APPENDIX C AIR NAVIGATION SERVICE PROVIDERS

Air Traffic Controllers routinely contribute to the prevention of runway excursions by helping flight crews fly stabilised approaches by adhering to procedures and, for instance, avoiding short-cuts that prevent flight crews from losing the necessary height and speed during the approach. Moreover, through the provision of safety significant, "essential" information such as changes to surface wind, reduced runway lengths and runway surface conditions, Air Traffic Control (ATC) ensures that flight crews have the latest aerodrome information available to enable safe takeoffs and landings.

However, breakdowns in these ATC functions can have unintended outcomes. For instance, sub-optimal control techniques such as late descent and inappropriate speed control can contribute to aircraft flying unstabilised approaches with, statistically at least, an increased risk of runway excursion. In addition, interruptions, omissions or errors involving the flow of "essential" information may deprive flight crews of operational safety decision-making data at critical stages of flight.

The following guidance material is intended to explain further the Recommendations it refers to and complement relevant ICAO provisions. In some instances, 'case study examples' are provided to amplify and provide additional reference to the issue being considered.

Recommendation 3.3.1 Ensure the importance of a stabilised approach and compliance with final approach procedures is included in training and briefing for air traffic control staff.

Recommendation 3.3.2 When assigning a runway or changing a runway assignment for arriving or departing traffic, consider the time a pilot will require to prepare/re-brief.

Air Navigation Service Providers are invited to review this guidance material and, where necessary, amend their training programmes, briefing practices and Standard Operating Procedures with regard to their involvement in stabilised approaches and flight crew briefing.

A prime role of ATC is to position aircraft so that a safe approach and landing is possible. The key points to highlight to air traffic controllers are:

- **Flight Crew Environment** Having a basic awareness and appreciation of flight crews' operating (cockpit) environment and constraints. For instance, non-precision approaches (NPAs) involve increased workload therefore, when positioning aircraft for NPAs a longer final approach may be necessary and speed instructions should be avoided.
- **Flight Crew Briefing** Understanding the importance of the flight crew approach brief. This has a single common objective - to preview what will or might well happen during an imminent approach and landing. There is no such thing as a typical briefing but the time to complete the majority of them might be within the range 2 - 6 minutes and it can be expected to be conducted 10 minutes before reaching the top-of descent point (ToD). Any approach re-briefing which might have to be conducted later would be at risk of being interrupted by either ATC communications and/or aircraft management priorities.
- **Inappropriate Speed Control Instruction** Avoiding inappropriate speed control instructions that are incompatible with aircraft performance, distance to go and the required vertical profile below FL100 after taking account of any significant head or tailwind components evident at altitude.
- **Distance to Go Information** Recognising that when providing vectors it is necessary to initially advise/periodically provide flight crews with estimated track miles to go.
- **Delayed Descent Instructions** Understanding that delaying descent and keeping aircraft unduly high may result in flight crews requesting additional track miles or contribute to high energy unstabilised approaches.

Example covering speed control, distance to go and delayed descent:

http://www.skybrary.aero/index.php/B733,_Burbank_CA_USA,_2000_(RE_HF)

- **Late Runway or Approach Type Changes** Appreciating that a change of instrument approach without adequate prior notification at any time after an aircraft has left the higher of cruise altitude or (typically) FL100 in descent to destination is undesirable. A 'late' change from a precision to a non-precision approach can be significant and may not always be feasible unless additional track miles are provided.

- **Runway Selection** Ensuring that the runway selected for operations is based on safety considerations, e.g. best length and or wind conditions, and not primarily on capacity, ease of controlling or environmental/ noise abatement reasons. However, it is recognised that at some locations for a variety of reasons these latter factors do influence the selection of the runway. In these circumstances it is incumbent on ATC to monitor the situation carefully and advise flight crews, for instance, about tailwinds. There is a balance to be struck, but when in doubt the safety considerations must assume primacy and runways should be changed to ensure the safety of operations.
- **Compliance with final approach procedures, including but not restricted to:**
  - According to ICAO Doc 4444, PANS ATM § 4.6.3.6 "Only minor speed adjustments not exceeding plus/ minus 40 km/h (20 kt) IAS should be used for aircraft on intermediate and final approach."
  - According to ICAO Doc 4444, PANS ATM § 4.6.3.7 "Speed control should not be applied to aircraft after passing a point 7 km (4 NM) from the threshold on final approach."

