Safety Nets Safety Forum
June 2016
Brussels:

Findings, Strategies and Action Opportunities

FROM THE INDUSTRY – FOR THE INDUSTRY

CONTENTS

Executive Summary

This report describes the background, objectives, and outcomes of the Safety Nets Forum, initiated by the Flight Safety Foundation, The European Regions Airline Association and EUROCONTROL that took place on 7 and 8 of June 2016 in EUROCONTROL Brussels.

The Forum discussed in-depth the issues related to the wide context of safety nets in a socio-technical system, runway safety nets, safety nets for the en-route phase of flight, how we can keep relying on safety nets without decreasing the skills of front-line operators, intended and unintended effects of safety nets.

The Forum outlined a number of Findings. Each Finding is one of the following:

❑ A current risk or a credible projection of one likely to be encountered in the near future in a given operational environment.

❑ A current risk factor or a credible projection of one for any unwanted outcome (both positive and negative influencers) in terms of their relative importance.

❑ A risk scenario that describes how risk factors combine in a sequence to create an unwanted outcome.

Based on the Findings, a series of Safety Strategies capable of achieving safety improvements were defined. These Strategies were then associated with one or more Action Opportunities which it was considered could be the basis for delivering such improvements.

The presentations and final outcomes of the Forum are published on SKYbrary, and thereby shared with all stakeholders in the global aviation community - pilots and air traffic controllers and those who manage and train them as well as manufacturers and industry safety regulators.

Chapter 1
Introduction

1.1   What is the purpose of this report?

Documenting and communicating.

This report describes the background, objectives, and outcomes of the Safety Nets Forum, initiated by the Flight Safety Foundation, The European Regions Airline Association and EUROCONTROL. The Forum took place on 7 and 8 of June 2016 in EUROCONTROL Brussel.

1.2   The objectives of the Safety Nets Forum

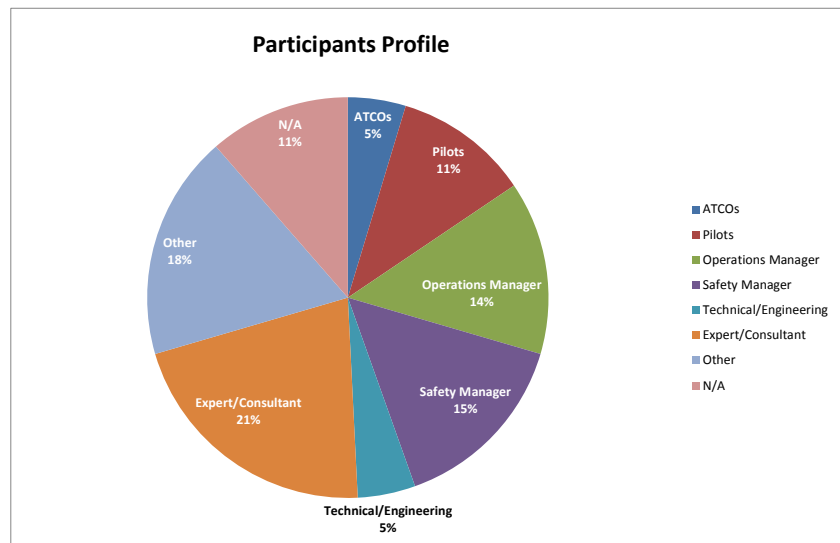*One Day, One Issue, One Co-ordinated Outcome Event.*

The Safety Nets Forum targeted operational and safety professionals with a short event focussed on a subject of common interest which could deliver not only a valuable experience for delegates but also lead to an event report containing pointers for safety improvement for the wider industry sectors.

