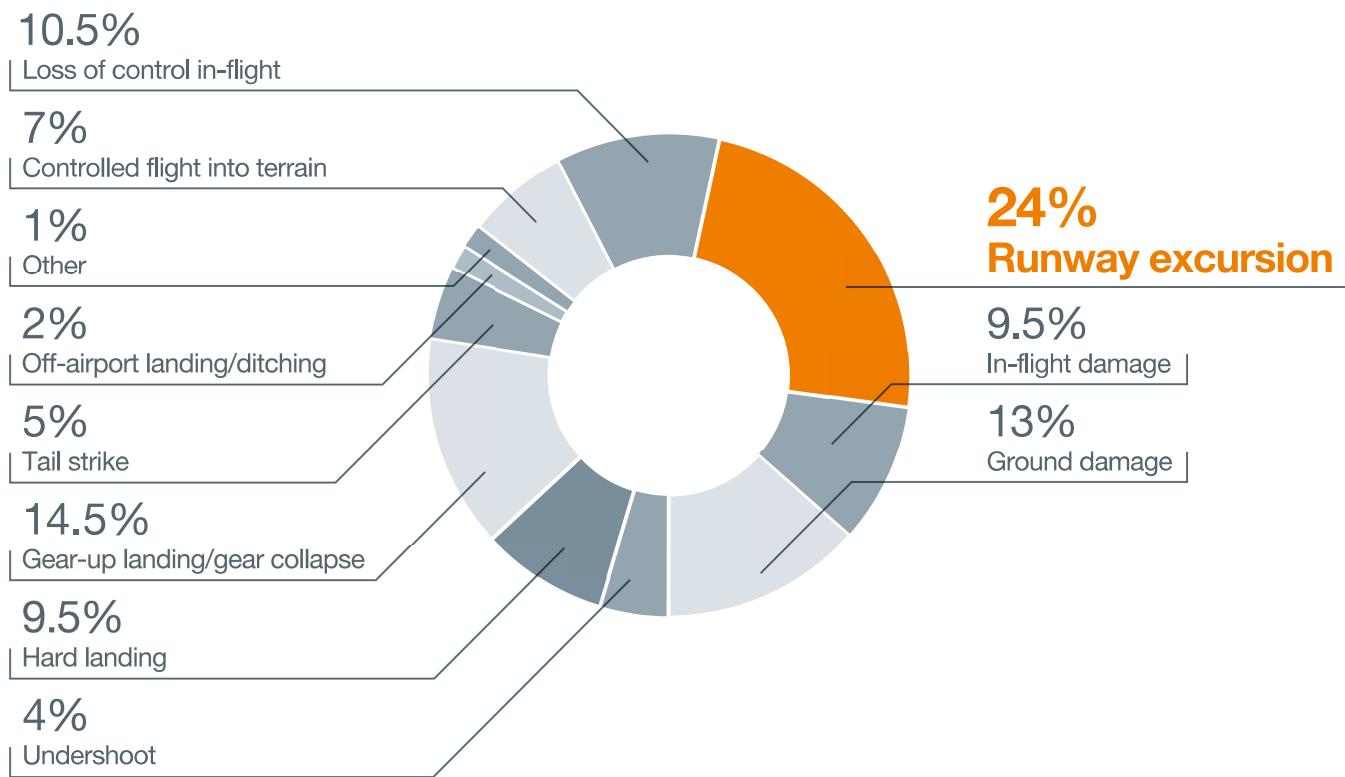
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**Airbus' Runway Overrun Prevention System (ROPS) is risk management technology that mitigates the n°1 source of accidents: runway excursions.**

Runway excursions at landing are the most common aviation accidents and a significant economic issue for the air transportation industry worldwide, costing US\$ 300 million per year (about 33% of all aviation segments' insurance claims). Studies demonstrate that the vast majority of these events could be avoided by providing flight crews with relevant information to make the right decision in a timely manner.

