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'AGPLA' - The Application of Ground Power to Live Aircraft

Introduction

For the purpose of attaching ground power (whether for an inoperative Auxiliary Power Unit (APU) or a standard arrival), it is recognised and accepted that at some airports, aircraft operators and ground service providers require a process during the arrival phase of the turnaround, whereby ground handling personnel need to approach the aircraft whilst the engines are still running and the anti-collision lights are still illuminated.

This article has been produced to raise awareness of the hazards generated by this activity, provide an insight into industry's expert analysis of the process and suggest topics that should form the basis of any related risk-based conversation and assessment.

The UK Civil Aviation Authority, via the Ground Handling Operations Safety Team (GHOST), has developed detailed guidance and procedures in accordance with regulatory obligations and industry best practices. This information, together with a Bowtie safety risk template, can be found in CAP642 and published on the CAA website Add link.

Background

The primary reason for implementing this practice is to reduce operating costs; i.e. reduction in fuel consumption and maintenance cycles of the APU, as well as minimising turnaround times.

As it is undesirable for aircraft to experience sustained periods without ground power, due to the costs and complications (see note below) associated with the discharging of batteries, ground handling/ramp personnel are required to approach the 'live aircraft', in order to supply ground power. Because of the inherent safety risks, this practice is not recommended and related warnings have been widely documented in CAP642 and IATA AHM/ IGOM publications.

Note: One common modern aircraft type would require approximately fifteen minutes clearing all of the associated warnings, if electrical power to aircraft systems was not sustained. This could cause unnecessary distraction to the flight crew during a turnaround, which in turn has safety implications as the crew prepares the aircraft and themselves for the subsequent departure.

Even between airlines, there is a difference of opinion as to whether or not the non-APU procedure is cost effective. Some will say that the cost savings are negligible and therefore they will not adopt it as a standard procedure. Others have assessed the costs and taken the decision to implement the policy across their network.

Environmental considerations (noise and emissions) at some airports also restrict use of the APU but typically come into effect 5 minutes after the arrival, and 10 minutes before pushback or engine start up, so will not affect the arrival process.

The Health and Safety Executive (HSE)

The Health and Safety Executive (HSE) set out their concerns and position, following the issue of a prohibition notice of the practice at Edinburgh Airport, in an open letter to industry (issued 01/02/11) and made it clear that health and safety

management systems require additional mitigation to protect workers on the ground.

As detailed in the HSE letter, a working group under the auspices of the CAA-led Ground Handling Operations Safety Team (GHOST) was tasked with researching and exploring the hazards and risks associated with AGPLA. The group sought to achieve an agreed conclusion and provide a detailed report to the HSE and the UK aviation industry for consideration.

In 2010, GHOST stated that it; "*…has discussed the risks and benefits at length, and considers that adoption of the procedure may introduce additional risks to the safety of persons working on the apron. As a group of industry professionals, GHOST cannot therefore endorse adopting the procedure for all arriving aircraft as industry 'best practice'.*"

However, at the request of stakeholders the CAA, via GHOST, agreed to conduct a further review of the procedure and in doing so established a dedicated working group involving a representative cross section from industry. Using Safety Management System principles that included the Bowtie risk model and human factors considerations, the group worked to produce guidance which, as previously mentioned, should form the basis of any related risk based conversations and assessments.

The HSE will accept the risk and control measures agreed by industry as standard good practice but due to the varying nature of aircraft operations, apron management practices and other local limitations, stakeholders should be able to determine the acceptability of the practice and procedures discussed in this document, and decide whether the risk mitigation is sufficiently robust.

Notwithstanding the risk assessment process and other safety considerations, aerodrome operators are not obliged to accept or permit AGPLA. It is strongly advocated that discussions on this topic are tri-party.