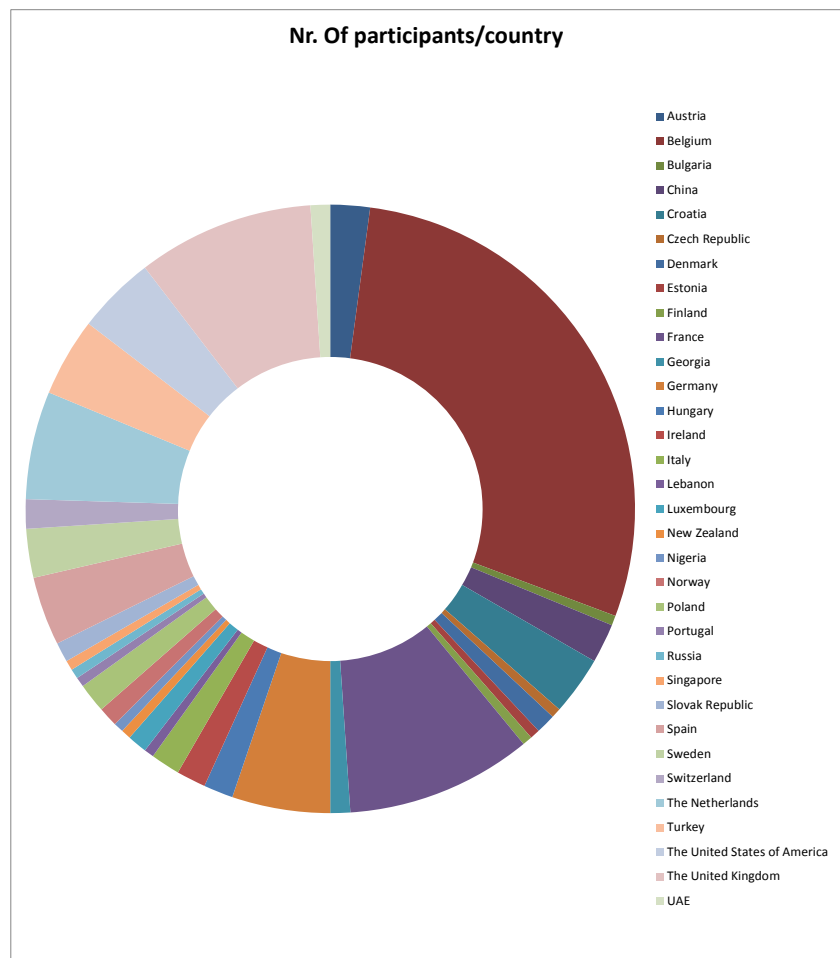It is an event from the industry for the industry.

1.3   Participants

The Safety Nets Forum attracted around 200participants - aviation professionals representing various stakeholders.

Participants Profile

Legend
ATCOs
Pilots
Operations Manager
Safety Manager
Technical/Engineering
Expert/Consultant
Other
N/A

Participants to the Safety Forum came from 33 countries.

Nr. Of participants/country

Legend
Austria
Belgium
Bulgaria
China
Croatia
Czech Republic
Denmark
Estonia
Finland
France
Georgia
Germany
Hungary
Ireland
Italy
Lebanon
Luxembourg
New Zealand
Nigeria
Norway
Poland
Portugal
Russia
Singapore
Slovak Republic
Spain
Sweden
Switzerland
The Netherlands
Turkey
The United States of America
The United Kingdom
UAE

1.4   *Outline of the results*

Findings, Strategies and Action Opportunities

The Forum outlines number of Findings. Each Finding is one of the following:

❑ A current risk or a credible projection of one likely to be encountered in the near future in a given operational environment.

❑ A current risk factor or a credible projection of one for any unwanted outcome (both positive and negative influencers) in terms of their relative importance.

❑ A risk scenario that describes how risk factors combine in a sequence to create an unwanted outcome.

Based on the Findings, a series of Safety Strategies capable of achieving safety improvements were defined. These Strategies were then associated with one or more Action Opportunities which it was considered could be the basis for delivering such improvements.

1.5   *SKYbrary knowledge management*

Promoting the results

The presentations and final outcomes of the Forum are published on SKYbrary, and thereby shared with all stakeholders in the global aviation community - pilots and air traffic controllers and those who manage and train them as well as manufacturers and industry safety regulators..

Chapter 2
Findings

REF	FINDINGS
F1	*Safety Nets should not be used as a primary means of task achievement.*
F2	*Safety Nets have resulted in both intended & unintended consequences, e.g. Loss/ degradation of some skills.*
F3	*Pilot and controllers are not always aware of the assumptions, limitations and potential risks associated with Safety Nets.*
F4	*The emphasis of future cockpit safety features is moving towards alerting systems & displays, new technology and information automation, to improve situational awareness and decision making.*
F5	*Industry must beware of an overreliance (compensating for risk) on Safety Nets.*
F6	*Approach and airfield operational areas offer many opportunities for Safety Nets.*
F7	*Safety Net performance and effectiveness are not always systematically and consistently being monitored and measured.*
F8	*Insufficient measurement creates a deficit of knowledge on the actual level of protection offered by Safety Nets.*
F9	*Due to their rare activation, Safety Nets sometimes cause effects like surprise and startle leading to overreaction and inappropriate response. The effectiveness of the Safety Net may therefore be diminished.*
F10	*Monitoring remains a primary safety defence but one that is not fully capitalized on.*