    NOTE:

    The flight crew has a requirement to fly a stabilized approach (airspeed and configuration) typically by 5 km (3 NM) from the threshold (Doc 8168, PANS-OPS, Volume I, Part III, Section 4, Chapter 3, 3.3 refers)
  - According to ICAO Doc 4444, PANS ATM § 8.9.3.6 "Aircraft vectored for final approach should be given a heading or a series of headings calculated to close with the final approach track. The final approach vector should enable the aircraft to be established in level flight on the final approach track prior to intercepting the specified or nominal glide path if an MLS, ILS or radar approach is to be made, and should provide an intercept angle with the final approach track of 45 degrees or less."
  - According to ICAO Doc 4444, PANS ATM in 6.7.3.2 Requirements and procedures for independent parallel approaches § 6.7.3.2.3 "When vectoring to intercept the ILS localizer course or MLS final approach track, the final vector shall enable the aircraft to intercept the ILS localizer course or MLS final approach track at an angle not greater than 30 degrees and to provide at least 2 km (1.0 NM) straight and level flight prior to ILS localizer course or MLS final approach track intercept. The vector shall also enable the aircraft to be established on the ILS localizer course or MLS final approach track in level flight for at least 3.7 km (2.0 NM) prior to intercepting the ILS glide path or specified MLS elevation angle."

Example Case Study:

http://www.bea.aero/docspa/2004/su-f040321a/pdf/su-f040321a.pdf

- **ILS Protected Zone during CAT II/III Training Approaches when Low Visibility procedures are not in force** Some aircraft operators conduct ILS CAT II/III approaches during CAT I (i.e. during non-LVP) for training purposes. The presence of vehicles or aircraft in ILS protected zone can cause undesirable autopilot behaviour at low altitude. In addition, these operations may compromise the regular flow of traffic/sequencing. Permission to conduct a training flight e.g. CAT II/III training approach in good weather must be requested by the aircraft operator as advised in the AIP. ATC may reject such a request or interrupt the current procedure according to the traffic situation at the time.

Example Case Study:

http://www.bfu-web.de/cln_030/nn_226462/EN/Publications/Investigation_20Report/2011/FactualReport_11_EX010_B777_Munic,templateId=raw,property=publicationFile.pdf/FactualReport_11_EX010_B777_Munic.pdf

- **Use of 'non-essential' information** Having a basic understanding that some well-intentioned actions, clearances and instructions to flight crews to improve the flow of air traffic may not always have the planned consequences. For instance, using phrases such as "landing long available" might induce pilots to touch-down further down the runway than they had originally intended/calculated. Furthermore, depending on flight crew experience and constraints, the surface conditions and the time/position in the landing sequence where the manoeuvre is executed, the use of "expedite vacate" may trigger pilots to travel too fast for the conditions and/or aerodrome layout. Of course, in many situations the use of these phrases may be perfectly legitimate (and safe). Nevertheless, to lessen the risk of runway excursion, controllers should use them with care. The

timing of the messages is a key consideration and they should be used only in circumstances that are appropriate to the prevailing runway surface conditions and/or aerodrome layout.

- **Periodic Briefing of Controllers** To complement the inclusion of stabilised approach awareness training for controllers, many ANSPs utilise their routine briefing facilities (e.g. Operational Information folders) to highlight runway excursion prevention issues (including stabilised approaches) to controllers on a periodic basis. In addition, immediate post runway excursion incident/accident awareness can be provided for written/oral briefing by Supervisors/Watch Managers as part of watch handover/takeover procedures. In slower time, information gathered in the spirit of ANSP Recommendations 3 and 6 can also be analysed and the outcomes (e.g. lessons learnt, operational changes etc) notified to control staff through the routine briefing processes.
- **ANSP Radar Display Marker** In some ATC facilities in France, controllers are provided with a 'Screen Interception Marker'. The marker arrow is displayed on the radar approach screen for the interception of the final approach track. The marker is located in accordance with ICAO PANS ATM (so as to provide 30 seconds straight and level flight at 180kts). Operational procedures specify that it should be considered as the final point for the controller to provide a straight and level flight.