Group Research

From the outset of the research, the subgroup of GHOST comprising representative members from industry and regulators (Initially CAA, IAA and later HSE), reviewed this practice and very quickly started to draw comparisons with the common practice of attaching ground power to a live aircraft, when the APU is inoperative. Despite such similarities, the group identified a number of widespread concerns, namely:

a) Inadequate stakeholder engagement;
b) Lack of industry standardisation;
c) Familiarity with procedures;
d) Inconsistent prior notification;
e) Inadequate compliance monitoring.

Inadequate Stakeholder Engagement

The main concern identified during the GHOST discussions was an apparent weak approach by respective stakeholders to this procedure. Generally, ground handling agents were not consulted during the formation of airline risk assessments and were simply instructed to adopt the procedure in accordance with agreed handling contracts. Evidence suggested that some risk assessments were being completed without the involvement of the airport/ aerodrome operator and with no consideration of human behaviours/ performance or of other organisations that operate on the ramp.

The organisations whose employees are most likely to be affected by the AGPLA procedure, namely ground service providers either directly working for, or contracted by the airline, should lead any risk assessment. The ground handling agent is often better placed to establish a 'Safe System of Work' as it is their employees that directly interact with aircraft and face the greater risk.

From a legal perspective, an employer is responsible for the safety of those involved in the aircraft turnaround. However, the Health and Safety at Work Act, Section 3, which reflects the airline contracting ground handling agent/ caterer/ cleaner etc. relationship, places the responsibility on those who have operational control:

- General duties of employers and self-employed to persons other than their employees

1. It shall be the duty of every employer to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that

persons not in his employment who may be affected thereby are not thereby exposed to risks to their health or safety.

2. It shall be the duty of every self-employed person to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that he and other persons (not being his employees) who may be affected thereby are not thereby exposed to risks to their health or safety.
3. In such cases as may be prescribed, it shall be the duty of every employer and every self-employed person, in the prescribed circumstances and in the prescribed manner, to give to persons (not being his employees) who may be affected by the way in which he conducts his undertaking the prescribed information about such aspects of the way in which he conducts his undertaking as might affect their health or safety.

In the event of an injury or worse, the changes to the sentencing guidelines (implemented in February 2015) now mean that related fines have increased significantly. Companies with a turnover of £50m or more will face fines that can extend beyond £10m (depending on a number of factors)

The guidance material found in the Appendices to this document will provide the basis for any such collaborative assessment process. Stakeholders will need to work together to ensure that any output/ decisions are robust and an accurate reflection of their own operation.

Lack of Industry Standardisation

The lack of standardisation can add ambiguity and lead to confusion to what is a safety critical task. As with many activities in the aviation industry's ground handling community, different organisations often determine different ways of conducting the same process.

Stakeholders are recommended to refer to, and align with the detailed procedures provided in **Appendix A**, which is consistent with industry best practice, as described in the **I**ATA **G**round **O**perations **M**anual.

Familiarity with Procedures

Familiarity with any procedure, or the lack of, can result in very different outcomes:

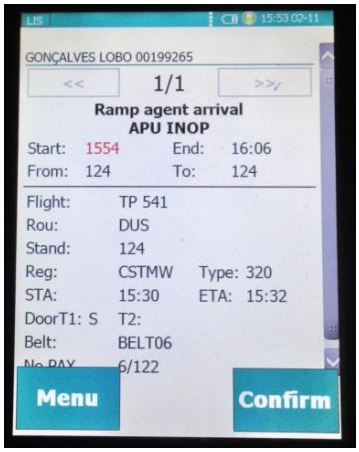
- Familiarity with a routine procedure often dilutes the safety critical nature of the task and breeds complacency;
- The lack of familiarity with a procedure will result in a reduced level of safety for all involved in the process;
- Whereas, total awareness of an 'unusual' situation may provide all involved with a heightened level of awareness.

Inconsistent Prior Notification

One of the acknowledged weak links in this process is the communication of the inoperative APU situation to the 'receiving' ramp team. This is vital for proper planning and preparation. There are currently various methods of communication but it was recognised that none were particularly robust due to the disparate nature of different companies serving the arriving aircraft, the sometimes late notification of an inoperative APU and the limitations of the human element.