F11	*Education and Training regarding Safety Nets needs to be improved both in application and effectiveness.*
F12	*Regulation is not always keeping abreast with technology-based Safety Nets.*
F13	*Analysis methods for evaluating the risk-benefit trade-off of introducing Safety Nets are necessary.*
F14	*Safety Nets definition and terminology needs to be improved for clarity and with regard to Ground-based and Airborne Safety Nets.*
F15	*Collaboration in regards to Safety Nets within the industry domains needs to be reinforced.*
F16	*Safety Nets are heavily dependent on the quality of data available.*
F17	*Safety Nets are complementary to 'normal' operational procedures; they are not intended to alter practitioners' ways of working but are designed for maximum effectiveness during hazardous/abnormal situations.*
F18	*The absence of available runway Safety Nets is a missed opportunity to provide added resilience to runway operations; according to need and local circumstances, appropriate Safety Nets should be identified and installed, and their performance monitored.*
F19	*Pilots, controllers (and vehicle drivers) do not always understand the limitations of what runway Safety Nets can, and cannot, do.*
F20	*The effectiveness of runway Safety Nets will be reduced unless they are intuitive, easy to use and optimise the time for decision making and conflict resolution action.*
F21	*The effectiveness of runway Safety Nets will be compromised without adequate familiarisation training and other forms of continuation training.*
F22	*The effectiveness of runway Safety Nets can be compromised unless they are integrated as part of overall SMS strategy (in ANSPs, airlines and aerodrome operators) which aims to improve operational resilience to the shared threat of, for example, RI/REs.*
F23	*The operational effectiveness of runway Safety Nets i.e. between pilots, ATC and drivers (aircraft operators, ANSPs, aerodrome operators, manufacturers) can be further improved through better liaison and cooperation.*
F24	*Monitoring of runway Safety Nets performance is inconsistent, meaning opportunities are missed to evaluate (the data) and make system changes that improve performance.*
F25	*The tuning and parameter setting of runway Safety Nets is sometimes sub-optimal which can lead to too many nuisance alarms.*
F26	*When well designed, visual and aural alert functionalities help to optimise the conflict resolution timeline (detection, alerting, warning, and action).*
F27	*Ground (including airside drivers)/cockpit cooperation and shared threat management is one of the major contributors to the improvement of any ATC system and its safety performance.*

F28	*ATC is not always able to track appropriate airside vehicles (in particular those that need to access the manoeuvring area/runway).*
F29	*Safety Nets that provide direct input to pilot/vehicle drivers can be effective (e.g. RWSL). However, pilots and or ATC do not always react to the way the system is designed; runway Safety Nets can have intended and unintended consequences.*
F30	*Operations on helipads may require different Safety Nets than other operations do.*
F31	*The quality of national AIP data is sometimes out of date/inaccurate (which represents a risk if it used in runway Safety Nets e.g. ROPS).*
F32	*Stakeholder engagement and coordination concerning the implementation and operation of runway Safety Nets (and runway safety in general) is sometimes sub-optimal.*
F33	*Operational feedback on runway Safety Nets' performance to Manufacturers is limited.*
F34	*Mean response times for ATCO, independent of their expertise level, are on average improved by over 20% with Enhanced Verbal (spoken) Alerts for Minimum Safe Altitude Warning (MSAW) / Area Proximity Warning (APW) / Short Term Conflict Alert (STCA).*
F35	*Safety Nets systems must be properly tuned in order to produce meaningful alerts.*
F36	*Flight progress compliance tools could be extended across ATC system.*
F37	*Research of downlinking TCAS Resolution Advisories (RA) to the ATC workstation in order to reduce potential likelihood of contradictory clearances and improve situational awareness of ATCO has a history of > 26 years. The aviation community is still split on operations of RA Downlink: ATCO/Flight Crew responsibilities are still unresolved and there is a lack of ICAO provisions.*
F38	*There is a potential that Mode S downlinked parameters improve the performance of Safety Nets.*
F39	*The positive deviance approach, based on operational data and ASMT (Automatic Safety Monitoring Tool), allows understanding of how operations work as a whole, capturing best practice and identifying systemic issues to be mitigated.*
F40	*Short Term Conflict Alert (STCA) should only be used for safety. Any resultant capacity increase is coincidental.*
F41	*RF load reduces the quality of surveillance picture.*
F42	*When the quality is impaired RF load reduction plans are needed.*
F43	*Advanced Surface Movement Guidance & Control Systems (A-SMGCS) deployed at Airports with 'Runway Monitoring & Conflicting Alerting (RMCA) only' are still having incidents – Therefore a need to complement A-SMGCS with Conflicting Air Traffic Clearances (CATC) and Conformance Monitoring Alerts for Controllers (CMAC) functionality.*
F44	*Deployment of Short- and Mid-Term conflict probes should provide further safety improvements for ATCOs.*

