

Last year's Paris Air Show was marked by an event that received wide media coverage: The right wingtip of an Airbus A380 struck a building at Le Bourget airport as the aircraft was maneuvering on the ground. Most ground damage incidents receive little, if any, public attention, but ground damage is a significant financial, operational and safety issue,

particularly given the airline industry's razor-thin profit margin.

Flight Safety Foundation several years ago estimated that "ramp accidents cost major airlines worldwide at least \$10 billion a year. These accidents affect airport operations, result in personnel injuries and damage aircraft, facilities and ground-support equipment." The Foundation also estimated

that 27,000 ramp accidents and incidents — one per 1,000 departures — occur worldwide annually.<sup>1</sup>

Many definitions of ground damage are offered by regulators and industry trade associations. Perhaps the most relevant is in Chapter 660 of the International Air Transport Association (IATA) *Airport Handling Manual (AHM)*.<sup>2</sup> The definition includes the

A ground accident program, ground damage database and revised ground handling services agreement promise to reduce ground damage.



# Covering the Ground

A Fokker F-27-500 engine was damaged in a collision with a towed ground power unit at Edinburgh Airport, Scotland.



terminology most commonly used in insurance policies that cover the cost of damage. The AHM distinguishes between the costs of aircraft physical damage and consequential losses.

*Aircraft physical damage* includes labor costs; material costs; handling fees for parts and materials used for repair; aircraft finance costs and cost of capital while the aircraft is out of service; temporary leasing costs of aircraft spare parts when replacements and repairs are not readily available to ensure aircraft serviceability; costs to ferry the damaged aircraft to a repair station or base station; extra parking costs, including overtime and security for the damaged aircraft at the current location; and external survey/claims administrative costs.

*Consequential losses* include costs related to passengers and crew incurred within 72 hours of the event, including the cost of transportation on other carriers; compensation associated with non-passenger revenue (cargo, mail, etc.); the internal cost of investigation/claims administration; delay of services (other stations); revenue loss; aircraft delay costs, including sub-charter on flights other than the one involved; operational disruption; loss of priority payload due to aircraft change; catering costs; and crew changes and rescheduling/interruption.

### Risks During Ground Operations

During airline ground operations, risks are “concentrated in the movement, control, guiding and synchronization of ground equipment with other pieces of equipment or other vendors working around the aircraft,” said Bill Johnson, a consultant in airline operations, fuel efficiency and cost management. “Furthermore, training and supervision also represent a very important area of risk.

“Cargo operations are typically more vulnerable because of the extent of damage caused by large, solid, heavy objects. Also, cargo operations are frequently not as well supervised in that there are fewer people around the aircraft, and they are frequently night operations when company management is often limited in presence and experience. In addition, as cargo operations are by nature sporadic, work crews are often characterized by high turnover, supplemented by part-time

and less experienced personnel, unfamiliar with the aircraft they are servicing and less familiar with the equipment they are operating.”

He added, however, that major operators such as FedEx and UPS staff their own operations, their management is experienced in night operations, their teams are permanent and they have established safety programs and staff.

IATA recently launched the Ground Damage Database, the industry’s first repository specifically for the collection and analysis of ground damage occurrences worldwide. Concerning the most common forms of damage based on data available to IATA, it is “too early to say, as we have only just started gathering industry data; however, preliminary analysis indicates the majority of damage is to hold compartments and doors,” said Guenther Matschnigg, IATA senior vice president, safety, operations and infrastructure.

### Safety Risks

Ground damage is associated with safety risks that cannot be underestimated. About 243,000 people are injured each year in ground occurrence accidents and incidents; the injury rate is 9 per 1,000 departures.

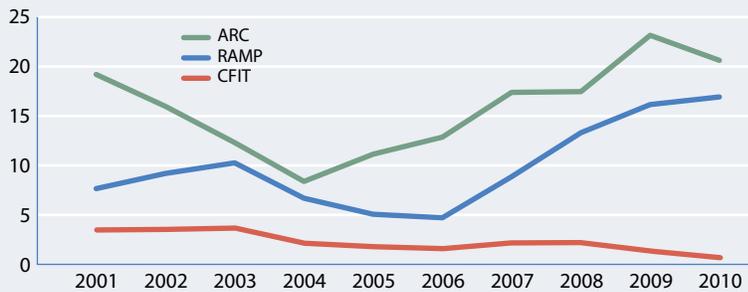
Accidents involving ramp events are increasing as a percentage of all accidents (Figure 1, p. 46).<sup>3</sup> The figure does not tell the whole story — it does not include incidents as defined by the International Civil Aviation Organization.