Some airlines operations department will send either a SITA (movement) message or an e-mail to the ground handling agent, allowing the ramp team to be notified at local level.

One agent has implemented an 'UNSERVICABLE APU HANDLING TEAM BRIEFING' card that is used nationwide by their company, following introduction by one airline.
Another utilises hand-held electronic devices to inform the ramp team of the inoperative APU.



There are many examples of the APU failing, when the flight crew has tried to start it in preparation for the arrival. However, that phase of flight must be conducted in a "sterile" environment, especially when in busy airspace, so the handling agent may not get notified of the required change to the arrival procedure.

Without knowing the aircraft's APU status, risks may be further increased for the ground crew. If for any reason an aircraft stops short of its final parking position, the ground crew may inadvertently interpret that they are now clear to approach to commence their duties. If at the same time, flight crews are focused with the final positioning of the aircraft and are unaware of the approaching ground crew, the situation becomes dangerously hazardous. If an increased "break-away" thrust setting is applied to counter ramp slope or a single engine taxy, engine danger areas will significantly increase.

This scenario reiterates the importance of robust and standardised communications between flight and ground crews, and is why the group is intent on supporting the widespread implementation of ICAO standard communications (hand signals) to ground crews, whenever the ground power is required on arrival.

Note: One airline has equipped their flight crew with iPads and in the event of an inoperative APU, a 'GPU REQUIRED' message will be flashed on the aforementioned tablet in the window of the aircraft.

Inadequate Compliance Monitoring

Practical drift, as defined in ICAO doc 9859, occurs when the baseline performance of any system "drifts" away from its original design when the organisation's processes and procedures cannot anticipate all situations that may arise in daily operations.

Effective management and supervision of any safety critical activity is imperative, so the agreed process must be included within all of the stakeholder's compliance monitoring programmes.

Whilst a desktop review of the risk assessment and procedures must be periodically conducted, it is essential to observe the actual process in all weathers and visibilities, day or night.

Other Risk Based Considerations

Whilst it is impossible to list and effectively cover every operational scenario, there were a number of key operational factors that were raised/ discussed during group research and these must be considered during any risk assessment. These included:

- Ramp observations have witnessed ground crew becoming overly confident and trying to open access panels and apply ground power before the aircraft has come to a standstill. This practice could lead to an operative being struck by the aircraft
- The presence of blast and engine noise may not be immediately obvious to a driver in a vehicle or a person wearing ear defenders
- Ground crew not required for the initial procedure of chocking the nose gear and attaching ground power to the aircraft were noted to be 'strategically' waiting in operational areas, not staying clear of the stand until the initial arrival process was completed
- Whilst the need to for flight and ground crews to maintain in visual contact has been mentioned in this article, it is recognized that this is not always possible, depending on the layout of the parking stand and surrounding infrastructure, particularly with wide-body aircraft
- Single point stand management control is seen as a key component to this procedure but the limitations of a single ramp coordinator must be recognised, as they can't be responsible for all parties around the aircraft
- Having one person 'in charge' could de-value and affect the behaviours of others. Agents can be reluctant to accept this task as some feel that the authority required to do so does not exist at present
- There are apparent misunderstandings with basic system functions. More than one agent incorrectly assumed that anti-collision warning beacons were physically connected to the engines
- Aerodrome and apron complexities and layouts are a significant factor. Stands are, in some cases, becoming more restrictive which will affect operations
- There are many different sources of ground power to consider; wheeled, towed, airbridge-mounted, ground fixed etc.
- Flight crew could consider shutting down the engines on the FEGP/ GPU receptacle side to significantly reduce the risk

- Engineers are for some types are required to use the headset to verify whether the aircraft brake temperatures are of levels that it is safe to interact with the aircraft under-wing. This action must be coordinated with ground crews and only completed after the aircraft has been chocked
- Inoperative anti-collision warning lights are a not so common problem but within the terms of the Master Minimum Equipment List, aircraft are able to operate without the benefit of this visual safety indicator for a limited number of sectors. It is also understood that one aircraft manufacturer is looking into concerns that a single engine taxi or electrical power transfer could even extinguish the anti-collisions
- A significant number of engine proximity incidents have involved ground personnel who were not part of the "receiving" team. There is a major concern that third party personnel may see the visual cue of workers active around an aircraft and take it as their "green light" to either approach the aircraft to pass behind it
- There are currently no industry standard (ICAO) hand signals to indicate it is clear for ground staff to approach the aircraft.