Fig 1: 2008 - 2012 aircraft accidents



### Reducing runway excursions is a n°1 priority

Initially developed between 2006 and 2009 as a smart automatic braking system named Brake-To-Vacate (BTV) for the A380 (read FAST magazine #44), it soon became apparent that elements of this system could be used to warn and protect against runway overrun risks, whatever the level of automation used for the braking system (pedal braking, classical Auto-Brake or BTV). This important safety system, named ROPS, has been in operation on A380 since October 2009 (nearly all operators) and on the A320 Family since November 2013. For A330 and A350 aircraft, ROPS approvals are expected over the next two years depending on engine types.

Realizing the global impact that ROPS-like technologies would have if applied on a worldwide scale, several safety bodies have already moved forward:

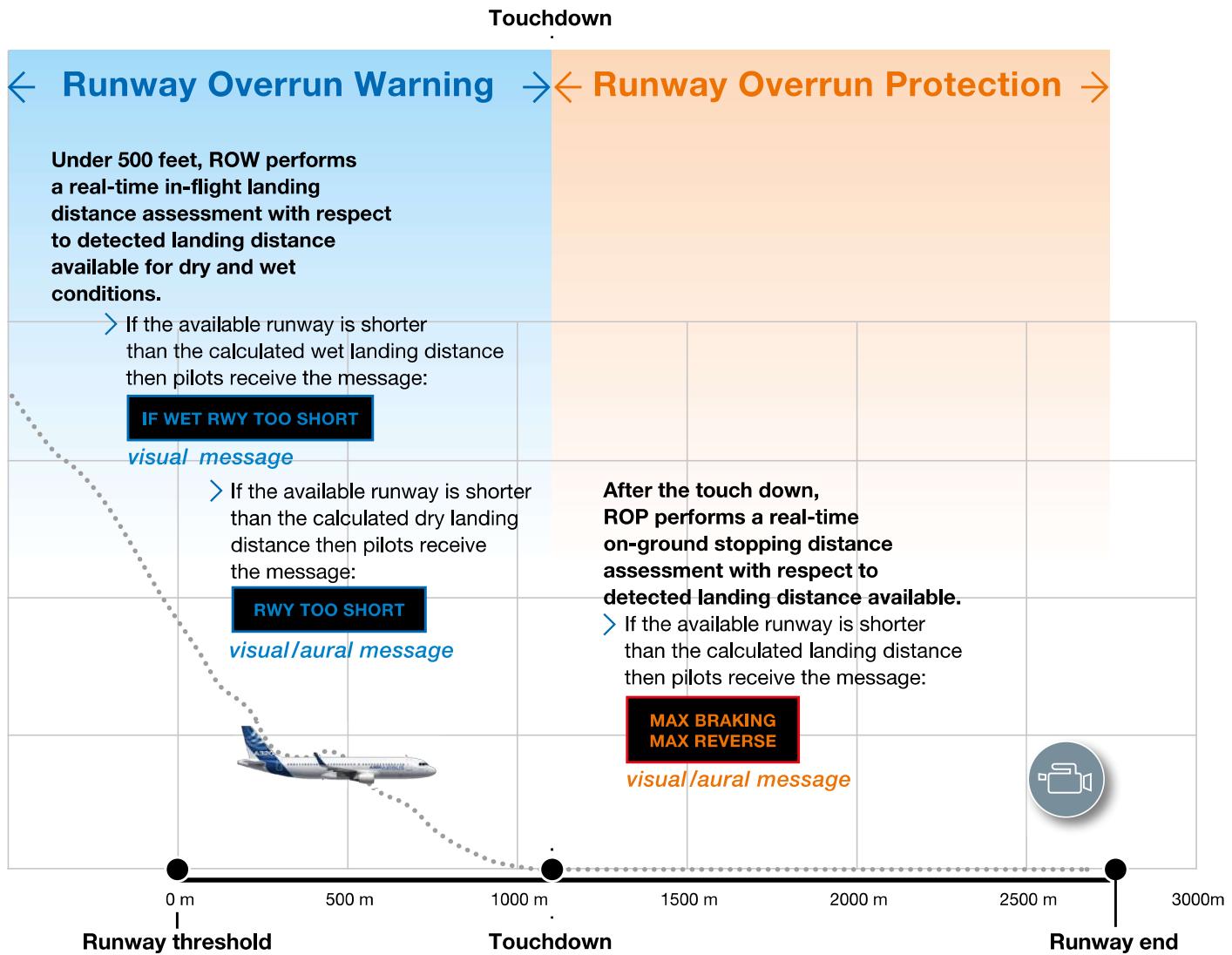
- In March 2011, the United States' NTSB recommended to the FAA to “actively pursue with aircraft and avionics’ manufacturers the development of technologies to reduce or prevent runway excursions and, once it becomes available, require that the technology be installed (A-11-28).”
- The European Action Plan for the Prevention of Runway Excursions released recommendations to aircraft manufacturers and operators in January 2013 to respectively develop and install “onboard real-time performance monitoring and alerting systems that will assist the flight crew with landing/go-around decisions and warn when more deceleration force is needed”.
- In mid-2013, EASA released a Notice Proposal of Amendment (NPA) regarding a possible mandatory installation of a “ROPS-like” system, generically called Runway Overrun Awareness Avoidance System (ROAAS) by 2017 for any new Type Certificate (TC) request, and by 2020 on any new delivered aircraft.