Example of the 'Screen Interception Marker' arrow (in the red circle)

More detailed guidance/advice to support better controller understanding of all the points listed previously can be found in the Reference material listed below.

Missed approach /go-around

Some runway excursions can be prevented by flight crews executing a go-around when needed. Safe and timely go-arounds are dependant on two main factors: flight crew decision-making and execution. However, ATC actions can also influence both of these processes, for instance, when initiating the execution of a go-around, controllers should use the standard PANS ATM (12.3.4.18) phraseology, "GO-AROUND" (flight crew response "GOING AROUND") rather than alternatives such as "break off the approach" or "execute missed approach" which may lead to misunderstanding.

NOTE:

See also Aircraft Operator Recommendation and Guidance Material - 3.4.16 & 3.4.19

Reference Materials:

- General Local Runway Safety Team (LRST) advice and guidance.
- ICAO PANS ATM, Doc 4444.
- SKYbrary (www.skybrary.aero).
- Runway Excursion Portal.
- Stabilised Approach Awareness Toolkit for ATC.
- Flight Deck Procedures - A Guide for Controllers - courtesy of the NATS, easyJet and bmi "Normal Operations" video.
- CANSO, "Unstable approaches - ATC Considerations", January 2011.
- Operators Guide to Human Factors in Aviation (OGHFA) (FSF).
- DGAC, France: 3 documents (available on SKYbrary Bookshelf).
- "Unstabilised Approaches"; "Synthesis on Unstabilised Approaches"; and "Stabilised Approaches Good Practice Guide".
- Flight Safety Foundation (FSF) ALAR Toolkit, Briefing Notes 4.1, 4.2, 7.1 and 8.1.
- FSF, Runway Excursion Risk Awareness Tool, May 2009.
- IATA, Runway Excursion Risk Reduction Toolkit.
- EUROCONTROL HindSight 12 magazine.
- IFALPA Position Paper: IFALPA Runway Safety Policy - Ref 09POS01.
- ICAO European Interim Guidance Material on Management of ILS Localizer Critical and Sensitive Areas.

Recommendation 3.3.3 Review available data (occurrence reports etc.) with the aim of identifying contributing factors and relevant actions regarding airspace design and procedures, air traffic controller training and procedures, etc

- Sector interfaces and the ability to control the speed and descent profiles should be taken into consideration while trying to remove the excursion risk from airspace design. ANSPs should consider using reported data from aircraft operators about unstabilised approaches in order to consider systemic changes to sector management (e.g. handover and flow rates), airspace design and associated procedures and runway management to reduce the risk of recurrence.
- This pre-supposes that aircraft operators are willing to provide the information to ATC in the first instance. Cooperation through Local Runway Safety Teams (LRSTs) may assist in this regard and ANSPs can address the issue within the wider context of their Safety Management Systems (SMS).
- Some ANSPs record and then analyse go-arounds/ missed approaches; any ATC contribution to unstabilised approaches may be identified during this process. Radar and R/T recordings are another useful source of information to help controllers learn lessons from reported events.

Reference Materials:

See Local Runway Safety Team advice and guidance.

Recommendation 3.3.4 Review processes covering the provision of safety significant 'essential' aerodrome information such as weather, wind and runway surface conditions (e.g. when 'wet' or contaminated):

4a. To ensure a consistent, timely and accurate broadcast of aerodrome information.

4b. To ensure the integrity of the safety significant information supply chain from the provider (e.g. Met Office/Aerodrome Operator) to ATC/AISP and on to the flight crew.

4c. Consider equipping for digital transmission of ATIS, as appropriate.

4d. Ensure that training on the use of ATIS/ D-ATIS is provided to relevant operational staff (ANSP/AISP).

Essential information is provided through 3 main types of media: Aeronautical Information Services (AIPs, NOTAMs etc); ATIS/D-ATIS; and radio telephony. In certain circumstances, aerodrome signage can also supplement the written and/or oral data.