Safety Reports

Over recent years, a number of related safety reports have been submitted and the following examples should support any risk based conversations:

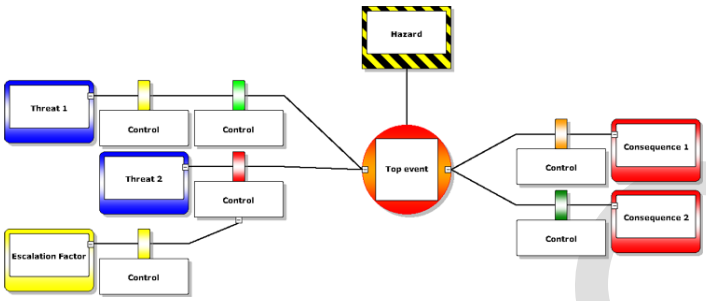
- The Captain signalled for the GPU to be connected whilst the engines were running. Ground crew were unaware that the aircraft required the GPU on arrival and therefore, no briefing for the inoperative APU was given. The ramp team leader saw the Captain's signal and approached to place the chocks. Once the chocks were placed, he backed away in order to take out the GPU cable and connect it to the aircraft. Whilst doing so, he observed the dispatcher of the flight, standing beside the airbridge signalling to someone. The ramp team leader turned around and observed a member of staff, approaching from the wing tip to the No. 1 engine in order to place the cone. The ramp team leader began signalling frantically for the member of staff to return to the waiting area
- Ramp Agent stopped Airport PRM staff from approaching aircraft with anti-collision lights on
- The aircraft pulled onto stand last night with an inop APU. We had not been informed of this and as a result, waited for the engines to spool down before attaching the GPU. The Captain signalled for the GPU to be attached and then proceeded to switch off the anti-collision lights, with the engines still running. The lights being switched off lead one of the new starts to believe that the aircraft was safe to approach and he had to be stopped from going towards No. 2 engine to position the safety cones
- Ramp agent approached aircraft with chocks and cones whilst No. 1engine still running. Several agents shouted but did not hear them. Agent passed in front of ingestion zone and also behind in blast zone
- The message that the flight would require an ASU for the entire day's operation was passed to the ramp team in the morning. They were also reminded on the way to the flight. The dispatcher had the INOP APU slip but did not pass it to the ramp team as she heard the team discussing the ASU requirement for the subsequent departure. The aircraft came onto stand and the front steps were pulled in towards the aircraft by two agents when the anti-collision lights were still illuminated and No. 2 engine on the opposite side of the aircraft had not spooled down
- Ground staff met the aircraft using the inop APU procedures. The aircraft had been marshalled, the nose gear chocked and the GPU was being connected when a fuelling agent approached the aircraft from the starboard side while the No.2 engine was still running and the aircraft anti-collision beacon was still illuminated. The TCO moved forward and caught the attention of the fuelling agent to prevent him walking behind a running engine
- All ramp equipment was positioned onto the B767 before the anti-collision lights were switched off. This was possibly due to an

inoperative anti-collision light on the belly of the aircraft. Ground engineer was informed.

Whilst we have been unable to verify whether this last report was related to this procedure, the words provide a valuable insight into the crew's concerns from the flight deck:

- We were parked on stand waiting for push and observed the arrival of the aircraft onto the adjacent stand. As the aircraft parked, staff moved toward to the aircraft with the beacon and engines still running, chocked the nose gear and opened the forward cargo hold. I was so concerned with what I saw, I spoke to our dispatcher and asked him to immediately remind the other ramp agents and staff of the dangers of doing so.