F45	*Use of the Direction Finder limits chances for track misidentification by ATCOs.*
F46	*The Area Proximity Warning System (APW) advises the ATCO of unauthorized potential or actual airspace infringements through generating two types of timely alerts: Type 1 when a civil aircraft is about to enter a defined area, and; Type 2 when an alert is produced when an aircraft (not under ATC control) is exiting a defined area.*
F47	*A Systems Engineering Lifecycle approach ("Identify Need", "Design", "Monitor" and "Evaluate") ensures the Safety Nets are appropriately designed and deployed for ATM operations.*
F48	*Mode S downlinked parameters improve the performance of ATC Safety Nets as long as quality of airborne data (avionics) is ensured.*
F49	*Real Time Simulations can combine multinational and multicultural ATC systems – and show how these factors affect use of Safety Nets and controller tools, it can also integrate Safety Nets with advanced ATC tools (such as MTCD, CPDLC. ASAS, ADS-B and RA Downlink).*

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Chapter 3
Strategies

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Strategy 1	Ensure fundamental operational resilience by a strong operational adherence to agreed procedures & good practice. Systemic safety can be supported / improved by the addition of proven Safety Nets.
Strategy 2	Ensure that Safety Net training covers all aspects of Safety Nets use including implicit threats and limitations.
Strategy 3	Implement effective and standardized training using the appropriate tools on Safety Nets.
Strategy 4	Safety Nets effectiveness and continuous improvement should be data-driven within an effective SMS system. Safety Net data should be shared within the industry.
Strategy 5	Regulators and Industry must keep themselves updated and where appropriate be able to apply safety features and Safety Nets more quickly.

Strategy 6	Regulators should address the potential risks associated with the introduction of Safety Nets.
Strategy 7	Implementation of runway Safety Nets should be part of ANSPs, Aircraft Operators and Aerodrome Operators SMSs that aims to improve the risk mitigation of aerodrome operations, in particular those affecting runway operations.
Strategy 8	ANSPs, Aircraft Operators and Aerodrome Operators to implement runway Safety Nets training, including human performance aspects, as appropriate.
Strategy 9	ANSPs, Aircraft Operators and Aerodrome Operators should ensure that they have a mutual understanding of the safety situation and the constraints and challenges affecting their operations as part of building an 'air safety concept'.
Strategy 10	ANSPs, Aircraft Operators and Aerodrome Operators (as appropriate) implement regular runway Safety Nets monitoring, evaluation (of use/performance data) and follow-up action and optimization.
Strategy 11	As part of design, Safety Nets specifications should include the capability to record/capture data for monitoring purposes.
Strategy 12	ANSPs and Aerodrome Operators should consider the tracking of appropriate airside vehicles by ATC – the runway should be a 'known traffic' environment.
Strategy 13	Regulatory Authorities and AISPs should ensure the robustness and accuracy of national AIP data since this data is used in Safety Nets.
Strategy 14	Regulatory Authorities should adopt a performance-based oversight strategy to drive forward runway Safety Nets improvement by encouraging appropriate stakeholder engagement and cooperation at airports; operational feedback to Manufacturers should also be included.
Strategy 15	Enabling technology for downlinking TCAS RA has advanced significantly in the past 26 years – and thus the aviation community also needs to 'move on' to resolve the issue of RA Downlink operational acceptability.
Strategy 16	Use of the CATC (Conflicting Air Traffic Clearances) or similar systems to mitigate situations where a clearance has been given to a mobile and then a conflicting clearance is subsequently given to another.

