Im Browser ansehen

Waypoints

VEREINIGUNG COCKPIT

Newsletter zu Flight Safety Themen der Vereinigung Cockpit Nr. 08 2019

Dear Members,

Our VC Waypoints represent one aspect of our aim to constantly contribute to the improvement of flight safety. Next to our popular links to publications of IFALPA, ECA, and EASA todays Waypoints edition covers the following topics:

- Fume Event Risk due to APU overfilling
- Unmanned Aircraft Systems Policy published
- B737 MAX Summit in Montreal
- GNSS Vulnerabilities in Middle East Region
- Evidence Based Training

We invite you to browse through the contents to learn the latest about your topic of interest.

Kind regards,

Your Team Flight Safety

Fume Event Risk due to APU overfilling

Cabin air quality and toxic contamination of cabin air are still a major problem in everyday flight operations. Our **Flight Health & Environment** working group is constantly working on

On A320 aircraft an APU oil overfill may occur when batteries are switched off too early after APU shutdown. According to normal procedures the batteries should be switched off after the APU door is closed. However, when switching off batteries too early, APU oil may not completely flow back into the sump and remains in the APU. Refilling APU oil under the above conditions up to the “FULL” mark may result in a sump overflow upon starting the APU the next time. APU oil thus may run into the APU casing with the potential to contaminate bleed air.

Therefore, we recommend to wait at least two minutes after APU shutdown is indicated on the display before batteries are switched off.

More information on contaminated cabin air and the **Fume Event Guide** is available on our Fume Event website.

Unmanned Aircraft Systems Policy published

Unmanned Aircraft Systems (UAS) are still one of the fastest growing sectors of air transportation. Therefore, our **Remotely Piloted Aircraft Systems** working group has published a new policy on UAS. The policy includes VC's fundamental position, recommendations and requirements for the safe operation and integration of UAS into the existing air traffic system.

B737 MAX Summit in Montreal

IFALPA's president Captain Jack Netskar reports from the second B737 MAX Summit. The purpose of this meeting, which was attended by Boeing, major airlines, regulators, ICAO, IFALPA, CAE and other stakeholders was to identify the challenges and gain understanding of a roadmap to bring the B737 MAX back to operation in the safest and most efficient manner possible.

GNSS Vulnerabilities in MID Region

With a Safety Bulletin IFALPA refers to a Safety Adivory of the Regional Aviation Safety Group for the Middle East Region

Evidence Based Training

ECA has published a position paper for the implementation of Evidence Based Training (EBT). The availability of data containing flight operations and training activity has improved substantially and ECA supports the implementation of EBT as a logical next step to update current training practices. However, ECA has addressed some concerns that could have negative consequences on the quality of future pilot training. Key concerns and comments thereto are provided in ECA's position paper.

IFALPA, ECA and EASA News

We would like to draw particular attention to the following position papers and publications:
IFALPA

- Hajj Pilgrimage season started: Safety Bulletin and AIRAC
- Awareness of Airspace Classification: Briefing Leaflet
- Increasing Commercial Space Operations: Position Paper
- Inter Pilot Journal 03/19

ECA

- Summer fatigue alert
- Age Limitations for CAT Pilots
- Single Pilot Operation

EASA

- EU wide rules on drones
- Safety precautions regarding the transportation of recalled portable electronic devices

As we continuously strive to improve our Waypoint we require and seek your feedback. Please forward your inputs to flightsafety@vcockpit.de or just use the reply function of your mail provider should you have any suggestions for improvement, tips, or wishes regarding topics to address. We will do our best to keep the Waypoints as informative and interesting as possible for your convenience.

VC POLICY

UNMANNED AIRCRAFT SYSTEMS (UNBEMANNTE FLUGSYSTEME)

Präambel

Die Vereinigung Cockpit e.V. (VC) ist bestrebt, die Flugsicherheit durch höchste Standards zu schützen und zu verbessern sowie weltweit ein einheitliches Sicherheitsniveau für alle Nutzer des zivilen Luftraums zu fördern. Dies ist insbesondere bei der Einführung eines neuen Technologiebereichs, wie dem der Unbemannten Flugsysteme (Unmanned Aircraft Systems (UAS[1]), umgangssprachlich auch als „Drohnen“ bezeichnet), von größter Bedeutung.

Die VC begrüßt und erkennt die potenziellen Vorzüge dieser neuen Technologie. Es ist von entscheidender Bedeutung, die sichere Integration von UAS in den gemeinsamen zivilen Luftraum zu gewährleisten.

Größe, Leistung, Betriebsart und Verwendungszweck von UAS variieren deutlich stärker als in der bemannten Luftfahrt. Die Größe von UAS kann Spannweiten ähnlich eines Modellflugzeugs bis hin zu Passagierflugzeugen aufweisen. Ihr Einsatz kann von lokalen bis zu interkontinentalen Flügen und von niedrigen bis zu sehr großen Höhen reichen. Sie haben oft unkonventionelle Formen, mit sehr unterschiedlichen Betriebseigenschaften und einem großen Spektrum an Leistungsmöglichkeiten.

Dementsprechend sind für die VC drei verschiedene Bereiche von größter Bedeutung:

1. **Grundsätzliches**
2. **Kollisionsrisiko kleinerer unbemannter Luftfahrzeuge (UA[2]) für die bemannte Luftfahrt**
3. **Integration unbemannter Luftfahrzeuge in den gemeinsamen zivilen Luftraum**

[1] **Unmanned Aircraft System (UAS)**: Überbegriff, welcher das Gesamtsystem bestehend aus Unbemannten Luftfahrzeug (UA), einer dazugehörigen Kontrollstation (Control Station bzw. Remote Pilot Control Station) sowie einer integrierten Befehls- und Steuerdatendatenverbindung (Command and Control-Data-Link) umfasst.

[2] **Unmanned Aircraft (UA)**: Bestandteil des UAS – umfasst jegliche Art von Luftfahrzeugen (z.B. Flächenflugzeug, Drehflügler, Multikopter, Luftschiffe, Ballone, etc.), welche keinen Piloten an Bord haben.

1. Grundsätzliches

Das hohe Sicherheitsniveau in der Luftfahrt basiert auf jahrelanger Erfahrung. Die bestehenden Regeln und Vorschriften haben sich aus dieser Entwicklung ergeben, was auch auf die Nutzung des Luftraums zutrifft. Die Einführung von UAS in einen sehr regulierten und stark genutzten Luftraum unter Erhalt des Sicherheitsniveaus gilt diesbezüglich als Herausforderung. Obwohl die Innovationen und technologischen Fortschritte von UAS schnell vorangeschritten sind, kann ihre Einführung in den gemeinsamen (nicht-segregierten) Luftraum nicht ohne Berücksichtigung der bestehenden Nutzer erfolgen.

POSITION 1: **Ein gemeinsamer Luftraum für alle Teilnehmer.**

Die VC ist der Ansicht, dass alle UAS in einen gemeinsamen Luftraum integriert werden müssen. Zugang zum Luftraum durch Segregation darf nur eine vorübergehende Maßnahme sein, da allen Luftfahrtnutzern nur ein Luftraum zur Verfügung steht. Benutzer mit unterschiedlichen Aufgaben und Rollen, sowie unterschiedlichen Leistungs- und Größenmerkmalen, müssen sich den gleichen Luftraum teilen - dies geschieht in der Regel über das Prinzip der Integration. Alle Nutzer müssen sowohl nach ähnlichen Prinzipien als auch in einem Rahmen arbeiten, der sie im erforderlichen Umfang kompatibel macht. Es müssen alle Anstrengungen unternommen werden, um Segregation in Integration zu überführen.

POSITION 2: **Bestehende Regeln der bemannten Luftfahrt dürfen nur zur Erhöhung der Sicherheit geändert werden.**

Die VC ist der Ansicht, dass es nicht akzeptabel ist, die Regeln und Vorschriften für die bemannte Luftfahrt zu ändern, um die Integration von UAS zu ermöglichen. Die Vorschriften für die bemannte Luftfahrt wurden über einen langen Zeitraum auf der Grundlage von Erfahrungen und bewährten Verfahren festgelegt. Diese Vorschriften dürfen nur zur Erhöhung der Sicherheit geändert werden. UAS müssen so entwickelt und betrieben werden, dass sie innerhalb eines gemeinsamen Regelwerks auf mindestens dem gleichen Sicherheitsniveau wie der bemannten Luftfahrt operieren, ohne dass zusätzliche Einschränkungen und Belastungen für die bemannte Luftfahrt entstehen.

POSITION 3: **Jedes UAS muss jederzeit über einen verantwortlichen Kommandanten verfügen, der angemessen trainiert und qualifiziert ist. Er betreibt das UAS eigenverantwortlich gemäß anerkannten Sicherheitsstandards.**

2. Kollisionsrisiko kleiner unbemannter Luftfahrzeuge (UA) für die bemannte Luftfahrt

Die bemannte Luftfahrt, vom Hubschrauber bis zum Großraumflugzeug, ist mit einer exponentiell steigenden Anzahl von Sichtungen und Beinahe-Kollisionen (Aircraft Proximity) mit UA in allen Lufträumen konfrontiert. Dies ist besonders auffällig unter 500 Fuß AGL, wo es einen Mischverkehr gibt, insbesondere Hubschrauber auf Rettungs-, Polizei- oder Feuerwehreinsätzen, Kontrollflüge, Grenzkontrollen, Militäreinsätze und Berichterstattung. Dabei handelt es sich um bemannte Luftfahrzeuge, die ihre Aufgaben mit besonderer Berechtigung erfüllen. Die VC ist über das Risiko einer Kollision zwischen einem UA und einem bemannten Luftfahrzeug und deren potenzielle Folgen besorgt.

POSITION 4: **Auswirkungen von Kollisionen zwischen UAS und bemannten Luftfahrzeugen müssen gründlich untersucht werden.**

Es ist dringend erforderlich, die Auswirkungen von Kollisionen zwischen kleinen UA und bemannten Luftfahrzeugen gründlich zu untersuchen, um die Schwere der Auswirkungen von Kollisionen festzustellen. Derzeit liegen nur wenige belastbare Daten aus wissenschaftlichen Untersuchungen vor, um das Risiko einer Kollision selbst kleiner UA mit den kritischen Oberflächen und Komponenten bemannter Flugzeuge zu ermitteln. Einige Beispiele hierfür sind Windschutzscheiben/-hauben, primäre Steuerflächen, Triebwerke, sowie Rotorwellen von Hubschraubern und deren Heckrotoren. Unabhängig von der Größe können UA erhebliche oder sogar katastrophale Schäden verursachen. Von besonderer Bedeutung sind dabei die Motoren und Akkus kleiner UA. Kritisch betroffen hiervon sind Hubschrauber aufgrund der Anzahl empfindlicher, sicherheitskritischer Komponenten. Mehrere Vogelschläge haben gezeigt, dass selbst ein Aufprall mit kleinen Vögeln (unter 200g) für einen Hubschrauber katastrophale Folgen haben kann.

Für eine letztendliche Bestimmung des Risikos fehlen derzeit noch Daten für den Schweregrad der Auswirkungen von Kollisionen. Durch die steigende Anzahl an Sichtungen von UA aus dem Cockpit hat sich die Wahrscheinlichkeit einer Kollision erhöht, so dass es dringend erforderlich geworden ist, die Schweregrade zu ermitteln.