In a unique initiative to globally reduce runway excursions, Airbus announced at the May 2011 ICAO Global Runway Safety symposium, its decision to offer ROPS technology to all aircraft and integrated avionics equipment manufacturers.

## Airbus ROPS technology

From the aircraft approach up to the aircraft stop, ROPS is a turnkey technology designed to continuously monitor total energy and the aircraft's landing performance compared to the runway end. Its safety benefits have been demonstrated with reviews and replays of actual runway overruns, and about five years of in-service experience with overrun situations already avoided.

### Real-time assessment, in-flight and on-ground



### ROPS - the inaugural Airbus BizLab project

**ROPS was the first idea to be taken on board at Airbus' BizLab.**

Airbus' BizLab is an aerospace accelerator where start-ups and Airbus innovators can unleash their potential to accelerate the transformation of innovative ideas into valuable businesses within a collaborative environment.

This initiative from Airbus Corporate Innovation actively seeks opportunities to stimulate and develop ideas that can be of benefit to the aviation industry.

BizLab takes a hybrid approach that mixes internal and external participants to foster an innovative culture and promote an entrepreneurial mindset throughout Airbus.



The A350 is fitted as standard with ROPS

**To effectively guide and assist the crew in the go-around decision-making process and the timely application of on-ground slowing down (reversers and braking), ROPS:**

- Automatically detects the upcoming landing runway using highly accurate runway information included in the terrain database (on A320 Family, A330 and A350) or the airport mapping database (A350 and A380).
- Performs a real-time in-flight landing distance assessment during the short final (last section of approach) taking into consideration the detected landing distance available. If the detected landing distance available is assessed too short, it triggers an alert to encourage the crew to go-around.
- Performs a real-time on-ground stopping distance assessment regarding the detected landing distance available. If the detected landing distance available is assessed too short, it triggers an alert to encourage the crew to apply and keep all available means of slowing-down.

## Real-time computation of realistic landing distance and remaining braking distance

In the air, the strength of ROPS is its ability to continuously monitor the aircraft's position and energy with regards to the remaining runway length. Consequently, any changes during the approach are immediately captured and the resulting distance required to stop is updated (e.g. changing winds affect the ground speed and thus the predicted touchdown speed, or flying above the normal glide-slope may affect the predicted threshold crossing point, or long flares which affect the predicted touchdown point).

The review of past incidents and accidents shows that seconds count (small delays have a large impact on the stopping distance), crews can be saturated with information and misjudgement concerning the amount of runway remaining is frequent. Moreover, acknowledging that ROPS cannot predict the future intention of the pilot, the system must protect against a pilot who is unknowingly approaching the runway end too fast while communicating that the current deceleration is not sufficient to stop the aircraft before the runway end. In addition, the system needs to protect against some unexpected degradation of aircraft braking performance (e.g. downward sloping runway end or runway end contamination by rubber).

# Creating a positive business case for operators with the ROPS risk management service

The wide adoption of safety-related technologies happens when a significant proportion of aircraft are equipped, which then creates a momentum within the industry. In the cases of the Terrain Awareness and Warning System (TAWS) and the Traffic Collision Avoidance System (TCAS) - two of the most important safety technological steps in aviation over the past 20 years (see FAST 45 and 52) - the installation took several years and was initially highly subsidized by governmental agencies.