More detailed guidance material covering Recommendation 4b and 4d can be found in the Aeronautical Information Service Providers section. Furthermore, the Aircraft Operator and Aerodrome Operator sections also have complementary Recommendations and Guidance Material for Aircraft Operators and Aerodrome Operators related to the provision of safety significant "essential" information.

Essential Information

ICAO Doc 4444, PANS ATM, states the following:

7.5.2 Essential information on aerodrome conditions shall include information relating to the following:
a) Construction or maintenance work on, or immediately adjacent to the movement area…
h) any other information.

7.5.3 Essential information on aerodrome conditions shall be given to every aircraft, except when it is known that the aircraft already has received all of or part of the information from other sources. The information shall be given in sufficient time for the aircraft to make proper use of it, and the hazards shall be identified as distinctly as possible. Note - "Other sources" include NOTAM, ATIS broadcast, and display of suitable signals.

It is incumbent on all personnel involved in the flow of "essential" information to not only ensure the quality of the data but also the integrity of the processes and procedures that ensures its onward transmission to ATC.

Formal arrangements between data providers and ANSP/ AISP (e.g. in the form of a contract or Service Level Agreement (SLA)) should be introduced to support and enable the relevant data exchange.

In turn, ATC working together with partners, should ensure the timely provision and delivery of the information to flight crews to assist in their operational decision-making.

ANSP/Aerodrome Operator Example - Runway Reporting System

Some air navigation service providers and aerodrome operators have worked together to introduce 'runway reporting systems' (hardware, software applications and associated communications) to forward runway conditions information in real-time and in fixed format automatically to air traffic control and onward to flight crews.

The main components of the systems are a continuous friction measurement device, and advanced pieces of software: one in a lap-top situated in the runway inspection vehicle, and the other on a server, which processes (possibly via 3G connection) transmitted information for various purposes.

Runway reporting systems forward information about the contaminants (e.g. snow and ice) on the runway surface, and about the level of friction. They can also produce SNOWTAM message and include in them, as a new feature, information regarding the operationally most significant contaminant on the runway. The information assists pilot decision-making to optimise safe takeoffs and landings.

The advantage of these systems is that information reporting can be quicker and more consistent.

An example of an operational runway reporting system is the one operated by Finavia and details can be found at https://ais.fi/ais/aica/A/A2011/EF_CIRC_2011_A_006_EN.pdf

ATIS/D-ATIS

NOTE:
Depending on the organisational/operational structure, ANSPs or AISPs may be responsible for the provision of ATIS/D-ATIS. This guidance material is therefore repeated in the Aeronautical Information Service Provider section.

The reception of ATIS via data-link, allows both pilots to maintain their listening of ATC communications during critical high workload phases of flight, thus increasing the situational awareness and reducing the likelihood of distraction induced mistakes, lapses or confusion. Furthermore, depending on the traffic density and the complexity of the approach, it may assist flight crews with the go-around /Landing decision making process by providing the latest changes to the runway condition and local weather, which is subject to the equipment being set up to allow this data to be send to the pilot automatically.

ICAO Annex 11, Air Traffic Services, Chapter 4 (Flight Information Services) states variously that ATIS/ D-ATIS broadcasts shall include,

- significant runway surface conditions (e.g. when the runway is 'wet' or the presence of other contaminants such as snow, slush, ice, rubber, oil) and, if appropriate, braking action;
- surface wind direction and speed, including significant variations;
- any available information on significant meteorological phenomena in the approach and climb-out areas including wind shear, and information on recent weather of operational significance;
- "*other essential operational information*". Runway surface conditions and reduced runway lengths for landing and takeoff fall into this category of data.

In accordance with Sections 4.1 and 4.3 of Appendix 3 to Annex 3, the surface wind direction and speed is to be averaged over 2 minutes. The wind information is to refer to conditions along the runway for departing aircraft and to conditions at the touchdown zone for arriving aircraft. Specifically, Annex 11 Chapter 4 also says that ATIS broadcasts shall include:

"surface wind direction and speed, including significant variations and, if surface wind sensors related specifically to the sections of runway(s) in use are available and the information is required by operators, the indication of the runway and the section of the runway to which the information refers."