The Bowtie Method



In the past, GHOST and many other industry organisations have utilised the Bowtie method to visually depict other ground operational risks, Therefore, in the interest of consistency, it was determined that this method should be used again to visualise this process. The completed template can be found in **Appendix B**.

A Bowtie is a diagram that visualises the risk you are dealing with in just one, easy to understand picture. The diagram is shaped like a bow-tie, creating a clear differentiation between proactive and reactive risk management. It provides an opportunity to identify and assess the key safety barriers either in place or lacking between a safety event and an unsafe outcome.

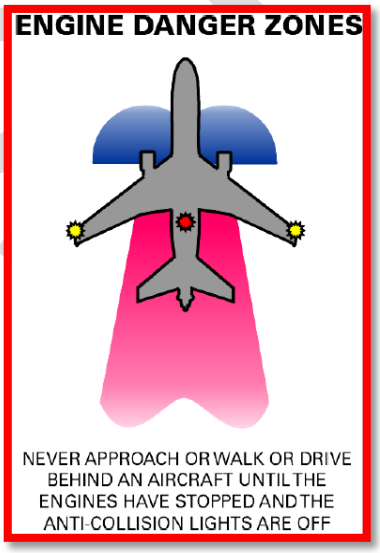
Summary

In a factory environment, physical barriers can be placed in the form of safety nets or shields to deal with close proximities and/ or abnormal situations but these do not exist when working in close proximity to live aircraft engines.

Due to the severity of the potential consequence, the robustness of mitigations and strict adherence to agreed procedures is vital.

Therefore, as part of the Safety Management System and duty of care obligations, aerodrome operators, airline operators and ground handling service providers should ensure that rules and procedures for safe engine running on the aerodrome are promulgated and understood by flight crews, handling staff and others working or intending to work on or around the aircraft**.**

There are many other activities around the aircraft during turnround that could be influenced by this activity, so it is important that any development and adoption of this procedure does not dilute the long established need for vigilance and situational awareness around aircraft whilst engines are running and anti-collision lights remain illuminated. Especially, as it is very easy for repetitive procedures to lose their significance over time.



Hopefully this article will provoke a few thoughts, provide a few explanatory considerations and most importantly remind all that safety is the number one priority. Therefore, in the interest of best practice, GHOST and the UKFSC recommend that stakeholders consider the following basic actions:

- All stakeholders are involved in the evaluation of the specific activity and work together to ensure that all associated risks are identified and managed to an acceptable level;
- Related procedures, documents and training plans are fully and regularly reviewed for detail and accuracy;
- Specifically check that all Flight and Ground Operations Manuals align;
- Related supervision and monitoring activities are in place that ensure that this topic is appropriately checked for performance and compliance;
- Personnel, working within a just culture, understand the importance of reporting related

incidents and concerns, including near misses, and;

- Work together during the subsequent investigations, to understand why they occurred and build the lessons learned into procedural reviews and future training.

For any related comments, feedback or information please contact GHOST@caa.co.uk

Appendix A

As a minimum, the following safety critical elements are expected to be incorporated within any related policies and procedures.

All persons not responsible for the following aircraft chocking and ground power actions **must not** approach the aircraft until this process has been fully completed:

1) All Ground Support Equipment (GSE) and personnel must be positioned clear of the aircraft path, outside the Equipment Restraint Area (ERA) (IGOM 4.1.1)
2) After the aircraft has come to a complete stop, receive confirmation from the flight crew that the parking brakes have been set (SERA 923/2012 Section 4 - Marshalling Signals)
3) Respond to the crew before positioning chocks at the nose landing gear wheels. Once the chocks have been positioned, notify the crew using the "chocks inserted" signal. This is the first action to take place around the aircraft, and shall be completed before any other activity (IGOM 4.1.2 & 4.2.1)
4) Position and connect the ground power to enable the flight crew to shut down the engine(s) (IGOM 4.1.2.2)
5) Only when the engine(s) have spooled down and the anti-collision lights have been switched off, is it safe for ground service providers to approach the aircraft and commence servicing tasks. (IGOM 4.1.2.2).