In the case of ROPS, Airbus has looked for an innovative way to incentivize operators to adopt ROPS without relying on state subsidies but leveraging the value created by ROPS for the operators: less risk of runway excursions.

## The ROPS Risk Management Service

When one knows that runway excursions are the number one risk in terms of cost for insurances, it then becomes obvious that the reduction of this risk should translate into an insurance cost reduction for the operators installing ROPS on their aircraft.

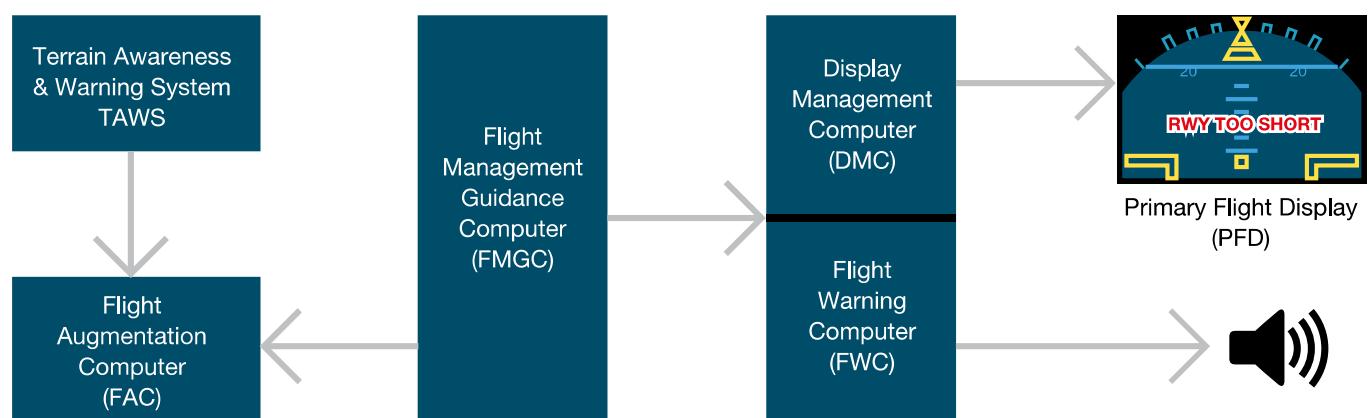
Airbus has consequently entered into an innovative partnership with Willis Aerospace (insurance broker) and Allied World (insurance company) to develop the ROPS Risk Management Service which comprises:

- The installation kit for ROPS including all required software and operational documentation to activate and operate ROPS function,
- The supply of ROPS specific high quality and verified runway database updates,
- The supply and the management by Willis Aerospace of a dedicated Hull, primary and A rated insurance policy which would indemnify the operator against hull loss directly resulting from a runway overrun at landing for amounts up to US\$ 15,000,000 for a single-aisle aircraft or up to US\$ 25,000,000 for a long-range aircraft.

With the ROPS Risk Management Service, operators can negotiate on a case-by-case basis with their lead insurer or broker, a reduction of the insurance premium they pay as they are already insured against the risk of runway excursion and get a protection against the potential revision of their premium in case of overrun.

This can create a positive business case for the installation of ROPS or at least alleviate significantly the cost of installation.

## An A320 ROPS architecture



## ROPS – Available for all Airbus families

### A320 Family and A330 Family status

- Implementation through software change mainly (retrofit can be done overnight)
- Certified for A320 Family by EASA and FAA in 2013
- Certification for A330/A340 Family expected in 2015

### A380

- Certified by EASA on October 15th 2009
- Selected on 77% of ordered/in-service A380s
- Implementation through software change only
- Coupled with Brake-To-Vacate (BTW)
- Proven: no runway overruns in seven years of operations

### A350

- Included in the basic entry-into-service configuration



## CONCLUSION

ROPS (Runway Overrun Prevention System) is an Airbus technological invention able to mitigate the n°1 source of accidents and insurance claims. This system is able to continuously monitor the aircraft's position and energy with regards to the remaining runway length and runway conditions, to effectively guide and assist the crew in the go-around decision-making process and the timely application of on-ground slowing down.

ROPS is available for linefit or retrofit on all Airbus aircraft and is being developed for non-Airbus aircraft.