POSITION 5: **Eine genehmigte, vollständige und transparente Risikobewertung muss abgeschlossen sein, bevor ein Betrieb aufgenommen werden kann.**

Dies würde es ermöglichen, alle Risiken, einschließlich der Kollision mit bemannter Luftfahrt und ihre möglichen Auswirkungen zu identifizieren. Der Betrieb darf erst dann erlaubt sein, wenn alle Gefahren ordnungsgemäß auf ein akzeptables Maß reduziert wurden. Jedes UAS, das im gemeinsamen Luftraum operiert, muss jederzeit in der Lage sein eine Kollision mit anderen Luftfahrzeugen oder anderen Hindernissen zu vermeiden. Eine Befreiung von dieser Forderung allein aufgrund statistischer Wahrscheinlichkeiten ist nicht ausreichend.

POSITION 6: Die Mindestbesatzung eines UAS muss formal qualifiziert und lizenziert sein.

Da es für das Führen von bestimmten UAS Kategorien keine formale Qualifikation gibt, kann nicht davon ausgegangen werden, dass es einen qualifizierten, ausgebildeten und kompetenten verantwortlichen Kommandanten gibt, der das UA führt. Für den Betrieb im Luftraum, in dem ein Zusammenstoß mit einem bemannten Luftfahrzeug möglich ist, muss eine obligatorische Schulung und eine Erlaubnis/Lizenz erforderlich sein.

Aufgrund des wirtschaftlichen Erfolgs insbesondere der kleineren UA müssen die ICAO und die regionalen/nationalen Behörden alle UAS "proportional" nach ihrem Risiko regulieren. Schlussendlich wird die überwiegende Mehrheit der kleinen UAS sehr schwach oder gar nicht reguliert bleiben. Das bedeutet in der Praxis, dass Piloten bemannter Luftfahrzeuge nicht davon ausgehen können, dass ein UA zertifiziert ist oder dass der verantwortliche Kommandant für den Betrieb des UA ähnlich ausgebildet wurde.

Wo eine Begegnung mit einem bemannten Luftfahrzeug möglich ist, muss der Kommandant eines kleinen UA in der Lage sein, das bemannte Luftfahrzeug wahrzunehmen und diesem auszuweichen. Offizielle Lizenzen für die Mindestbesatzung von UA müssen eingeführt werden, um eine sichere Integration in den gemeinsamen Luftraum zu gewährleisten. Diese Genehmigungen müssen den Risiken angemessen sein und mindestens sicherstellen, dass die Mindestbesatzung eines UA ausreichende Kenntnisse über das eigene Luftfahrzeug, den Luftraum, die Betriebsumgebung sowie andere Luftfahrzeuge hat, denen im Flug begegnet werden könnte.

Um die Kontinuität der Sicherheit zu gewährleisten, die aktuell im zivilen Luftraum besteht, müssen Mindestbesatzungsmitglieder von UAS, die zu kommerziellen Zwecken eingesetzt werden, eine gewerbliche Zulassung mit einer Instrumentenberechtigung erhalten, wenn dies für die Kategorie und Klasse der zu fliegenden Luftfahrzeuge erforderlich ist. Zusätzlich müssen sie über eine entsprechende flugmedizinische Tauglichkeit verfügen.

POSITION 7: Staaten haben eine umfassende Informationspflicht.

Jeder Staat muss eine umfassende Öffentlichkeitskampagne über die Sicherheitsrisiken, Pflichten, Haftungsfragen, Versicherungsanforderungen, Verantwortlichkeiten und Datenschutzfragen Dritter im Zusammenhang mit dem Betrieb von UAS durchführen.

Es ist die Pflicht der Staaten, dafür zu sorgen, dass Informationen bezüglich der operationellen Risiken sowie Beschränkungen des Betriebs dem potenziellen Kommandanten adäquat zur Verfügung gestellt werden. Dazu gehört auch zu wissen, wo, und wo nicht, das UAS betrieben werden darf, indem die offiziell veröffentlichten Informationen leicht zugänglich und verständlich sind. Staaten müssen zudem von UAS Herstellern verlangen, diese Informationen beim Verkauf von UAS zur Verfügung zu stellen.

POSITION 8: Die Registrierung über ein staatliches System muss für alle UAS verpflichtend sein.

Dies erleichtert die Durchsetzung von Regeln und gibt Ausbildungsanreize innerhalb der UAS-Gemeinschaft. Mit Ausnahme einiger Staaten wird die überwiegende Mehrheit der UAS verkauft, ohne Verkäufer und Käufer zu verpflichten, sicherzustellen, dass das UA ordnungsgemäß registriert wird. Die Registrierung hilft bei der Durchsetzung der Vorschriften und ermöglicht Behörden, ein UA zu ihrem Eigentümer/Kommandanten zurückzuverfolgen, ähnlich wie die Zulassung von Autos im Straßenverkehr. Damit kann es als wichtiges Element zur Förderung der Einhaltung von Regeln dienen und gleichzeitig die UA-Besitzer/Kommandanten ermutigen, die notwendigen Fähigkeiten und Qualifikationen zu erwerben. Die obligatorische Registrierung muss vor der Erstnutzung erfolgen.

POSITION 9: Die zuständigen Behörden, die mit der Durchsetzung der Vorschriften für den Betrieb von UAS betraut sind, müssen ausreichend besetzt, ausgebildet und ausgestattet sein, um die Wirksamkeit der Durchsetzung zu erhöhen.

Angesichts knapper werdender Ressourcen haben Luftfahrtbehörden die Verantwortung für die Aufsicht über bestimmte Bereiche der Sicherheit des UAS-Betriebs an andere Behörden, wie beispielsweise die Polizei, delegiert. Das Hauptargument ist, dass das Risiko für die Luftfahrt in diesen Sektoren als gering angesehen wird und die erforderlichen Ressourcen offensichtlich den Einsatz von speziellem Luftfahrtpersonal nicht rechtfertigen. Obwohl die VC die zugrundeliegende Risikoanalyse in Frage stellt, müssen Staaten erkennen, dass ihre Behörden für eine wirksame Durchsetzung jeglicher Vorschriften gut ausgestattet, geschult und ausgerüstet sein müssen. Darüber hinaus muss die UAS-Gemeinschaft eine professionelle Einstellung zu ihrer Ausbildung und Verantwortung als Voraussetzung für ihren Betrieb entwickeln. Jeder der ein UAS fliegt, welches eine Gefahr für andere Luftfahrzeuge darstellt oder Gesetze verletzt, muss ermittelt und strafrechtlich verfolgt werden.

POSITION 10: Betrieb von kleinen UA in Sichtflugweite ist nicht mit Modellflug vergleichbar – daher sind Sicherheitsvergleiche ungültig.

Der Einsatz von UAS findet in der Regel nicht in begrenzten Bereichen wie Modellflugplätzen statt und wird für gewöhnlich auch nicht wie der Flugbetrieb auf Modellflugplätzen überwacht.

Während die Piloten eines Modellflugzeugs in der Regel auf einem Modellflugplatz ausgebildet werden und die Anforderungen an die Luftfahrt verstehen, insbesondere in Bezug auf die Risiken für die bemannte Luftfahrt, haben die meisten Kommandanten kleiner UAS keinen solchen luftfahrttechnischen Hintergrund oder die Möglichkeit einer solchen Ausbildung. Der Hauptzweck des Betriebs von UAS ist nicht der Luftsport, sondern die Erfüllung anderer Aufgaben.

Der Betrieb von kleinen UA in Sichtflugweite („Visual Line Of Sight“ (VLOS)) kann nicht mit dem Modellflugbetrieb verglichen werden, da sich die Absicht und der Standort des Betriebs erheblich unterscheiden. Daher sind Sicherheitsvergleiche ungültig. Wenn Staaten beabsichtigen, Freizeit-UA in nationale Modellflugvorschriften aufzunehmen, müssen sie spezifische Regeln für diese festlegen.

POSITION 11: **Wenn der Kommandant eines UA nicht ordnungsgemäß qualifiziert und formell lizenziert ist, müssen verbindliche technische Leistungsbegrenzungen wie Geofencing und Höhen- sowie Reichweitenbegrenzungen eingeführt werden, um das Risiko von Kollisionen und Luftraumverletzungen zu verringern.**

Die bemannte Luftfahrt ist verpflichtet, mit einer Lizenz zu operieren, die einen formalen Ausbildungsnachweis darstellt. Dies muss auch eine Voraussetzung für jedweden UAS-Betrieb sein (siehe Position 6). Kann eine Lizenzierung nicht erreicht werden, müssen anstelle dessen Einschränkungen der Leistung des UA eingeführt werden. Technologien wie Geofencing (d.h. ein UA fliegt nur an vorab genehmigten Orten und nur bis zu vordefinierten Höhen) und Reichweitenbegrenzungen (d.h. ein UA fliegt nicht weiter als eine vordefinierte Entfernung von seinem Kommandanten) könnten als Minderungsmaßnahmen des Kollisionsrisikos dienen.

Es müssen in diesem Zusammenhang auch Regeln gelten, um z.B. Flugbetrieb in der Nähe von Krankenhäusern, Landeplätzen, landwirtschaftlichen Flächen, militärischen Einrichtungen oder Kraftwerken zu verhindern. In einigen Staaten werden diese Flugbeschränkungsgebiete als "No Drone Zones" bezeichnet. Dies müssen auch für den Betrieb von UAS in der Nähe von kontrollierten und unkontrollierten Flugplätzen, einschließlich Hubschrauberlandeplätzen, gelten.

3. Integration unbemannter Luftfahrzeuge in den gemeinsamen zivilen Luftraum

Unbemanntes Luftfahrzeug ist der Oberbegriff für Luftfahrzeuge, die keinen Piloten an Bord haben. Es gibt im Wesentlichen zwei Arten:

a) Autonome Luftfahrzeuge, die einen Eingriff des Kommandanten in das Management des Fluges nicht zulassen.

b) Remotely Piloted Aircraft Systems (RPAS[3]), die immer noch von einem menschlichen Kommandanten kontrolliert werden.

3a. Autonome Luftfahrzeuge

Die ICAO definiert ein autonomes Luftfahrzeug als "ein unbemanntes Luftfahrzeug, das keinen Eingriff des Kommandanten in das Management des Fluges zulässt". Ein Beispiel für bereits bestehende Luftfahrzeuge dieser Kategorie sind unbemannte Freiballone, wie sie in ICAO Annex 2, Kapitel 3.1.10 und Anhang 5 beschrieben sind. Mit Ausnahme von "Leichtballonen, die

[3] **Remotely Piloted Aircraft System (RPAS)**: Subkategorie von UAS, welche immer noch von einem menschlichen Kommandanten kontrolliert werden. Autonome UA (derzeit noch nicht umsetzbar), sowie einige höchtsautomatisierte UA fallen nicht mehr in die Kategorie der RPAS, da diese UA nicht mehr unter direkter Kontrolle eines menschlichen Kommandanten stehen. Auf absehbare Zeit fällt der Großteil, der sich im Betrieb befindlichen UA unter die Kategorie RPAS.

ausschließlich zu meteorologischen Zwecken verwendet und in der von der zuständigen Behörde vorgeschriebenen Weise betrieben werden", unterliegen alle anderen Ballone den Bestimmungen von Artikel 8 des Chicagoer Abkommens. Dies macht sie im Wesentlichen zu einer Ausnahme vom ICAO-Rahmen unter nationaler Hoheit, jedoch nach den in Artikel 8 beschriebenen Grundsätzen: "Jeder Vertragsstaat verpflichtet sich, dafür zu sorgen, dass der Flug solcher UA in für Zivilluftfahrzeuge zugänglichen Regionen, so kontrolliert wird, dass Gefahr für Zivilluftfahrzeuge abgewendet wird".