Strategy 17	Use of the CMAC (Conformance Monitoring Alerts for Controllers) or similar system to mitigate situations where there is a non-conformance to procedures or instructions (e.g. lining up / attempt to take off without clearance).
Strategy 18	Contingency Safety Nets and routinely used controller tools, ranging in warning times from short to long term, enhanced by downlink parameters should be seamlessly integrated for optimal safety performance.
Strategy 19	Promote effective and timely ATCO response, when calibrating ground based safety nets by reducing nuisance and irrelevant alerts whilst also maximising alerts for operationally relevant situations.
Strategy 20	The lifecycle approach (identify need, design, monitor and evaluate) should be applied to both the present systems and its future developments.
Strategy 21	Connect different simulators to demonstrate end to end effects (e.g. Connect "en-route" with "tower" similar to investigate Conflicting ATC Clearances (CTAC), Conformance Monitoring Alerts for Controllers (CMAC), Runway Monitoring & Conflict Alerting (RMCA).
Strategy 22	Enhance safety and improve ATCO response times (at all expertise level) to events through 'human centred design' of Semantic[1] Audio Alerts.

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[1] relating to meaning in language or logic

Chapter 4
General Industry
Action Opportunities

REF	Strategy	Finding	ACTION OPPORTUNITY
GI1	S1, S2, S3	F1, F5, F9, F10	*Industry should ensure that operators and users are trained so as to be able to operate without Safety Nets at a "primary safety level".*
GI2	S5, S6	F6, F12, F13, F15	*Industry should consider, decide on and then actively support approved Safety Nets in a timely manner.*
GI3	S3, S2	F2, F3, F4, F5, F9, F11	*It should be ensured that the operational training of Safety Nets covers the technology itself, the operational use including limitations and any potential secondary effects.*
GI4	S4	F7, F8, F13, F15, F16	*Data should be used to define, improve and advance the effective use of Safety Nets.*

GI5	S7	F17, F18	*ANSPs, Aircraft Operators and Aerodrome Operators, as required, should review operational procedures and check that they are not overly reliant on runway safety nets for normal operations. An acceptable level of safety should still be assured with or without runway safety nets.*
GI6	S8, S7	F19, F20, F21, F22	*ANSPs, Aircraft Operators and Aerodrome Operators should include training in runway safety nets to ensure not only essential technical understanding but also the intended function and operational and human performance impacts and limitations.*
GI7	S7, S10, S11	F22, F24, F25, F26	*ANSPs, Aircraft Operators and Aerodrome Operators should initiate a runway safety nets monitoring regime, as part of SMS, to improve/optimise their effectiveness and performance.*
GI8	S9	F23	*ANSPs, Aircraft Operators and Aerodrome Operators should work together to identify common safety issues and agree complementary mitigations:* • *Local runway safety teams can be used as a means to foster cooperation and understanding of all parties concerned with the operation of runway safety nets.* • *Encouraging mutual visits to cockpits/ATM environment by all parties involved.*
GI9	S10, S11	F24, F25, F26	*ANSPs, Aircraft Operators and Aerodrome Operators should jointly evaluate ATC/pilot/driver runway safety nets conflict resolution - including reaction times - to better understand the limitations and ensure safe resolutions.*
GI10	S9	F27	*ANSPs, Aircraft Operators, Aerodrome Operators and Manufacturers should review runway safety net change management processes to ensure that the effects and impacts of any changes are understood by all users.*
GI11	S15	F34, F35, F36, F37, F38, F39, F40	*Awareness (pilots and controllers) of unnecessary RAs due to high vertical rates should be raised.*

Chapter 5
Aircraft Operator
Action Opportunities

REF	Strategy	Finding	ACTION OPPORTUNITY
AO1	S8	F29, F30	ANSPs, Aircraft Operators and Aerodrome Operators should include training in runway safety nets to ensure not only essential technical understanding but also the intended function and operational and human performance impacts and limitations.
AO2	S8	F29, F30	Aircraft Operators should consider the environment within which they operate and the types of aircraft they operate when evaluating which safety nets are appropriate. Identification of common 'hotspots' could be useful.
AO3	S1, S3	F6, F9, F10	Wider use of the so-called "shared", "split" or "monitored" approach should be considered. Key to this approach: • It demands complete "engagement" by both pilots (PM & PF) throughout the whole approach • It places the crew in a stronger situation as regards any possible intervention.
AO4	S15	F34, F35, F36, F37, F38, F39, F40	TCAS training for pilots (realistic simulator capabilities) should be improved.