The full procedure for ground crews, flight crew and other airside personnel is as follows:

1. Pre-Arrival

1.1 All personnel in the team **MUST** be fully briefed prior to aircraft arrival. As a minimum, the briefing should consist of the following:

a) Aircraft type characteristics and procedures
b) The assignment of personnel to communicate with the fight crew, position chocks and connect ground power
c) A reminder that other members of the team are not to engage the aircraft (approach or drive equipment onto the aircraft) until they have been given clear instructions to do so
d) As much as possible, notify any other providers that are also present.

1.2 The designated responsible person will ensure the ground crew assigned to chock and power the aircraft, are positioned at the head of stand and, whenever possible stay in visual contact with the flight crew

1.3 Other ground crew members, providers and equipment **MUST** remain in the designated safe area at the head of stand and await the aircraft's arrival.

2. Arrival on Stand

2.1 When turning onto stand, flight crews should use the minimum power required to carry out a normal arrival. Where possible the aircraft should be kept moving to avoid the need to apply 'break away' power to continue the approach to the stand. For example, one operator's B737 Flight Crew Training Manual stipulates 5-10 knots with idle thrust.

3. Pre-positioning of GPU/ FEGP

3.1 GPUs **MUST NOT** be pre-positioned unless there is an assigned position provided and approved by the aerodrome operator. FEGPs can be pre-positioned but must remain outside of the ERA. IGOM 4.1.3.1:

a) It is permitted to pre-position a GPU inside of the ERA provided here is an assigned parking position
b) Position the GPU on the appropriate side of the nose parallel to the aircraft centre line with the towbar facing away from the aircraft as shown below

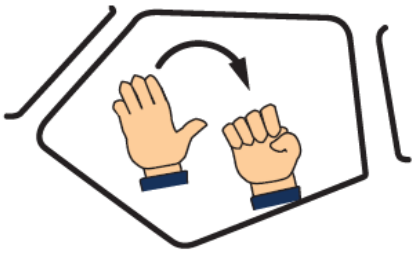
c) Set parking brake/ chock the GPU.

4. Post Arrival

4.1 When the flight crew has brought the aircraft to a complete stop and the parking brake has been set, they **MUST** signal to the ground crew, that the brakes have been set.

Brakes Set

Raised arm and hand, with fingers extended, horizontally in front of face. Hand is then closed to fist



This is to inform the designated responsible person that they have finished maneuvering the aircraft and that it is safe to approach.

4.2 If it is clear to flight crew that the ground crew were not aware of the need to supply ground power on arrival, the flight crew **MUST** give the following signal to the ground crew.

Connect Ground Power

Open left hand horizontally and move fingers of right hand into and touch the palm of left hand, forming a "T"

This should clearly inform the ground crew that ground power is required.

If there is any ambiguity, all engines **MUST** be shut down in the interest of safety.

4.3 Flight crew will keep one engine running to maintain electrical power. The anti-collision beacon will remain switched on

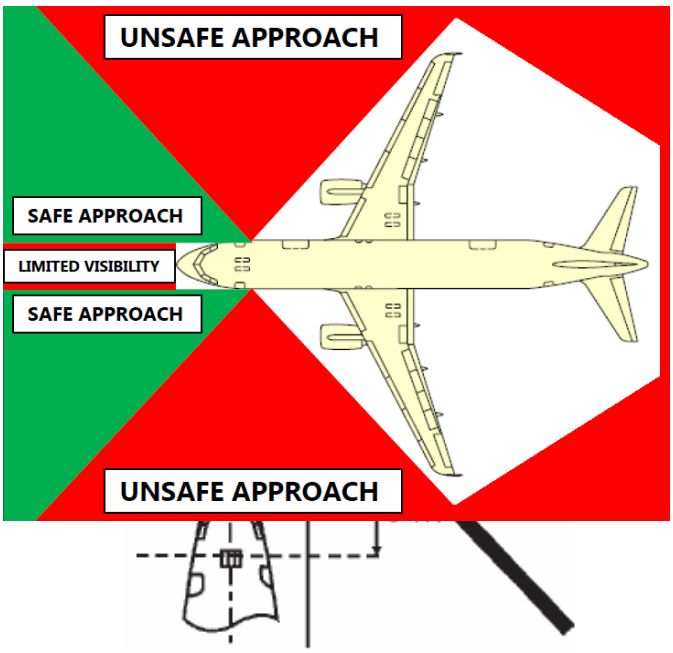
4.4 As much as possible, the designated responsible person will ensure that no other staff, vehicles or equipment approaches the aircraft