POSITION 12: **Derzeit ist die VC der Ansicht, dass autonome UA nicht in den gemeinsamen Luftraum integriert werden können.**

Gemäß Chicagoer Abkommen, gibt es im gemeinsamen Luftraum einen verantwortlichen Luftfahrzeugführer, der von Regeln abweichen kann, wenn diese Abweichung im Interesse der Sicherheit absolut notwendig ist (siehe ICAO-Annex 2, Kapitel 2.3.1). Da autonome UA diese Voraussetzung derzeit nicht erfüllen, können sie nicht in den gemeinsamen Luftraum integriert werden.

POSITION 13: **Die VC lehnt es ab, der bemannten Luftfahrt den Zugang zu Lufträumen zu verweigern, um autonomen UAS den Betrieb zu ermöglichen.**

Derzeit reservieren Behörden Lufträume, um Luftfahrzeuge voneinander zu trennen, die nicht die Anforderungen für den Betrieb im gemeinsamen Luftraum erfüllen. Dies reduziert die Kapazität für die bemannte Luftfahrt, was nicht akzeptabel ist.

3b. RPAS

Im Gegensatz zu autonomen Luftfahrzeugen werden alle anderen unbemannten Luftfahrzeuge ferngeführt. Die Tatsache, dass sie unter Kontrolle eines menschlichen Kommandanten stehen, macht sie grundsätzlich kompatibel mit dem ICAO-Rahmen.

Der Umstand, dass der Pilot nicht an Bord des Luftfahrzeugs ist, stellt große Herausforderungen für die Art und Weise dar, wie ein UAS geführt werden kann. Es müssen neue technische Lösungen entwickelt werden, um das Fehlen eines Luftfahrzeugführers an Bord auszugleichen.

POSITION 14: **Die VC ist der Ansicht, dass die derzeitige UAS-Technologie nicht in der Lage ist, alle notwendigen Fähigkeiten eines menschlichen Luftfahrzeugführer an Bord zu ersetzen, insbesondere in komplexen zeit- und sicherheitskritischen Situationen.**

Viele schwere Zwischenfälle hätten in einer Katastrophe enden können, wurden aber abgewendet, weil ein menschlicher Pilot an Bord war. Dieses menschliche Element bietet ein Plus an Sicherheit und kann als letzte Barriere zur Verhinderung von Unfällen dienen. Menschen haben die Fähigkeit, in unklaren Situationen Entscheidungen zu treffen, Funktionen von ausgefallenen Systemen zu übernehmen und die einzigartige Fähigkeit, in Echtzeit zu lernen. Ohne an Bord zu sein, ist es für einen Menschen schwierig, ein genügendes Situationsbewusstsein zu haben, um von diesen menschlichen Eigenschaften zu profitieren.

POSITION 15: **Die VC geht davon aus, dass UAS auf absehbare Zeit nicht ohne einen erheblichen Mehraufwand an Ressourcen das gleiche Sicherheitsniveau erreichen können, wie der kommerzielle bemannte Luftverkehr heute.**

POSITION 16: **Alle UAS, die im gemeinsamen öffentlichen Luftraum eingesetzt werden, müssen zertifiziert sein und den nachstehend beschriebenen Bestimmungen entsprechen, bevor sie ihren Betrieb aufnehmen dürfen.**

Die sichere Integration von UAS in den zivilen, gemeinsamen Luftraum kann nur erreicht werden, wenn UAS und ihr Betrieb den bestehenden Regeln und Vorschriften für andere Luftfahrzeuge im selben Luftraum entsprechen und mit diesen vereinbar sind. Non-konforme UAS werden eine inakzeptable Reduzierung von Kapazitäten bedeuten, insbesondere in hoch-frequentierten Lufträumen und an Flugplätzen.

POSITION 17: **Es müssen angemessene Lizenzierungs- und Tauglichkeitsstandards für den Betrieb von UAS gelten.**

Für die in Position 6 geforderten Lizenzen, sowie für die Kriterien bezüglich Auswahl, Unterweisung und Ausbildung von UAS-Betreibern/-Kommandanten müssen Standards von Zertifizierungsstellen festgelegt werden.

Des Weiteren müssen die für die Fernführung eines Luftfahrzeugs erforderlichen Fähigkeiten, Fertigkeiten sowie angemessene medizinische Anforderungen (inklusive psychische Gesundheit) festgelegt werden.

POSITION 18: **Es müssen angemessene Dienst- und Ruhezeitenregelungen für den Betrieb von UAS gelten.**

Für Dienst- und Ruhezeitenregelungen muss es, analog zur bemannten Luftfahrt, eine Unterscheidung zwischen verschiedenen Diensten (z.B. „Dienstzeit“ und „Flugdienstzeit“) geben. Als Grundlage für die Erarbeitung sinnvoller Dienst- und Ruhezeiten können Erfahrungen aus der bemannten Luftfahrt (Dienst- und Flugdienstzeit gemäß EASA-OPS (VO (EU) Nr. 965/2012), i.V.m. §§ 8 bis 15der 1. DV LuftBO) oder anderen Bereichen (z.B. gewerblicher Güterverkehr) dienen. Die Dienstzeit von Luftfahrzeugfernführern und zugehörigen Besatzungsmitgliedern müssen angemessen begrenzt werden. Diese Kriterien und Einschränkungen müssen sich auf die bestehenden Vorschriften für Flugzeugführer und wissenschaftliche Erkenntnisse stützen.

POSITION 19: **UAS Flug- und Luftsicherheitsstandards (Safety & Security) müssen analog der bemannten Luftfahrt eingeführt werden.**

Es muss eine Luftsicherheitsbedrohungs- und Risikobewertung für alle Arten von UAS durchgeführt werden, um die Bedrohung und das Risiko für die Zivilluftfahrt zu ermitteln und zu verstehen. Diese risikobasierte UAS-Luftsicherheit muss streng reglementiert werden. Wenn eine solche Regulierung nicht möglich oder nicht vorhanden ist, müssen UAS in ihrer Einsatzfähigkeit eingeschränkt werden.

Basierend auf obiger Risikobewertung müssen die Orte, an denen die UAS oder Systemkomponenten (einschließlich Luftfahrzeugfernführer Kontroll- und Programmierstationen) betrieben, gelagert, gewartet und vorbereitet werden, über adäquate

Zugangs- und Sicherheitskontrollen, sowie -Verfahren verfügen, um unbefugten Zutritt, Sabotage, unrechtmäßige Eingriffe und Manipulationen zu verhindern und um die Integrität wichtiger Komponenten zu gewährleisten. Personen, einschließlich ihrer mitgeführten Gegenstände, die diese Räumlichkeiten betreten, müssen einer Überprüfung und Sicherheitskontrolle unterzogen werden.

Das Personal, das für die Programmierung, Flug-Vorbereitung, Wartung, den Betrieb und/oder die Fernführung der UAS zuständig ist, sowie Personen, die unbegleiteten Zugang zu den vorgenannten Orten erhalten, müssen im Rahmen einer Zuverlässigkeitsüberprüfung auf ihren Sicherheitshintergrund überprüft werden. Die Sicherheit muss Teil der Trainings- und Sensibilisierungsprogramme für das gesamte Personal sein.

Die Integrität und Sicherheit der Kommunikation/Datenverbindung, einschließlich der verwendeten Hard- und Software, muss gegen Sabotageakte, (Cyber-)Angriffe und Handlungen rechtswidriger Eingriffe geschützt werden, einschließlich Denial-of-Service und Systemausfälle.

POSITION 20: **Zertifizierungsstellen und Zertifizierungskriterien müssen ein adäquates Sicherheitsniveau nachweisen.**

Den Zertifizierungsstellen muss eine Sicherheitsbewertung mit einem für die Betriebsart angemessenen Sicherheitsniveau nachgewiesen werden.

Flugkritische Komponenten der Kommunikation/Datenverbindung und der Bodenkontrollstation sind als Flugzeugteile zu betrachten und daher in die Zertifizierungskriterien aufzunehmen. Sie können entweder Teil eines UAS als Ganzes oder unter gesonderten Typenbezeichnungen stehen.

POSITION 21: **Menschliche Faktoren (Human Factors) müssen bei UAS berücksichtigt werden.**

Menschliche Faktoren sind in der unbemannten Luftfahrt mindestens ebenso wichtig wie im bemannten Flug. Bei der Gestaltung von Kontroll-Leitstellen/-Geräten müssen menschliche Faktoren berücksichtigt werden, insbesondere die Bedienelemente, Anzeigen, Software und Schnittstellen sowie der Betrieb eines UAS.

POSITION 22: **Es darf nur ein UA von einem verantwortlichen Luftfahrzeugfernführer geführt werden.**

Das Betriebskonzept eines UAS darf dem UA-Pilot-In-Command (PIC - gemäß ECA Automations-Positionspapier) nicht erlauben, zu irgendeinem Zeitpunkt mehr als ein UA gleichzeitig zu führen.

POSITION 23: **Ablenkung des Luftfahrzeugfernführers muss während des Betriebs vermieden werden.**

Die VC fordert Kommandanten, welche ein UAS kontrollieren, frei von Ablenkungen zu halten, welche die Betriebssicherheit beeinträchtigen (analog "steriles Cockpit Konzept").

POSITION 24: Die VC fordert beim Transport externer Lasten ein der Gefährdung angemessenes Sicherheitsniveau.

Die Anforderungen müssen hierbei grundsätzlich denen bemannter Luftfahrzeuge entsprechen und Gefährdungsbewertungen müssen für alle Teilnehmer identisch sein.

POSITION 25: Für den Transport von Gefahrgütern müssen die gleichen Regularien und Regeln gelten wie für die bemannte Luftfahrt.

Gefahrguttransporte dürfen nicht auf einem UAS durchgeführt werden, es sei denn, es kann ein Sicherheitsniveau erreicht werden, welches dem bemannter Luftfahrzeuge entspricht. Geringere Standards für UAS sind inakzeptabel. Die Nichtverfügbarkeit einer Besatzung in der Luft zur Bekämpfung von Vorfällen im Zusammenhang mit Gefahrgut muss berücksichtigt werden.

Die Beförderungsvorschriften (inkl. Verpackungs-, Beschriftungs- und Dokumentations-vorschriften) der IATA Dangerous Goods Regulations, sowie die ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air (Begrenzung der Stückzahl pro Packstück, Benachrichtigung des verantwortlichen Luftfahrzeugführers und Berichtspflichten) müssen hierbei eingehalten werden.

Die Auswirkungen von Gefahrgütern auf die Umwelt, Menschen am Boden und Eigentum, die aus einem Absturz eines UA aufgrund geringerer Lufttüchtigkeitsanforderungen resultieren, müssen berücksichtigt werden.

Besondere Aufmerksamkeit muss der Anforderung gewidmet werden, zuständige Behörden, einschließlich des Notfallpersonals, im Falle eines Vorfalls oder Unfalls über Gefahrgutinformationen zu informieren.

POSITION 26: Flugsicherungsverfahren und -standards müssen denen der bemannten Luftfahrt entsprechen.