Why are so many risks associated with ground operations? More important, why are ramp events increasing as a proportion of all accidents? Ivar Busk, who has been head of airside safety at SAS since 1982 and manager of SAS Group Insurance since 2004, lists the main reasons: time pressure on ground personnel, increased production and therefore congestion of airports, technology and change management, training and education of ground personnel, and human factors.

“The ever-increasing demand for quick aircraft turnaround puts considerable pressure on people working on the ramp,” said Busk. “There is not only an airline’s management-enforced policy of quick turnarounds, but I personally know of several examples of ground incidents directly linked

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## ARC, RAMP and CFIT Accidents, EASA Member State Airlines, 2001–2010



ARC = abnormal runway contact; CFIT = controlled flight into terrain; EASA = European Aviation Safety Agency; RAMP = ground handling

Source: European Aviation Safety Agency

Figure 1

with time pressure exercised by pilots, ATC [air traffic control], etc., on ground personnel,” said Busk.

“Most of the world’s big hubs have more flights today than ever, but they have grown without appropriate investments in their capacity. Airports struggle for efficient and effective space management and many incidents are linked to insufficient maneuvering space. The congestion of airports is also associated with a frequent alternation of gates between narrow-bodied and wide-bodied aircraft. This is one of the leading causes of confusion to ground personnel, which can be the basis of ground damage, especially during peak times.”

### Technology and Change Management

New technology increases production, but it also can have negative consequences, Busk said: “Some towbarless (TBL) tractors now operate like fly-by-wire (steer-by-wire), and airbridges also are becoming increasingly sophisticated, some operating nearly automatically. If there is a crash in the computer system, huge damage can result. It is very important at the time of new technology implementation to train ground personnel appropriately so that they

can learn to manage new technology safely and proactively.

“The ground operations industry does not lack high quality standards, like the IATA *AHM*, but the training of personnel is a real problem — during turnarounds standards are not followed as strictly and professionally as they are followed in the cockpit during flight operations. The root cause more often than not lies at the budgeting and business planning phases, because investments in training are always easily postponed to the following year.

“Very often, there are a number of human factors reasons behind a damage incident, and if the relevant investigation is not carried out in detail, the conclusion often is that the person did not follow the procedure, and instead of going deeper into the case to find the root causes, the case is closed. Even on the ground, human factors need to be taken seriously into consideration as a leading cause of equipment damage.”

### Cost of Ground Damage

Airlines normally pay directly for any ground damage below deductibles and underwriters pay for ground damage

above deductibles (the insurers’ premium being equal to average claims plus administration costs plus profits). Refunds for ground damage caused by ground handling companies are normally included in turnaround charges to airlines. The whole cost of ground damage is paid directly or indirectly by the world’s airlines.

One reason airlines bear the whole cost is that “after privatization, airlines set about horizontally integrating and thus divesting themselves of their cleaning, catering and other ground handling divisions,” said Andrew Dixon, owner of Aviation Recovery and formerly accident recovery manager at British Airways. “This was in pursuit of economies of scale and to focus on what they do best through simplifying their business model. Whilst regulatory hurdles slowed airline integration, the same cannot be said for their former divisions. These handling divisions amalgamated at great speed and have formed companies that are now often larger than the flag carriers that used to control them. Where the engineering departments are now separate companies, the airlines now get real invoices for damage repairs. The balance of power has moved away from airlines. These giant handling companies now include internal insurance companies and have become very sophisticated.

“It is a more difficult problem for the airlines, and with the insurers raising the deductibles at the airlines’ behest, the amounts at stake are increasing. The larger airlines have generally risen well to this task and have skilled and experienced teams chasing recoveries, but the smaller airlines are at a disadvantage, as they simply don’t have enough volume of activity to build up sufficient experience and expertise.”

## New Risks in the Equation

While ground damage threatens safety on the ramp or taxiways, it is less likely to represent an immediate flight safety threat because harm to aircraft structural integrity is often detected before takeoff, partly because normal operating procedures dictate visual checks of airframe and engine surfaces before flight. The relative ease in detecting ground damage may not be here to stay, however.