Chapter 6
ANSP
Action Opportunities

REF	Strategy	Finding	ACTION OPPORTUNITY
ATM1	S8	F19, F20, F21	ANSPs should consider recurrent training of controllers in active scanning and listening techniques. Particular attention should be given to understanding the effects of 'tunnel vision' and how this impacts on the ability of controllers to react to a safety net alarm and effect a safe resolution.
ATM2	S12	F28	ANSPs, in conjunction with Aerodrome Operators, should consider all available means to assist controllers in determining the position and identification of aircraft and vehicles on the aerodrome surfaces (especially the runway); automated detecting devices when a vehicle approaches a defined aerodrome 'hotspot' could also be considered.
ATM3	S15	F34, F35, F36, F37, F38, F39, F40	Work on better integration of ATCO tools and Safety Nets, including reduction of unnecessary/nuisance alerts should be done.

ATM4	*S15*	*F34, F35, F36, F37, F38, F39, F40*	*RA downlink integration into ATM should be considered and the issue of RA downlink operational acceptability should be reviewed.*
ATM5	*S15*	*F34, F35, F36, F37, F38, F39, F40*	*RAs in own airspace should be monitored.*
ATM6	*S15*	*F34, F35, F36, F37, F38, F39, F40*	*RA downlink experience by early adopters (lessons learned) should be monitored.*
ATM7	*S16, S17, S18, S19, S20, S21*	*F41, F42, F43, F44, F45, F46, F47, F48*	*Potential future use of SAFNET and ASMT data to enhance safety includes:* • *Correlating Safety Events (STCA/SMI/ACAS-RA) and traffic metrics* • *Correlating Safety Events, RIMCAS alerts and Go-around/Missed Approach alerts* • *Perform hotspot analysis of false/nuisance SAFNET events for tuning of system and performance monitoring*
ATM8	*S16, S17, S18, S19, S20, S21*	*F41, F42, F43, F44, F45, F46, F47, F48*	*The best balance between length of safety nets look ahead warning times and nuisance alert rates should be found.*
ATM9	*S16, S17, S18, S19, S20, S21*	*F41, F42, F43, F44, F45, F46, F47, F48*	*Parameters and performance of safety nets should be monitored and its performance should be analysed via statistical analyses.*
ATM10	*S16, S17, S18, S19, S20, S21*	*F41, F42, F43, F44, F45, F46, F47, F48*	*A multidisciplinary team to be responsible for Safety Nets, sharing system information and lessons learned should be appointed.*
ATM11	*S16, S17, S18, S19, S20, S21*	*F41, F42, F43, F44, F45, F46, F47, F48*	*Use of both subjective and objective data derived from the system should be maximized in order to drive design and operation of Safety Nets.*
ATM12	*S16, S17, S18, S19, S20, S21*	*F41, F42, F43, F44, F45, F46, F47, F48*	*Findings from connected simulator work should be used to align and improve Safety Net warnings.*

Chapter 7
Aircraft / System Manufacturers Action Opportunities

REF	Strategy	Finding	ACTION OPPORTUNITY
A/SM1	S20, S22	F20, F25, F26, F47, F48, F49	Semantic Audio Alerts should be designed so that they: • Are salient and distinguishable • Provide knowledge not data • Have no requirement to decipher meaning • Reduce risk of startle and incorrect response • Are nuisance free • Are intuitive
A/SM2	S20, S22	F47, F48, F49	To further enhance ATM Safety, requirements for Future Safety Nets – including A-SMGCS, Electronic Flight Strips (EFS) and ATCO training should be developed.
A/SM3	S20, S22	F47, F48, F49	Use of both subjective and objective data derived from the system should be maximized in order to drive design and operation of Safety Nets.
A/SM4	S20, S22	F47, F48, F49	Findings from connected simulator work should be used to align and improve Safety Net warnings.

Chapter 8
Regulatory Authorities
Action Opportunities

REF	Strategy	Finding	ACTION OPPORTUNITY
RA1	S13	F31	*Regulatory Authorities and their designated AISPs should review their AIP quality control processes to make sure that AIP data used in the design and usage of Safety Nets is accurate.*
RA2	S14	F32, F33	*Regulatory Authorities should strongly encourage the use of Local Runway Safety Teams which have effective representation from all stakeholders especially on behalf of non-based airlines. This should help to facilitate improvements to the implementation, use and monitoring of runway safety nets.*
RA3	S5, S11	F16	*Regulatory Authorities should ensure that certification of Safety Net avionics meets stakeholder needs, efficiency and quality criteria.*
RA4	S2, S5, S9	F11, F47	*Regulatory Authorities should collect, analyse and promote best practices in place within stakeholder's safety nets policy, thus ensuring that any organization is aware of effective positive actions taken by others.*