Der Betrieb von UAS im zivilen Luftraum muss, z.B. durch spezielle Flugverfahren, für den täglichen Betrieb anderer Luftverkehrsteilnehmer (kommerzielle und allgemeine Luftfahrt) keinen Unterschied darstellen.

Die Reaktionszeit eines UAS auf Flugsicherungsanweisungen muss mit der eines bemannten Luftfahrzeugs vergleichbar sein. Verzögerungen aufgrund von Kommunikationsübertragungs-/Datenverbindungszeiten sind inakzeptabel.

POSITION 27: UAS-Betreiber müssen Sicherheitsmanagementsysteme in Übereinstimmung mit den Bestimmungen der ICAO einführen und vom Staat des Betreibers genehmigen lassen.

POSITION 28: Meldewesen und -pflicht müssen analog der bemannten Luftfahrt etabliert werden.

Die verantwortlichen Behörden müssen gesetzliche Vorschriften zur Meldung von Unfällen oder schweren Zwischenfällen aufgrund oder in Verbindung mit dem Betrieb von UAS festlegen. Diese Vorschriften müssen bestehende Meldevorgaben der bemannten Luftfahrt abbilden, wie Verordnungen (EU) Nr. 996/2010 und Nr. 376/2014. Kommandanten von UAS müssen über ihre gesetzliche Meldepflicht unterrichtet werden. Dies beinhaltet die Art meldepflichtiger Vorfälle, anzugebende Mindestinformationen, Einreichungsfristen und die für Annahme und Untersuchung zuständige Behörde. Darüber hinaus muss jegliches am Betrieb von UAS beteiligtes Personal ermutigt werden Vorfälle freiwillig zu melden. Um Letzteres zu unterstützen muss ein non-punitives Meldeumfeld, basierend auf den Prinzipien einer "Redlichkeitskultur" (Just Culture), etabliert werden (anonymes Melden kann in Betracht gezogen werden).

POSITION 29: **Staatlich betriebene UAS dürfen nicht grundsätzlich von den oben genannten Anforderungen ausgenommen werden.**

Begriffsbestimmungen

Die VC definiert für diese Policy folgende Begrifflichkeiten, in Anlehnung an die ICAO:

Unmanned Aircraft System (UAS)

Überbegriff, welche das Gesamtsystem bestehend aus Unbemannten Luftfahrzeug (UA), einer dazugehörigen Kontrollstation (Control Station bzw. Remote Pilot Control Station) sowie einer integrierten Befehls- und Steuerdatendatenverbindung (Command and Control-Data-Link) umfasst.

Unmanned Aircraft (UA)

Bestandteil des UAS – umfasst jegliche Art von Luftfahrzeugen (z.B. Flächenflugzeug, Drehflügler, Multikopter, Luftschiffe, Ballone, etc.), welche keinen Piloten an Bord haben.

Remotely Piloted Aircraft System (RPAS)

Subkategorie von UAS, welche immer noch von einem menschlichen Kommandanten kontrolliert werden. Autonome UA (derzeit noch nicht umsetzbar), sowie einige höchstautomatisierte UA fallen nicht mehr in die Kategorie der RPAS, da diese UA nicht mehr unter direkter Kontrolle eines menschlichen Kommandanten stehen. Auf absehbare Zeit fällt der Großteil, der sich im Betrieb befindlichen UA unter die Kategorie RPAS.

Drohne

Der Begriff Drohne wird umgangssprachlich für alle der obigen Begriffe benutzt und dabei oft nicht zwischen den einzelnen Systemkomponenten unterschieden.

IFALPA Editorial
Captain Jack Netskar, President

B737 Max Summit, Montreal, Canada

In March 2019, regulators and airlines around the world grounded the B737 MAX passenger aircraft after two nearly new aircraft tragically crashed less than five months apart, killing all 346 passengers and crew. The accidents befell Lion Air Flight 610 on October 29, 2018 and Ethiopian Airlines Flight 302 on March 10, 2019.

Ethiopian Airlines was first to ground the aircraft, effective the day of the accident. On March 11, the aircraft's airworthiness was publicly reaffirmed by its certifying agency, the US Federal Aviation Administration. The same day, the CAA of China was the first regulator to order the MAX grounding.

In the next two days, most other airlines and regulators around the world grounded it as well. On March 13, the FAA was one of the last agencies to ground the MAX, citing similarities between the two crashes. In total, 387 airplanes were grounded.

From the time the B737 MAX was grounded until today, countless news articles, television/radio broadcasts, PRs, aviation expert commentary and so-called experts have been produced. Information has been provided about the relationship between regulators and the manufacturer regarding withholding important information about the aircraft type, about the cost pressures that challenge flight safety as priority number 1, about problematic issues concerning internal reporting, etc.

For IFALPA, it is important to maintain credibility in our statements and positions as safety professionals. We must, therefore, seek information from the primary source, and, at the same time, keep track of what our Member Associations and the community at large bring forward.

As part of this information gathering, IFALPA has, among other things, met with representatives of Boeing for three separate briefings. Most recently, we attended the IATA B737 MAX 2nd Summit in Montreal, just last week.

The purpose of this exceptional meeting, attended by 18 airlines, 9 regulators, Boeing, ICAO, IFALPA, CAE, lessors, and other relevant stakeholders, was to identify the challenges and gain a common understanding of a roadmap to bring the B737 MAX back to operation in the safest, most efficient, and timely manner possible.

The big question amongst all stakeholders, including IFALPA, is the "return to service" process. Views on this will vary depending on who you talk to, but for us the priorities are clear:

1. The technical challenges must be remedied and satisfy established safety standards;
2. The regulatory processes must take place in a way that prevents a greater degree of self-regulation and removal of factors for different understanding of the systems;
3. The training must be adequate and relevant information about the flight systems must be available.

The absence of one or more of these points will result in a lack of trust, and that is precisely where we have been, and still partially remain. It was therefore fruitful that the three main contributions came from Boeing, the FAA, and CAE.

Point 1 is technically being solved by Boeing and approved by the FAA. MCAS is one component of the Speed Trim System (STS). The technical fix is based on new software/Flight control law in the 737 MAX flight control computer. This will provide similar flaps-up protection to the already existing flaps-down 737NG STS. IFALPA is confident that all parts of the system are being reviewed and secured. Boeing as a company cannot withstand another accident.

Point 2 has been a concern at IFALPA for a long time. We have a long-standing cooperation with OEMs through, among others, the ADO Committee, but we have no formal lines to Certifying state and therefore have less insight into the processes surrounding certifying types. This process takes place between the individual state CAA and OEM. IFALPA and our MAs are related to the CAAs more on the oversight part. This means that we must rely on Certifying state and aircraft manufacturers to do a qualitatively good job and ensure that assessments are based on flight safety and not selling points. Are we creating software fixes to be able to sell an aircraft as one type to reduce required training? It is an important question to ask.

The FAA is focused on providing Safe and Compliant Aircraft Design and changes to MCAS design on one hand and the return-to-service process on the other. EASA, TCCA, and ANAC have a commitment to collaborative process with the FAA for certification, pilot training, and ungrounding. Given the reduced degree of trust that exists for both the manufacturer and the regulator, it will be crucial that all these regulators, as well as China, reach an agreement before the aircraft is put into service.

It would be very problematic politically to argue that the aircraft is safe when someone does not approve parts of the changes and does not return it to service. What is important to understand is that only the FAA certifies Boeing, while all other regulators validate this process.

> *"In a world of growing competitions, we need to improve and increase the amount of training a professional pilot receives, not diminish it. The gradual erosion of training time will have a delayed effect as the older generation of pilots leave the left seat and take their experience with them."*
> *IFALPA Pilot Training Standards Manual*

"It all comes down to trust. Trust towards the regulator, trust towards the manufacturer, trust towards the operator. At the Summit, all the stakeholders from IATA, FAA, and Boeing, to Regulators and ICAO, pointed to the pilots as the main symbol of trust for the public."

In this context, it is important that IFALPA coordinate our input to the FAA, EASA, Transport Canada, and ANAC, on a global level.

Normally, the inputs would come separately, through each national MA, without much use of IFALPA. However, in this context, we believe it is very important to align in the same way as the regulators do.

Point number 3, Training. This is an extremely important part of the whole problem. We have seen that the requirements for training and qualification have gradually been reduced over the last decades for economic reasons. Some will argue that new technology and reduced fail margins and frequencies mean that the need for training is not the same as it once was.

But it is precisely *because* systems have become increasingly complex and failures occur less often that there is a need for more and relevant training. As type training is recommended by the OEM and approved by the regulator; I firmly believe that, as a profession, we should have a greater say in this process.

As IFALPA's Pilot Training Standards Manual States, "In a world of growing competitions, we need to improve and increase the amount of training a professional pilot receives, not diminish it. The gradual erosion of training time will have a delayed effect as the older generation of pilots leave the left seat and take their experience with them."
(https://bit.ly/2J3ikYI)

The opportunities for varied and customized training were presented well by CAE during the meeting, but investments by the operators are required, and regulators must be able to withstand the cost perspective in their assessments. Based on Boeing's prediction of the need for 600,000 new pilots over the next 20 years, this becomes increasingly important to maintain future requirements for the flight safety standard.

As I mentioned, it all comes down to trust. Trust towards the regulator, trust towards the manufacturer, trust towards the operator. At the Summit, all the stakeholders from IATA, FAA, and Boeing, to Regulators and ICAO, pointed to the pilots as the main symbol of trust for the public. IFALPA will, in a trustworthy and reliable way, contribute to the process of return-to-service of the MAX, but always with a view to safer skies as our main goal, in this and in all our ventures.

What is IFALPA's position on the MAX at this moment? We are doing our utmost to validate the process; we cannot presently approach the public with a clean bill , but will, if and when we feel comfortable to do so.

IFALPA
The Global Voice of Pilots
Safety Bulletin

19SAB07 18 July 2019

GNSS Vulnerabilities

The Regional Aviation Safety Group for the Middle East Region (RASG-MID) has issued a Safety Advisory concerning GNSS Vulnerabilities and provided guidance material to mitigate the safety and operational impact of GNSS service disruption. The Safety Advisories are issued to encourage States and aviation Stakeholders to adopt practices that mitigate major aviation safety risks in the Middle East Region as identified through the analysis of regional safety data.

GNSS supports positioning, navigation, and timing (PNT) applications. GNSS is the foundation of Performance Based Navigation (PBN), automatic dependent surveillance – broadcast (ADS-B) and automatic dependent surveillance – contract (ADS-C). GNSS also provides a common time reference used to synchronize systems, avionics, communication networks and operations, and supports a wide range of non-aviation applications.

With the increasing dependence on GNSS, it is important that GNSS vulnerabilities be properly addressed. This RASG-MID Safety Advisory provides guidance on a set of mitigation measures that States would deploy to minimize the GNSS vulnerabilities impact on safety and air operations. The RSA-14 also includes the regional reporting and monitoring procedures of GNSS anomaly with the aim to analyze the threat and its impact on performance and assess the effectiveness of the mitigation measures in place.

There are two types of GNSS Interference Sources; Intentional and Unintentional sources. The latter is not considered a significant threat, provided that States exercise proper control and protection over the electromagnetic spectrum for both existing and new frequency allocations. Solar Effect, Radio Frequency Interference, and On-board systems are examples of Unintentional GNSS interference sources. However, the Intentional sources such as jamming and spoofing are considered serious threats to the continued safety of air transport.