The increasing use of composite materials in aircraft manufacturing may pose a new threat because often, after being hit, a composite surface returns to its original shape and the damage underneath is invisible.

“Safety occurrences have been attributed to the fact that the defect of composite material surfaces was missed during daily and weekly checks,” said Philipp Reichen, an aerospace and aviation consultant and contractor specializing in engineering and maintenance. “A simple ‘tap’ test might not detect delaminations at early stages or in specific areas.

“Some of the most abused aircraft surfaces while on the ground are cargo and passenger doors, which might be hit several times a day by ground service equipment and can therefore be exposed to minor delaminations, which in turn could lead to problems sometime in the future.”

The Boeing Co., with regard to the use of composites in the airframe and primary structure of the 787, says that “in addition to using a robust structural design in damage-prone areas, such as passenger and cargo doors, the 787 has been designed from the start with the capability to be repaired in exactly the same manner that airlines would repair an airplane today — with bolted repairs. The ability to perform bolted repairs in composite structure is service-proven on the 777 and [requires] comparable repair times and skills [to

those] employed on metallic airplanes. (By design, bolted repairs in composite structure can be permanent and damage tolerant, just as they can be on a metal structure.)

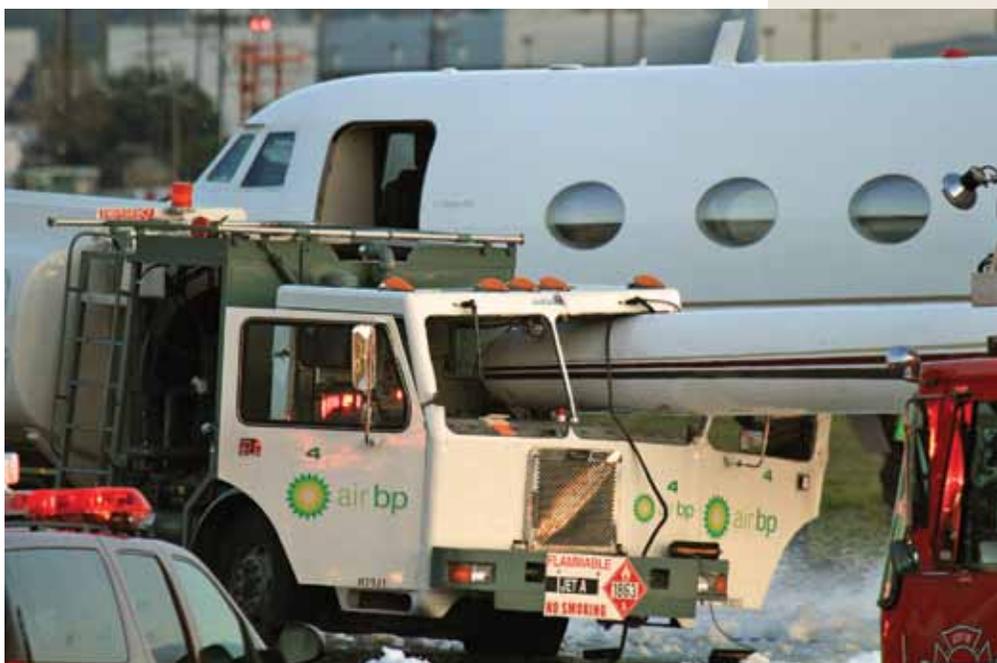
“In addition, airlines have the option to perform bonded composite repairs, which offer improved aerodynamic and aesthetic finish. These repairs are permanent, damage tolerant, and do not require an autoclave.”<sup>4</sup>

## Increasing Maintenance Costs

The repair of composite surfaces will be a major step for most maintenance, repair and overhaul organizations (MROs). “Composite repairs demand new techniques and technologies that are not yet used by most MROs,” said Reichen. “This could cause a concentration of repair stations with the required capabilities and increase the repair cost for structural damages associated with ground occurrences, as the investments in the new technologies are substantial.”

According to Busk, “In the new technology of ground operations, the maintenance of sometimes very complicated pieces of equipment (such as automated airbridges and modern TBL tractors) creates the need for new types of maintenance skills that could increase the costs of ground damage.”