In addition, ICAO PANS ATM section 6.6.4 says:

"At the commencement of final approach, the following information shall be transmitted to aircraft:

a) significant changes in the mean surface wind direction and speed;

NOTE
Significant changes are specified in Annex 3, Chapter 4. However, if the controller possesses wind information in the form of components, the significant changes are:

- *Mean headwind component: 19 km/h (10 kt).*
- *Mean tailwind component: 4 km/h (2 kt).*
- *Mean crosswind component: 9 km/h (5 kt)."*

Furthermore, ICAO Annex 3, § 4.1.5.2 states that presence of wind gusts more than 5kts above the average will be indicated if noise abatement procedures are in force. A wind below 1kt will be considered as 'calm'. This information is essential to pilots in their process decision making.

To ensure that ATIS/D-ATIS provide operational and safety benefits, it is essential that the relevant operational AIS/ATC staff is competent in the use of ATIS/D-ATIS equipment and understand and apply the broad principles for the operation of these systems as described in Annex 11, Chapter 4.

Example Case Study:

http://www.skybrary.aero/index.php/B773,_Auckland_Airport_New_Zealand,_2007_(RE_HF)

Radio Telephony

Time critical aerodrome information (such as weather, surface conditions, wind, etc) which may affect runway operations shall be provided to pilots in 'real time' using radio telephony communication, in accordance with ICAO Annex 11 (Chapters 2 and 4).

Reference Materials:

- ICAO Annex 11, Air Traffic Services.
- ICAO Annex 3, Meteorological Services for International Air Navigation.
- ICAO Doc 4444, PANS ATM.
- ICAO Doc 9432, Manual of Radiotelephony.
- Flight Safety Foundation (FSF) ALAR Toolkit. Briefing notes 8.1, 8.5, 8.6 and 8.7.

Recommendation 3.3.5 Ensure that pilots in command/flight crews are informed of the Takeoff Run Available (TORA) or the Landing Distance Available (LDA) if these differ from the published data.

Declared Distances

ICAO Annex 14, Aerodromes, §2.8 recommends that distances shall be calculated to the nearest metre or foot for a runway intended for use by international commercial air transport. These 'declared distances' include: takeoff run available (TORA); takeoff distance available (TODA); accelerate-stop distance available (ASDA); and landing distance available LDA).

NOTE:
Guidance on calculation of declared distances is given in Attachment A, Section of Annex 14.

TORA and LDA for a particular runway may vary from those published due to a variety of reasons, e.g. construction work or snow clearing operations which may reduce the takeoff and landing distances available. **This "essential information" must be made available to flight crews via an appropriate mechanism and format**, in accordance with ICAO Annex 15, Aeronautical Information Services.

Intersection Departures

- Flight crews may opt for, or ATC may suggest, a departure from a runway intersection that effectively reduces the runway length available for flight operations. Intersection departures should be appropriate to the aircraft type and take into account work in progress and other relevant factors limiting operations.
- The ultimate decision rests with the aircraft commander. However, ATC actions assist in the decision-making process. To ensure that the intersection TORA distances are known, ATC should inform pilots of the takeoff run available (in metres) from the runway intersection position if this differs from signage.

ICAO Doc 7030, EUR SUPPs § 6.5.2.4, states:

"Runway declared distances for an intersection takeoff position shall be published in the relevant AIP, clearly distinguishable from full runway declared distances"

- Best practice exists concerning the associated phraseology to be used by ATC which is line with the guidance in the ICAO EUR SUPPs, namely:
  - "TORA" (to be pronounced as "TOR-AH") replaces the words "TAKEOFF" in the R/T message.
  - Thus, an example ATC R/T message to advise of the takeoff run available from an intersection will be:

"Call sign, Tora runway 09, from intersection alpha, 2800 metres".

Example Case Study:

http://www.skybrary.aero/index.php/B772,_St_Kitts_West_Indies,_2009_(HF_RE)

To supplement the oral message, ICAO Annex 14, Aerodromes, recommends that an intersection takeoff sign should be provided when there is an operational need to indicate the remaining TORA for an intersection takeoff. In addition, Annex 14 § 5.4.3.29 says that, "*the inscription on an intersection takeoff sign shall consist of a numerical message indicating the remaining takeoff run available in metres plus an arrow, appropriately located and oriented, indicating the direction of takeoff…*".