The success of many of the countermeasures is dependent on having a detailed understanding of the threats. In order to establish this understanding and to maintain an up-to-date knowledge of the threats, in terms of both types and number of threats, it is necessary for States to monitor the threat environment and the impact on performance.

The Air Navigation Service Provider (ANSP) must be prepared to act when anomaly reports from aircraft or ground-based units suggest signal interference. If an analysis concludes that interference is present, ANS providers must identify the area affected and issue an appropriate NOTAM.

From the perspective of the aircrew, a GNSS anomaly occurs when navigation guidance is lost or when it is not possible to trust GNSS guidance. In this respect, an anomaly is similar to a service outage. An anomaly may be associated with a receiver or antenna malfunction, insufficient satellites in view, poor satellite geometry, or masking of signals by the airframe. The perceived anomaly may also be due to signal interference, but such a determination requires detailed analysis based on all available information.

In case of GNSS anomaly detected by aircrew,

PILOT ACTIONS SHOULD INCLUDE:

- reporting the situation to ATC as soon as practicable and requesting special handling as required;
- filing the **GNSS Interferance Reporting Form** (page 3-4 of this document), and forwarding information to the IATA MENA sfomena@iata.org and ICAO MID Office icaomid@icao.int as soon as possible, including a description of the event (e.g. how the avionics failed/reacted during the anomaly).

CONTROLLER ACTIONS SHOULD INCLUDE:

- recording minimum information, including aircraft call sign, location, altitude, and time of occurrence;
- cross check with other aircraft in the vicinity;
- broadcasting the anomaly report to other aircraft as necessary;
- notify the AIS Office in case NOTAM issuance is required and enable the fallback mode and implement related procedure and process (contingency measures).

ANSP ACTIONS SHOULD INCLUDE:

- ensuring the issuance of appropriate advisories and NOTAM, as necessary;
- attempting to locate/determine the source of the interference if possible;
- notifying the agency responsible for frequency management (the Telecommunication Regulatory Authority);
- locating and eliminating source in cooperation with local regulatory & enforcement Authorities;
- tracking and reporting all activities relating to the anomaly until it is resolved; and
- reviewing the effectiveness of the mitigation measures for improvement.

MID OFFICE ACTIONS SHOULD INCLUDE:

- collecting anomaly-related information and determining the course of action required to resolve reported anomalies;
- follow-up with State having interference incident to ensure implementation of required corrective actions;
- coordinate with concerned adjacent ICAO Regional Office(s) to follow-up with States under their accreditation areas, when needed; and
- Communicate with ITU Arab Office and Arab Spectrum Management Group to resolve frequent interference incidents, when needed.

A copy of the ICAO MID-Region Guidance Material Related to GNSS Vulnerabilities is available from the IFALPA Regional Officer, Carole Couchman, carolecouchman@ifalpa.org.

Please find GNSS Interferance Reporting Form on page 3-4 of this document.

1. **GNSS interference reporting form to be used by pilots**
** Mandatory field*

Originator of this Report:	
Organisation:	
Department:	
Street / No.:	
Zip-Code / Town:	
Name / Surname:	
Phone No.:	
E-Mail:	
Date and time of report	
Description of Interference	
*Affected GNSS Element	[ ] GPS [ ] GLONASS [ ] other constellation [ ] EGNOS [ ] WAAS [ ] other SBAS [ ] GBAS (VHF data-link for GBAS)
Aircraft Type and Registration:	
Flight Number:	
*Airway/route flown:	

Coordinates of the first point of occurrence / Time (UTC):	UTC: Lat: Long:
Coordinates of the last point of occurrence / Time (UTC):	UTC: Lat: Long:
*Flight level or Altitude at which it was detected and phase of flight:	
Affected ground station (if applicable)	Name/Indicator; [e.g. GBAS]
*Degradation of GNSS performance:	[ ] Large position errors (details): [ ] Loss of integrity (RAIM warning/alert): [ ] Complete outage (Both GPSs), [ ] Loss of GPS1 or Loss of GPS 2 [ ] Loss of satellites in view/details: [ ] Lateral indicated performance level changed from:___to ___ [ ]Vertical indicated performance level changed from: __ to __ [ ] Indicated Dilution of Precision changed from __ to__ [ ] information on PRN of affected satellites (if applicable) [ ] Low Signal-to-Noise (Density) ratio [ ] Others
*Problem duration:	[ ] continuous for 20 minutes [ ] intermittent

Note: Only applicable fields need to be filled!

RASG-MID SAFETY ADVISORY – 14

(RSA-14)

April 2019

MID-Region

GUIDANCE MATERIAL REALTED TO GNSS VULNERABILTIES

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Disclaimer

This document has been compiled by the MID Region civil aviation stakeholders to mitigate the safety and operational impact of GNSS service disruption. It is not intended to supersede or replace existing materials produced by the National Regulator or in ICAO SARPs. The distribution or publication of this document does not prejudice the National Regulator's ability to enforce existing National regulations. To the extent of any inconsistency between this document and the National/International regulations, standards, recommendations or advisory publications, the content of the National/International regulations, standards, recommendations and advisory publications shall prevail**.**

TABLE OF CONTENTS

ACRONYMS

ABAS	AIRCRAFT BASED AUGMENTATION SYSTEM
ADS-B	AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST
AHRS	ATTITUDE AND HEADING REFERENCE SYSTEMS
ANS	AIR NAVIGATION SERVICES
ATC	AIR TRAFFIC CONTROLLER
DME	DISTANCE MEASURING EQUIPMENT
EGPWS	ENHANCED GROUND PROXIMITY WARNING SYSTEM
FIR	FLIGHT INFORMATION REGION
FMS	FLIGHT MANAGEMENT SYSTEM
GBAS	GROUND BASED AUGMENTATION SYSTEM
GLONASS	GLOBAL NAVIGATION SATELLITE SYSTEM
GNSS	GLOBAL NAVOGATION SATELLITE SYSTEM
GPS	GLOBAL POSITION SYSTEM
HAL	HORIZONTAL ALERT LIMIT
ILS	INSTRUMENT LANDING SYSTEM
IRS	INERTIAL REFERENCE SYSTEM
ITU	INTERATIONAL TELECOMMUNICATION UNION
MIDANPIRG	MID AIR NAVIGATION PLANNING AND IMPLEMENTATION GROUP
NAV	NAVIGATION
NOTAM	NOTICE TO AIRMEN
PBN	PERFORMANCE BASED NAVIGATION
POS	POSITION
RAIM	RECEIVER AUTONOMOUS INTEGRITY MONITORING
RF	RADIO FREQUENCY
RNAV	AREA NAVIGATION
RNP	REQUIRED NAVIGATION PERFORMANCE
SBAS	SPACE BASED AUGMENTATION SYSTEM
TAWS	TERRAIN AVOIDANCE WARNING SYSTEM
TSO	TECHNICAL STANDARD ORDER
VHF	VERY HIGH FREQYENCY
VNAV	VERTICAL NAVIGATION
VOR	VERY HIGH OMNI DIRECTIONAL RADIO RANGE
WAAS	WIDE AREA AUGMENTATION SYSTEM

GNSS VULNERABILITIES

1. INTRODUCTION

GNSS supports positioning, navigation and timing (PNT) applications. GNSS is the foundation of Performance Based Navigation (PBN), automatic dependent surveillance – broadcast (ADS-B) and automatic dependent surveillance – contract (ADS-C). GNSS also provides a common time reference used to synchronize systems, avionics, communication networks and operations, and supports a wide range of non-aviation applications.

GNSS Vulnerability has been identified as a safety issue and one of the main challenges impeding the implementation of PBN in the MID Region. The sixteenth meeting of the MID Air Navigation planning and Implementation Regional Group (MIDANPIRG/16Kuwait, 13-16 February 2017) recognized the impact of the GNSS signal interference and vulnerabilities and agreed that the subject should be addressed by the Regional Aviation Safety Group-Middle East (RASG-MID) in order to agree on measures to ensure effective reporting of GNSS interferences, which could be mandated by the States' regulatory authorities. The meeting invited the RASG-MID to consider the development of a RASG-MID Safety Advisory (RSA) related to GNSS vulnerabilities, highlighting the Standard Operating Procedures (SOP) for pilots, including the reporting procedures.

The RASG-MID/6 (Bahrain, 26 – 28 September 2017) agreed that IATA and ICAO MID Office should develop a RSA on GNSS vulnerabilities.

With the increasing dependence on GNSS, it is important that GNSS vulnerabilities be properly addressed. This Safety Advisory provides guidance on set of mitigation measures that States would deploy to minimize the GNSS vulnerabilities impact on safety and air operation. The RSA also includes the regional reporting and monitoring procedures of GNSS anomaly with the aim to analyze the threat and its impact on performance, and assess the effectiveness of the mitigation measures in place.

2. DESCRIPTION

Dependence on GNSS is increasing as GNSS is used for an ever-expanding range of safety, security, business and policy critical applications. GNSS functionality is being embedded into many parts of critical infrastructures. Aviation is now dependent on uninterrupted access to GNSS positioning, navigation and timing (PNT) services.

Aviation relies heavily on GNSS for area navigation and precision approach. Aircraft avionics such as the Flight Management Systems (FMS) require GNSS timing for a large number of onboard functions including Terrain Avoidance Warning System (TAWS) or Enhanced Ground Proximity Warning Systems (EGPWS). Onboard avionics are highly integrated on commercial aircraft and are very dependent on GNSS timing data. At the same time, GNSS vulnerabilities are being exposed and threats to denial of GNSS services are increasing.

There are several types of threat that can interfere with a GNSS receiver's ability to receive and process GNSS signals, giving rise to inaccurate readings, or no reading at all, such as radio frequency interference, space weather induced ionospheric interference, solar storm, jamming and spoofing. The disruption of GNSS, either performance degradation in terms of accuracy, availability and integrity or a complete shutdown of the system, has a big consequence in critical infrastructure. For example, local interference in

an airport could degrade position accuracy or lead to a total loss of the GNSS based services, which could put safety of passengers in jeopardy.
There are two types of GNSS Interference Sources; Intentional and Unintentional sources, the latter is not considered a significant threat provided that States exercise proper control and protection over the electromagnetic spectrum for both existing and new frequency allocations. Solar Effect, Radio Frequency Interference and On-board systems are examples of Unintentional GNSS interference sources. However, the Intentional sources such as Jamming and spoofing are considered as serious threats to the continued safety of air transport.

GNSS Jamming occurs when broadcasting a strong signal that overrides or obscures the signal being jammed. The GNSS jamming might occur deliberately by a military activity or by Personal Privacy Devices (PPDs). GNSS jamming has caused several GNSS outages in the MID Region.

In some States, military authorities test the capabilities of their equipment and systems occasionally by transmitting jamming signals that deny GNSS service in a specific area. This activity should be coordinated with State spectrum offices, Civil Aviation Authorities and ANS providers. Military and other authorities operating jamming devices should coordinate with State/ANS providers to enable them to determine the airspace affected, advise aircraft operators and develop any required procedures.

Spoofing is another source of intentional GNSS Interference, which is a deliberate interference that aims to mislead GNSS receivers into general false positioning solution.

Detailed information about the GNSS Implementation and Vulnerabilities can be found in MID DOC 010 – The Guidance on GNSS implementation in the MID Region.