A truck driver was pinned inside the cab until rescued by firefighters following a collision with a Gulfstream II at Seattle King County International Airport.



Ground safety needs commitment of resources by airline management, but what tools are available for ground damage mitigation? More important, what should an industrywide effort to reduce ground damage concentrate on?

### Ground Accident Prevention Program

Flight Safety Foundation was one of the first organizations to become proactive in addressing ground safety issues. In 2003, the Foundation launched the Ground Accident Prevention (GAP) program in response to industry requests. “The GAP program developed information and products in a practical format — ‘e-tools’ — designed to eliminate accidents and incidents on airport ramps (aprons) and adjacent taxiways, and during the movement of aircraft into and out of hangars,” the Foundation says.

The e-tools on the Foundation’s website include a ground accident prevention cost model, a set of videos illustrating safe aircraft towing, ground accident prevention leadership tip sheets and a template outlining ramp operational safety procedures. “The document is intended to assist ramp supervisors in the development or improvement of their organizations’ written SOPs,” the Foundation says. “The template is presented in Microsoft Word format to facilitate customization by the user, including revision, deletion and addition of information as necessary to tailor the document to the organization’s ramp activities.”

IATA’s main initiatives are the Ground Damage Database, ISAGO (the IATA Safety Audit for Ground Operations) and AHM/IGOM (the AHM with the supplementary *IATA Ground Operations Manual*).

Matschnigg said of IATA’s efforts, “The main difficulties are concerned with the wide range of reporting

cultures, attaining a consolidated approach and pinpointing exact causes of ground damage. The Ground Damage Database is designed to answer these difficulties. IGOM establishes core ground handling procedures, AHM provides standards, ISAGO audits ground operations which currently use AHM standards as guidance and will include IGOM procedures in the near future. Based on the Ground Damage Database outputs, the standards/procedures of AHM/IGOM and ISAGO will be assessed for their abilities to reduce damages and potential risks.”

### Ground Handling Agreement

The most commonly used ground handling services agreement is IATA’s Standard Ground Handling Agreement (SGHA).

According to Article 8 of the SGHA, the ground handling company “shall indemnify the carrier against any physical loss of or damage to the carrier’s aircraft caused by the handling company’s negligent act or omission, *provided always that* the handling company’s liability shall be limited to any such loss of or damage to the carrier’s aircraft in an amount not exceeding the level of deductible under the carrier’s hull all-risk policy which shall not, in any event, exceed USD \$1,500,000 except that loss or damage in respect of any incident below USD \$3,000 shall not be indemnified.”

Furthermore, “the carrier shall not make any claim against the handling company and shall indemnify it ... against any legal liability for claims or suits, including costs and expenses incidental thereto... ”

The Association of European Airlines has proposed to IATA to amend the SGHA limits to the liability of ground handling companies. “The overall goal is that airlines should not suffer as they

do today when ground damage occurs,” said Busk. “Is it fair that airlines have to reimburse their stranded passengers as per the European Union passengers’ bill of rights when damage is caused by a third party? Is it fair that airlines suffering ground damage are refunded by their service providers only the cost of physical damage, which is only a minor fraction of the total damage cost incurred? There is no other industry with such strict liability limits when somebody damages another party.

“Ground handlers tend to assume that a change in the SGHA will be followed by an increase in the premium charges they will have to pay to their underwriters, and therefore an overall increase in the aircraft turnaround charges to airlines, but by amending the SGHA we should aim at an improvement in the overall efficiency and safety awareness of ground operations, so that the cost of ground damage to the industry is reduced. This will not increase premiums.”

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### Notes

1. Flight Safety Foundation (FSF). *Ground Accident Prevention (GAP)*. <flightsafety.org/archives-and-resources/ground-accident-prevention-gap>. The data, developed in conjunction with the FSF Ground Accident Prevention initiative, were the first attempt to arrive at a worldwide picture of ground damage costs. While they are now more than five years old, no more recent data have been calculated.
2. Available for purchase at <www.iata.org/publications/pages/ahm.aspx>.
3. EASA (2011). *Annual Safety Review, 2010*. Cologne, Germany: EASA Safety Analysis and Research Department.
4. Boeing, *Aero Quarterly*, Quarter 4, 2006.