4.5 With confirmation from the flight deck that aircraft parking brakes have been set, the designated responsible person will firstly respond to the flight crew that the message has been received and understood by replicating the hand signal, then indicate to the previously assigned person that it is the safe and appropriate time for the nose wheel chocks to be positioned

4.6 The nose wheel chocks will then be positioned. Once the chocks have been positioned, notify the flight crew using the "chocks inserted" signal.
(If additional chocking of the main wheels is a requirement then these **MUST NOT** be inserted until after the engines have spooled down, the anti-collision beacon switched off and the signal to approach given by the designated responsible person).

4.7 Personnel chocking the aircraft are only to approach the aircraft from the nose, never immediately in front of the nose wheels, or from its extremities (wing areas) and stay clear of engines and propellers

4.8 Only after the aircraft nose gear is chocked, can the ground power be connected. Personnel applying ground power are only to approach the aircraft from the nose, never immediately



in front of the nose wheels, or from its extremities (wing areas), staying clear of engines and propellers:

a) For some aircraft types, the connection of ground power may be more complex as due to the height of the GPU receptacle, personnel may require engineering steps to reach it.

4.9 When the ground power has been connected, the designated responsible person should inform the flight crew that it is connected and available

4.10 Once the flight deck systems indicate that the aircraft is accepting the ground power, the flight crew will shut down the engine(s) and extinguish the anti-collision lights. If there any problems with the delivery of the power source, this **MUST** be clearly communicated to the ground crew:

a) Whilst an alternative power source is found, the designated responsible person will, as much as possible, ensure that no other staff, vehicles or equipment approaches the aircraft.

4.11 Only when the engine(s) have spooled down and the anti-collision lights have been switched off, is it safe for ground service providers to approach the aircraft and commence servicing tasks.

Appendix B

The following Bowtie template for the Application of Ground Power to Live Aircraft procedure:

- **IS NOT** a definitive risk assessment and should only be used following further local development and subsequent review by all relevant parties
- **IS** one of many risk evaluation methods that can be used to analyse and demonstrate causal relationships in high risk scenarios. It has been produced by industry (airport operators and ground handling service providers) in conjunction with the CAA. In its development, the group has considered all of the known factors which could lead to the unwanted event and the associated barriers and escalation factors.

The use of this methodology/procedure must be "triple lock":

1. The Ground Handling Service Provider should continuously review each of the barriers, assess the effectiveness of them in terms of adequacy and reliability, and ensure that the associated hazards are managed to a level they deem acceptable to their personnel
2. The Aerodrome License Holder should review the risk assessment for the areas where the barriers lie within their control (such as the airside safety induction or airside driver training provided to staff other than that of a ground handling agent) to verify adequacy and reliability
3. The Aircraft Operator should review the risk assessment for the areas where the barriers lie within their control (such as crew not shutting down the correct engine or not communicating an unserviceable Auxiliary Power Unit) to verify adequacy and reliability.

Only then, can the risk assessment and associated control measures that have been agreed by all relevant parties, be used to determine local policies and procedures. If any aspect of the activity deviates from the circumstances used for the original evaluation, further assessment will be required.

The policy and associated procedures must be subject to regular oversight and be reviewed and maintained accordingly.