3. RISK ASSESSMENT

The risk assessment covers affected operations during en-routre, terminal, and approach phase of flights. In addition, the aircraft impact at table (1), which presents an overview of different potential impacts from GNSS interference, needs to be considered for risk assessment.

Understanding the different types of threat and how likely they are to occur is key to conducting an accurate risk assessment. Broadly, the threat types break down as follows:

Threat Source	Threat Type	Description	Impact on the User
Solar Storms	Unintentional	Electromagnetic interference from solar flares and other solar activity “drowns out” the satellite signals in space.	Loss of signal, or range errors affecting the accuracy of the location or timing information.
Jamming	Intentional	Locally-generated RF interference is used to “drown out” satellite signals.	Loss of signal (if the jammer is blocking out all satellite signals) or range errors affecting the accuracy of the location or timing information

Spoofing	Intentional	Fake satellite signals are broadcast to the device to fool it into believing it is somewhere else, or at a different point in time.	False location and time readings, with potentially severe impacts on automated and autonomous devices and devices that rely on precise GNSS timing.
RF Interference	Unintentional	Noise from nearby RF transmitters (inside or outside the device) obscures the satellite signals.	Loss of signal (if the transmitter is blocking out all satellite signals) or range errors affecting the accuracy of the location reading (if the receiver is at the edge of the transmitter's range).
Signal Reflection	Unintentional	Reflection due objects such as buildings	GNSS signals can reflect off relatively due to distant objects, such as buildings, which would cause gross errors in position accuracy if the receiver falsely locks onto the reflected signal instead of the direct signal
User Error	Unintentional	Users over-rely on the GNSS data they are presented with, ignoring evidence from other systems or what they can see.	Can lead to poor decision-making in a range of scenarios

Table 1: Threats types

Depending on the nature of the interference and the nature of the application, a user may be affected in several ways; the impact may range from a small nuisance to an economic, operational or a safety impact. The detailed risk assessment methodology is addressed at **Appendix B**.

4. Mitigation Strategies

To minimize the risks associated with GNSS vulnerabilities, several mitigation strategies can be deployed to reduce the likelihood and impact of the threat.

4.1 Reducing The Likelihood Of GNSS Interferences

The likelihood of interference depends on many factors such as population density and the motivation of individuals or groups in an area to disrupt aviation and non-aviation services. To reduce the likelihood of GNSS interference, the following measures may be applied:

a) Effective spectrum management; this comprises creating and enforcing regulations/laws that control the use of spectrum and carefully assessing applications for new spectrum allocations.

b) The introduction of GNSS signals on new frequencies will ensure that unintentional interference does not cause the complete loss of GNSS service (outage) although enhanced services depending upon the availability of both frequencies might be degraded by such interference.

c) State should forbid the use of jamming and spoofing devices and regulate their importation, exportation, manufacture, sale, purchase, ownership and use; they should develop and enforce a strong regulatory framework governing the use of intentional radiators, including GNSS repeaters, pseudolites, spoofers and jammers. The enforcement measures include:

- detection and removal of jammers / interference sources; and
- direct or indirect detection (e.g. use of dedicated interference detection equipment).

d) Education activities to raise awareness about legislation and to point out that 'personal' jammers can have unintended consequences.

e) Multi-constellation GNSS would allow the receiver to track more satellites, reducing the likelihood of service disruption.

4.2 REDUCING THE IMPACT OF THE GNSS VULNERABILITIES

The GNSS signal disruption cannot be ruled out completely and States/ANSPs must be prepared to deal with loss of GNSS signals, and that States conduct risk assessment and implement mitigation strategies. The risk and impacts from these threats can be managed by evaluating the growing threat of GNSS interference, jamming and spoofing.

The disruption of GNSS signals will require the application of realistic and effective mitigation strategies to both ensure the safety and regularity of air services and discourage those who would consider disrupting aircraft operations. There are three principal methods, which can be applied in combination:

a) taking advantage of on-board equipment, such as Inertial Reference System (IRS);

IRS provides a short-term area navigation capability after the loss of GNSS updating. Many air transport aircraft are equipped with IRS and these systems are becoming more affordable and accessible to operators with smaller, regional aircraft. Most of these systems are also updated by DME.

b) Development of contingency procedures and processes to enable operations in a fallback mode in case of loss of GNSS (aircrew and/or ATC).

Procedural (aircrew or ATC) methods can provide effective mitigation in combination with those described above, taking due consideration of:

- the airspace classification;
- the available ATC services (radar or procedural);
- the avionics onboard
- aircrew and air traffic controller workload implications;
- the impact that the loss of GNSS will have on other functions, such as ADS-B based surveillance; and
- the potential for providing the necessary increase in separation between aircraft in the affected airspace.

c) taking advantage of conventional navigation aids and radar, conventional aids can provide alternative sources of guidance.

The regulator should conduct safety oversight of the service provider's GNSS based Services and validate the safety aspects of mitigation strategies, considering the impact on ATM operations. Details on Risk assessment process including some examples are at **Appendix B.**

The data analysis of the reported GNSS vulnerabilities for the period January 2015to June 2018 showed that the impact of the GNSS interference on Aircraft Operations in the MID Region were as follows:

1. Loss of GPS1 (fault)/ Loss of GPS2 (fault)
2. Observation of "Map shift" on Navigation display
3. Switching to an alternative navigation mode (IRS displayed, VOR/DME)
4. Degraded PBN Capability (NAV Unable RNP)
5. GPS POS Disagree
6. EGPWS warning
7. ADS-B Traffic triggered

5. MONITORING

The success of many of countermeasures is dependent on having a detailed understanding of the threats. In order to establish this understanding and to maintain an up-to-date knowledge of the threats - in terms of both types and number of threats – it is necessary to States to monitor the threat environment and the impact on performance.

Monitoring and reporting is required to inform stakeholders of the threats that exist. This would help directly with enforcement (detecting and removing sources of interference) as well as monitoring the response to changes in legislation or education activities.

Receiver autonomous integrity Monitoring (RAIM) provides integrity monitoring by detecting the failure of a GNSS satellite. It is a software function incorporated into GNSS receivers.

In the event of GNSS performance degrading to the point where an alert is raised, or other cause to doubt the integrity of GNSS information exists, the pilot in command must discontinue its use and carry out appropriate navigation aid failure procedures. Should RAIM detect an out-of-tolerance situation, an immediate warning will be provided. When data integrity or RAIM is lost, aircraft tracking must be closely monitored against other available navigation systems.

States may consider the deployment of GNSS threat monitoring system, which allows monitoring of local GNSS interference environment; signal recording and monitoring for situational awareness of any drop in signal quality or signal outage and ground validation of GNSS-based flight procedures. The detection equipment may include localization utilities.

With reference to ICAO Doc 9849:

Given the variety of avionics designs, one service status model cannot meet all operators' requirements. A conservative model would produce false alarms for some aircraft. A less conservative model would lead to missed detection of a service outage for some and false alarms for others. Regardless, only the aircrew, not ATC, is in a position to determine whether, for example, it is possible to continue an ABAS-based instrument approach. In contrast, ATC has access to ILS monitor data and can deny an ILS approach

clearance based on a failure indication. The real time monitor concept is neither practical nor required for GNSS ABAS operations. It may be practical for SBAS and GBAS, but implementation would depend on a valid operational requirement.
Aircraft operators with access to prediction software specific to their particular ABAS/RAIM avionics will find it advantageous to employ that software rather than use the general notification service. In the case of SBAS and GBAS, operators will rely on service status notifications.

6. REPORTING

ANSP must be prepared to act when anomaly reports from aircraft or ground-based units suggest signal interference. If an analysis concludes that interference is present, ANS providers must identify the area affected and issue an appropriate NOTAM.

From the perspective of the aircrew, a GNSS anomaly occurs when navigation guidance is lost or when it is not possible to trust GNSS guidance. In this respect, an anomaly is similar to a service outage. An anomaly may be associated with a receiver or antenna malfunction, insufficient satellites in view, poor satellite geometry or masking of signals by the airframe. The perceived anomaly may also be due to signal interference, but such a determination requires detailed analysis based on all available information.

In case of GNSS anomaly detected by aircrew, **Pilot** action(s) should include:

a) reporting the situation to ATC as soon as practicable and requesting special handling as required;
b) filing a GNSS Interference Report using the Template at **Appendix A**, and forwarding information to the IATA MENA (sfomena@iata.org) and ICAO MID Office (icaomid@icao.int) as soon as possible, including a description of the event (e.g. how the avionics failed/reacted during the anomaly).

Controller action(s) should include:

a) recording minimum information, including aircraft call sign, location, altitude and time of occurrence;
b) cross check with other aircraft in the vicinity;
c) broadcasting the anomaly report to other aircraft, as necessary;
d) notify the AIS Office in case NOTAM issuance is required; and enable the fallback mode and implement related procedure and process (contingency measures).

ANSP action(s) should include:

a) ensuring the issuance of appropriate advisories and NOTAM, as necessary;
b) attempting to locate/determine the source of the interference, if possible;
c) notifying the agency responsible for frequency management (the Telecommunication Regulatory Authority);
d) locate and eliminate source in cooperation with local regulatory & enforcement Authorities;
e) tracking and reporting all activities relating to the anomaly until it is resolved; and
f) review the effectiveness of the mitigation measures for improvement.

ICAO MID Office action(s) should include:

a) collect anomaly related information and determine the course of action required to resolve reported anomalies;
b) follow-up with State having interference incident to ensure implementation of required corrective actions;
c) coordinate with concerned adjacent ICAO Regional Office(s) to follow-up with States under their accreditation areas, when needed; and
d) Communicate with ITU Arab Office and Arab Spectrum Management Group to resolve frequent interference incidents, when needed.

7. References:

- Annex 10 Aeronautical Telecommunications, Volume I ─ Radio Navigation Aids
- Annex 11 Air Traffic Services
- PANS-ATM, ICAO doc 4444
- ICAO Doc 9613 PBN Manual
- ICAO Electronic Bulletin 2011/56, Interference to Global Navigation Satellite System (GNSS) Signals.
- GNSS Manual, ICAO Doc 9849
- Standardization of GNSS Threat reporting and Receiver testing through International Knowledge Exchange, Experimentation and Exploitation, STRIKE3 EUROPEAN Initiative, Paper 74
- The report of Vulnerabilities Assessment of the Transportation Infrastructure relying on the Global Position System, US Department of Transportation.
- Operational Impacts of Intentional GPS Interference. (A Report of the Tactical Operations Committee in Response to Tasking from the Federal Aviation Administration. March 2018.
- CANSO Cyber security and Risk Assessment guide.
- ICAO GNSS RFI Mitigation Plan and associated EUROCONTROL Efforts, 8 Nov 2016
- European Global Satellite Agency System, GNSS Market Report issue 4, March 2015
- MID Doc 007 (MID Region PBN Implementation Plan
- MID Doc 010 (The Guidance on GNSS implementation in the MID Region)

Appendix A

1. **GNSS interference reporting form to be used by pilots**
   ** Mandatory field*

Originator of this Report:	
Organisation:	
Department:	
Street / No.:	
Zip-Code / Town:	
Name / Surname:	
Phone No.:	
E-Mail:	
Date and time of report	
Description of Interference	
*Affected GNSS Element	[ ] GPS [ ] GLONASS [ ] other constellation [ ] EGNOS [ ] WAAS [ ] other SBAS [ ] GBAS (VHF data-link for GBAS)
Aircraft Type and Registration:	
Flight Number:	
*Airway/route flown:	

Coordinates of the first point of occurrence / Time (UTC):	UTC: Lat: Long:
Coordinates of the last point of occurrence / Time (UTC):	UTC: Lat: Long:
*Flight level or Altitude at which it was detected and phase of flight:	
Affected ground station (if applicable)	Name/Indicator; [e.g. GBAS]
*Degradation of GNSS performance:	[ ] Large position errors (details): [ ] Loss of integrity (RAIM warning/alert): [ ] Complete outage (Both GPSs), [ ] Loss of GPS1 or Loss of GPS 2 [ ] Loss of satellites in view/details: [ ] Lateral indicated performance level changed from:___to ___ [ ]Vertical indicated performance level changed from: __ to __ [ ] Indicated Dilution of Precision changed from __ to__ [ ] information on PRN of affected satellites (if applicable) [ ] Low Signal-to-Noise (Density) ratio [ ] Others
*Problem duration:	[ ] continuous for 20 minutes [ ] intermittent

Note: Only applicable fields need to be filled!