ANSPs should cooperate with aerodrome operators to clarify the signage requirements on individual aerodromes.

Construction/Work in Progress

The runway length available for takeoff or landing may change during construction or other work in progress. The revised runway lengths available (TORA/LDA) if these differ from States published data, should be made available to flight crews via changes to the AIP and/or NOTAM. ATIS/D-ATIS should also be used to re-enforce the message.

For short-notice reductions when the necessary aeronautical information amendments have not been promulgated, it is important to clearly state that the TORA / LDA is different from published and it will be necessary for ATC to broadcast the essential information via R/T and/or ATIS/D-ATIS. In addition, ATC may also consider it appropriate to provide this information in 'real-time' even when the changes **have been** notified in aeronautical publications and/or ATIS/D-ATIS.

ICAO Doc 4444, PANS ATM Phraseologies § 12.3.1.10 states:

d) CAUTION CONSTRUCTION WORK (location);
e) CAUTION (specify reasons) RIGHT (or LEFT), (or BOTH SIDES OF RUNWAY [Number]);
f) CAUTION WORK IN PROGRESS (or OBSTRUCTION) (position and any necessary advice).

Example Case Study:

http://www.skybrary.aero/index.php/B738,_Manchester_UK,_2003_(GND_RE_HF)

http://www.skybrary.aero/index.php/DH8D,_Chania_Greece,_2010_(RE_HF)

APPENDIX C AIR NAVIGATION SERVICE PROVIDERS

Landing Distances

As far as reduced landing distances (displaced threshold) are concerned, then Annex 14 §3.5 states:

"Where a runway has a displaced threshold, then the LDA will be reduced by the distance the threshold is displaced… A displaced threshold affects only the LDA for the approaches made to that threshold; all declared distances for operations in the reciprocal direction are unaffected."

Takeoff Cancellation

In certain scenarios (e.g. a runway incursion seen by the controller) it may be necessary for the controller to cancel a takeoff clearance or stop an aircraft that has begun its takeoff roll.

The correct PANS ATM phraseology (para 12.3.4.11) to cancel a takeoff clearance is:

e) HOLD POSITION, CANCEL TAKEOFF, I SAY AGAIN CANCEL TAKEOFF (reasons)

Whilst to stop a takeoff after an aircraft has commenced takeoff roll it is:

g) STOP IMMEDIATELY [(repeat aircraft call sign)] STOP IMMEDIATELY

Readback

h) STOPPING

The final authority rests with the flight crew. There are situations for example at high speeds where the flight crew will decide to continue the take-off regardless of any ATC instructions.

Reference Materials:

- ICAO Annex 14, Aerodromes.
- ICAO Annex 15, Aeronautical Information Services
- ICAO Doc 7030, Regional Supplementary Procedures (Europe).
- ICAO Doc 4444, PANS ATM.
- ICAO Doc 9432, Manual of Radiotelephony.
- Flight Safety Foundation (FSF) ALAR Toolkit. Briefing note 8.3

Recommendation 3.3.6 Participate in safety information sharing networks to facilitate the free exchange of information on actual and potential safety deficiencies.

Exchanging safety information provides significant safety benefits. It allows ANSPs to learn not only from their own experiences but also from the experiences of others.

Having direct contact with other stakeholders allows ANSPs to get first-hand information. It also provides an opportunity to ask specific questions and communicate on specific issues related to runway excursions without losing precious time.

ANSPs can participate in safety information sharing in several ways as part of ongoing SMS activities:

- Set up safety information exchange with other ANSPs.
- Set up safety information exchange agreements with aircraft operators or other stakeholder groups.
- Register and use Internet safety information exchange facilities such as SKYbrary (www.skybrary.aero).
- Join one of the existing safety information exchange networks such as EVAIR (EUROCONTROL Voluntary ATM Incident Reporting); IATA STEADES; Flight Safety Foundation.
- By being an active member of Local Runway Safety Teams.