Appendix B

Risk Assessment

Threats and vulnerabilities

A threat assessment should be performed to determine the best approaches to securing a GNSS against a particular threat. Penetration testing exercises should be conducted to assess threat profiles and help develop effective countermeasures.

Table (B1) presents an overview of different potential impacts from GNSS interference. This is a snapshot of impacts based on input from two manufacturers and not intended to be a comprehensive list of all impacts:

Effect	Affected Operation	Impact
Loss of GNSS-based navigation	Enroute/ Terminal/ Approach	Aircraft with Inertial Reference Unit (IRU) or Distance Measuring Equipment (DME)/DME may have degraded RNP/RNAV. Aircraft may deviate from the nominal track May increase workload on aircrew and ATC May result in missed approach or diverting to other runway in case the aerodrome operating minima cannot be met through conventional precision or visual approaches. Conventional ATS routes, SIDs and STARs would be used.
Larger than normal GNSS position errors prior to loss of GNSS	Enroute/ Terminal/ Approach	Interference could cause the GNSS position to be pulled off but not exceed the HAL (2NM , 1NM, 0.3NM for enroute, terminal and approach phases, respectively).
Loss of EGPWS/ TAWS	Enroute/ Terminal/ Approach	Reduced situational awareness and safety for equipped aircraft. Terrain Awareness and Warning System (TAWS) is required equipment for turbine-powered airplanes > 6 passengers. Loss of GPS results in loss of terrain/obstacle alerting. Position errors as GPS degrades can result in false or missed alerts.
Loss of GPS aiding to AHRS	Flight Control	Can result in degradation of AHRS pitch and roll accuracy with potential downstream effects such as was experienced by a Phenom 300 flight.

Loss of GNSS to PFD/MFD	All flight phases	Can result in: -Loss of synthetic vision display and flight path marker on PFD -Loss of airplane icon on lateral and vertical electronic map displays, georeferenced charts, and airport surface maps without DME-DME or IRU -Loss of airspace alerting and nearest waypoint information without DME-DME or IRU Overall loss of situational awareness to flight crew and increased workload.
No GNSS position for ELT	Search and Rescue	Loss of GNSS signal could result in larger search areas for the Emergency Locator Transmitters (ELTs)

Table B1: Potential Impact from GNSS

Consequence/Impact of risk occurring

Category	Effect on Aircrew and Passengers	Overall ATM System effect
Catastrophic 1	Multiple fatalities due to collision with other aircraft, obstacles or terrain	Sustained inability to provide any service.
Major 2	Large reduction in safety margin; serious or fatal injury to small number; serious physical distress to air crew.	Inability to provide any degree of service (including contingency measures) within one or more airspace sectors for a significant time.
Moderate 3	Significant reduction in safety margin.	The ability to provide a service is severely compromised within one or more airspace sectors without warning for a significant time.
Minor 4	Slight reduction in safety margin.	The ability to provide a service is impaired within one or more airspace sectors without warning for a significant time
Negligible 5	Potential for some inconvenience.	No effect on the ability to provide a service in the short term, but the situation needs to be monitored and reviewed for the need to apply some form of contingency measures if the condition prevails.

Table B2: Impact of Risk Occurring

Likelihood of risk occurring

The definitions in the table (B3) were adopted for estimating the likelihood of an identified risk occurring, for this purpose, five situations are considered:

Event is expected to occur	
1	More frequently than hourly
2	Between hourly and daily
3	Between daily and yearly
4	Between yearly and 5 yearly
5	Between 5 and 50 years
6	Less frequently than once every 50 years

Table B3: Likelihood of risk occurring

Assessment of the level of risk and risk tolerance

All identified risks were reviewed and provided for each an overall risk ranking which is a combination of the two characteristics of consequence and likelihood. For example, a risk with a major consequence but a "5" likelihood would be described as having an "A" or "unacceptable" risk rating. The conversion of the combination of consequence and likelihood into a risk rating has been achieved by use of the following matrix.

Likelihood Criteria		**Consequence Criteria**				
Event expected to occur:		**Catastrophic 1**	**Major 2**	**Moderate 3**	**Minor 4**	**Insignificant 5**
1	**More frequently than hourly**	**A**	**A**	**A**	**A**	**C**
2	**Between hourly and daily**	**A**	**A**	**A**	**B**	**D**
3	**Between daily and yearly**	**A**	**A**	**B**	**C**	**D**
4	**Between yearly and 5 yearly**	**A**	**B**	**C**	**C**	**D**
5	**Between 5 and 50 years**	**A**	**B**	**C**	**D**	**D**
6	**Less frequently than once every 50 years**	**B**	**C**	**D**	**D**	**D**

Table B4: Risk Assessment Table

The previous matrix provides a guide to determine which risks are the highest priorities from the perspective of the timeliness of the corrective action required. The following table outlines the position in more definitive terms.

Safety tolerability risk matrix

Risk Index Range	Description	Recommended Action
A	Unacceptable	Stop or cut back operation promptly if necessary. Perform priority/immediate risk mitigation to ensure that additional or enhanced preventive controls are put in place to bring down the risk index to the moderate or low range
B	High Risk	Urgent action. Perform priority/immediate risk mitigation to ensure that additional or enhanced preventive controls are put in place to bring down the risk index to the moderate or low range
C	Moderate Risk	Countermeasures actions to mitigate these risks should be implemented.
D	Low Risk	Acceptable as is. No further risk mitigation required

Table B5: Risk Tolerability Matrix

Sample risk assessment

The risk assessment table (B6) could be used to identify and capture the threats, select the risk rating based on the risk matrix above considering the existing controls. In addition, recommended actions could be selected to minimize the risk.

L = Likelihood
C = Consequence
R = Risk

Threat	**Initial Risk**			**Existing controls**	**Accept/Reduce**	**Recommended controls**	**Residual Risk**		
	L	C	R				L	C	R

Table B6: Sample Risk Assessment tables

The table (B7) below is an example of risk assessment for approach phase of flight, the detailed Risk assessment process is at Appendix B

L = Likelihood
C = Consequence
R = Risk

Threat	Initial Risk			Existing controls	Accept/ Reduce	Recommended controls	Residual Risk		
	L	C	R				L	C	R
Between daily and yearly	**3**	**2**	A	-Error message notification by avionic	Reduce	1)using of on-board equipment (IRS); 2)Interference detector by ANSPs 3) executing miss-approach	3	4	C

Table B7: Example Risk Assessment for Approach phase of flight

Another example risk assessment for en-route phase of flight at table (B8)

L = Likelihood
C = Consequence
R = Risk

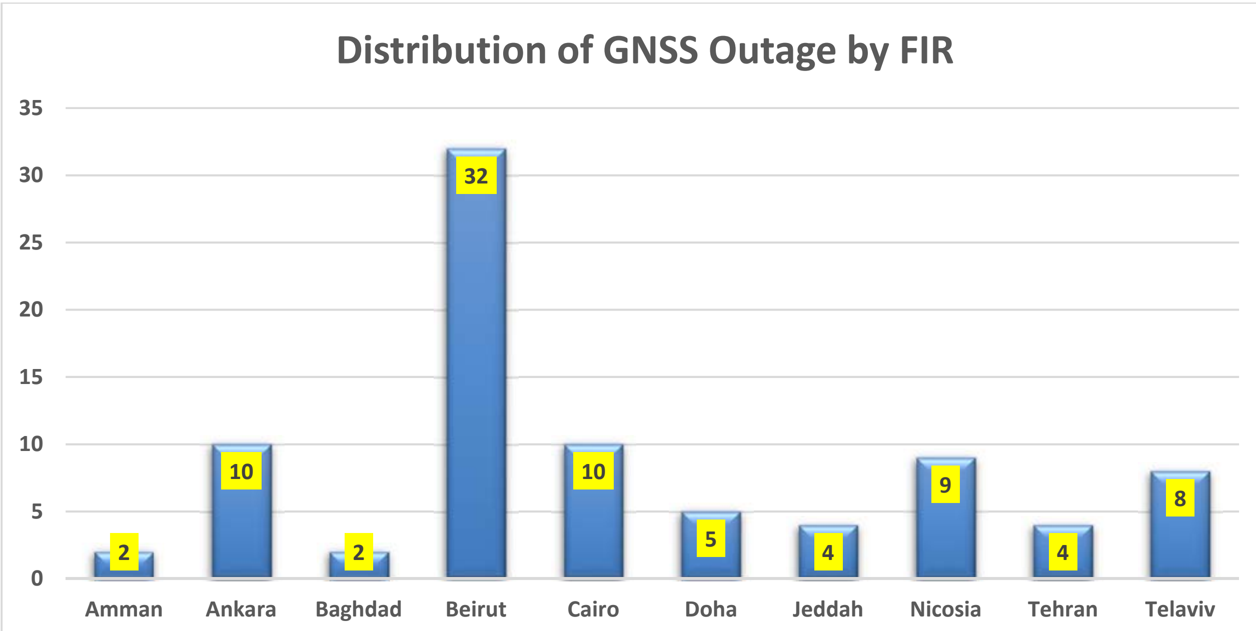
Threat	Initial Risk			Existing controls	Accept/Reduce	Recommended controls	Residual Risk		
	L	C	R				L	C	R
Between 5 and 50 years (short time GNSS Outage)	5	5	D	-Error message notification by avionic -Regulations/ law to protect the GNSS signal	Accept	-			

Table B8: Example risk assessment for enroute phase of flight

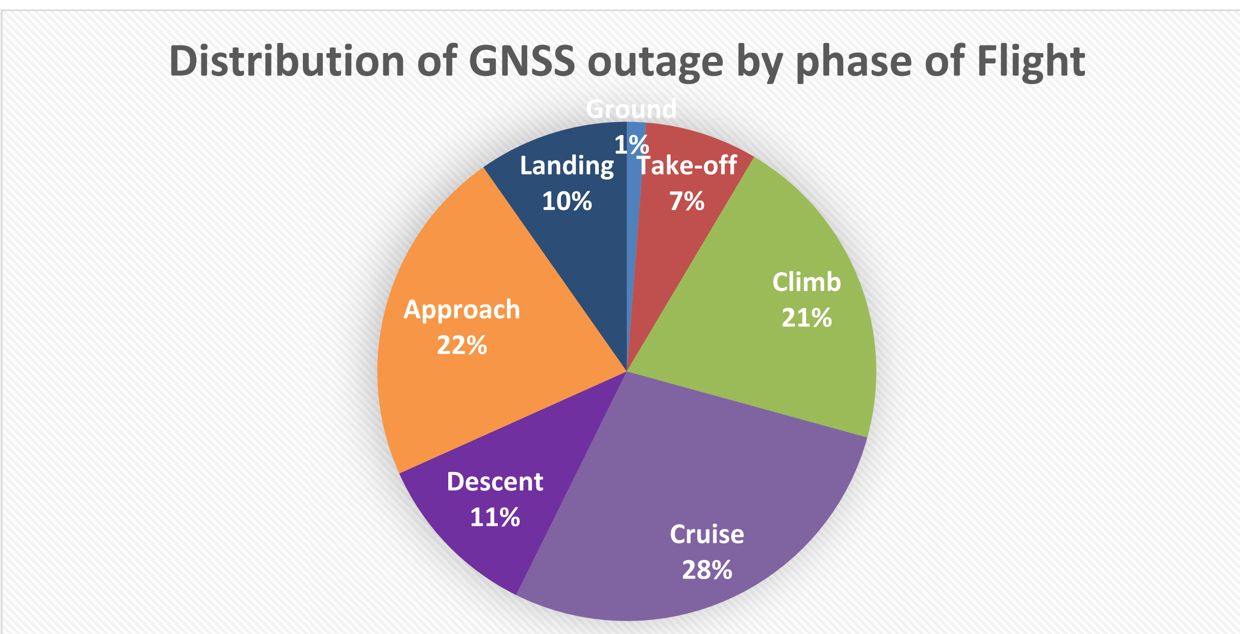
Appendix C

GNSS Anomaly for the Period January 2015- June2018

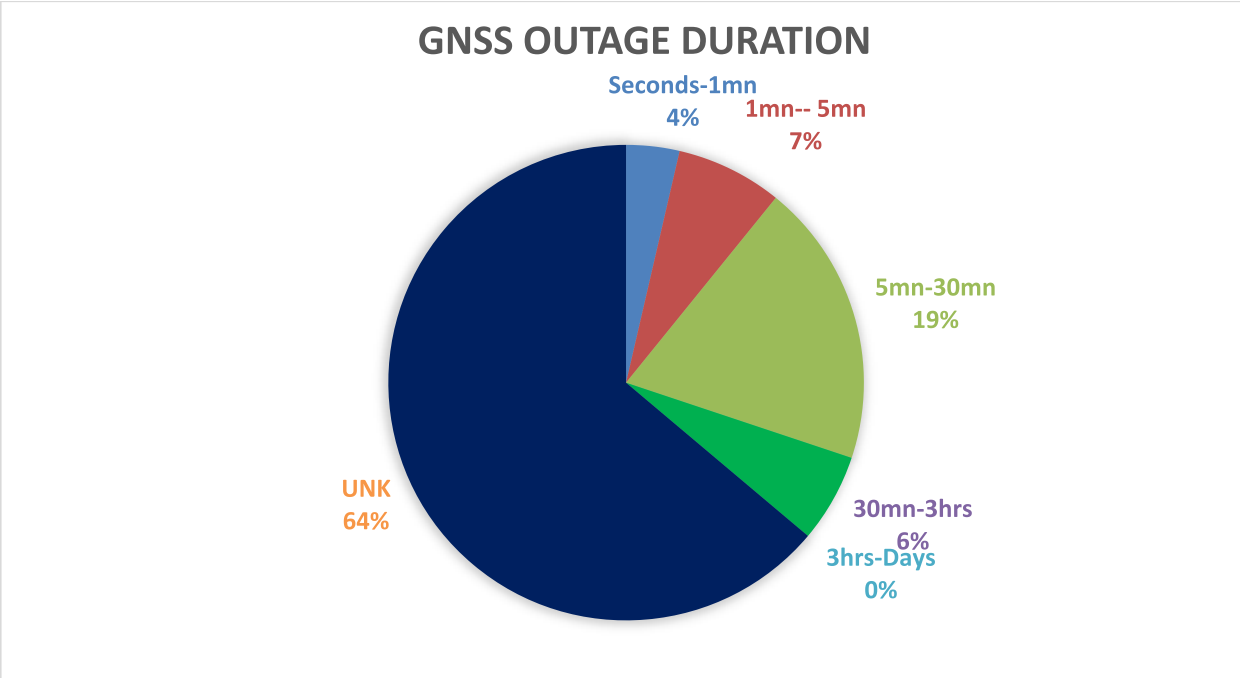
Brief data analysis of the incidents reported during Brief data analysis of the incidents reported by Air Operator is as follows:



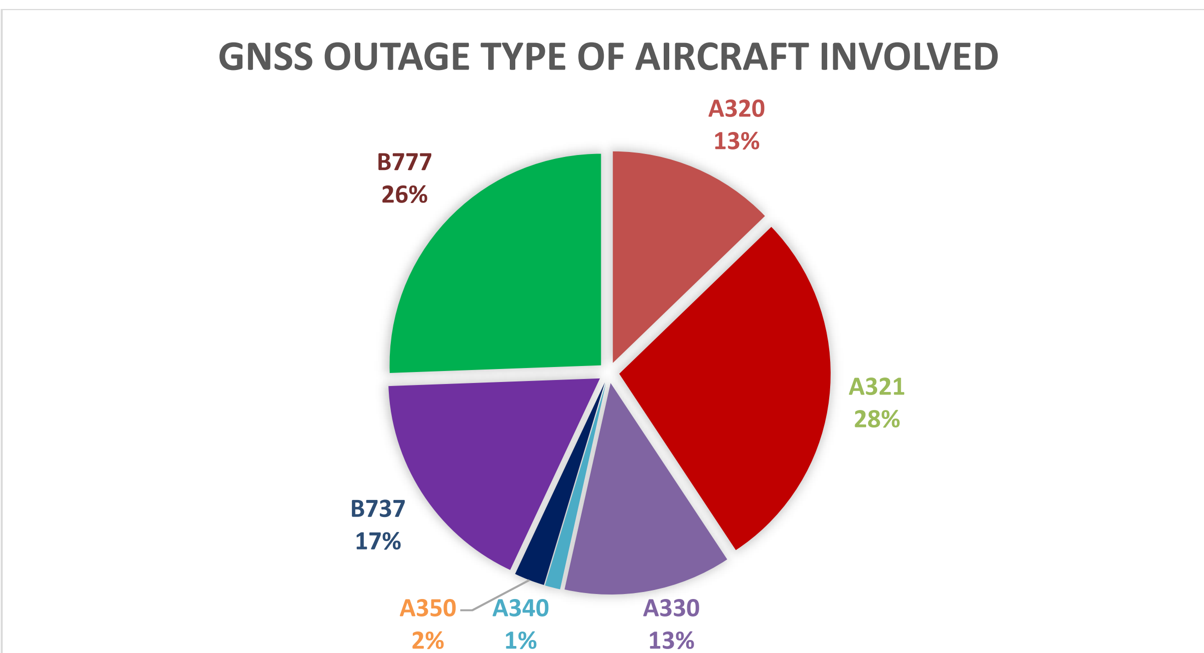
The data revealed that the most significant Flight Information Regions (FIRs) affected Beirut, followed by Cairo, Ankara, and Nicosia.



The data shows that the highest GNSS Outage occurred during the phase of flights cruise, approach, climb, and descent.



The data shows the highest GNSS outage duration was between 5 minutes- 30 minutes. Regarding the Unknown (UNK) it could not be determined as the data was not provided.



The A321, B777, and B737 were most flown aircraft type in areas most affected.

Implementation of Evidence Based Training (EBT)

Position & detailed comments in response to NPA 2018-07

1. Introduction

While in general ECA endorses EBT and the principle of 'less checking more training' a **cautious approach to the implementation of EBT is crucial**, while keeping in mind several essential safeguards. Implementation of EBT means a paradigm shift and cannot be understood simply as replacement of a sometimes-outdated set of critical events with a new set. Crucially, EBT implementation must have as a goal more effective training programs with associated improvements in operational safety.

In order to achieve that, it is crucial that EBT programs are closely linked to the respective operator's environment and are not generic. Also, before a competent authority approves an EBT program for a respective operator, it must assess the operator's capability to support the implementation of such program. Where a competent authority grants an approval for EBT programs, inspectors must receive qualification and training in EBT principles, application, approval processes and continuing oversight.

The availability of data covering both flight operations and training activity has improved substantially over the past years. ECA therefore supports the implementation of EBT as a logical step to update the current training practices in the light of evidence from these data sources. It is however of utmost importance that data collection and the protection of data are at an adequate level, and only deindividualized data is being used for the training purposes.

This paper outlines **ECA's views and concerns on selected proposals as introduced via NPA 2018-07**, that - if approved and implemented - could have negative consequences on the quality of future pilot training.

2. ECA's key concerns as identified in NPA 2018-07

To deliver on the anticipated improvements in pilot training quality and associated operational safety, the following concerns need to be addressed:

- Too loose link of the EBT program to the operator
- Insufficient involvement of the authorities in the approval of the operator's competency framework
- Insufficient requirements for EBT inspectors (need for qualification & training in EBT principles, application, approval processes and continuing oversight)
- License revalidation by an instructor who has not performed the final competency assessment
- Limited or no line flying practice for instructors
- Practical assessment in competencies by an SFI[1]

[1] Synthetic Flight Instructor

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- ✈ Training provided by pilots not being FCL instructors
- ✈ Possibility for a renewal of type rating within an EBT program
- ✈ Lack of provisions for adequate data collection and protection (use of deindividualized data for training purposes).

3. Detailed comments

■ Operational characteristics of the operator and a key role to play for the national aviation authorities

EBT programs cannot be generic but must be linked to the respective operator's environment. When enhancing a baseline EBT training program it is important to first analyse the specific operational characteristics of the operator. This includes aircraft types, route structure and typical sector lengths, special operations, destinations requiring special attention, pilot experience levels and company/safety culture. It is very important to focus on the most critical operational risks identified and the training that can demonstrably mitigate these. Hence, there **must be a close correlation between training and operations**.

Before approving an EBT programme for a respective operator - the competent authority must assess the capability of an operator to support the implementation of the EBT programme. The criteria of **maturity of operator's safety management system** must be clearly defined in EASA's governing regulation, and detailed guidance must be provided to enable the authority to assess what is meant by maturity. When capability is simply linked to the availability of resources, important aspects of such maturity might not be captured.

Moreover, where a competent authority grants an approval for EBT programmes, **inspectors must have received qualification and training in EBT principles, application, approval processes and continuing oversight.** The competent authority shall assess and oversee the EBT programme, together with the processes that support the implementation of the EBT programme. For proper approval and oversight of evidence-based training programmes - it is therefore important that the inspectors are trained in EBT assessment of competence in the same way as any EBT instructor to be able to perform efficient supervision.

Due to the lack of experience and the newness of the EBT concept, we are going to observe a disparity of criteria amongst competent authorities, which may affect crews, operators, and therefore might create an unfair competition by different requirements. National authorities will need to be trained and guided, to ensure that their assessment and oversight is standardised and aligned with the EASA principles.

ECA proposes **EASA to provide and be responsible for the training, guidance, oversight and final approval of EBT programs**, at least in the initial stages of mixed and base line implementation.

■ Competency framework & involvement of the authorities

Just like for quality processes and instructors' standardization, the EBT concept offers the possibility for an operator to assess competencies with different frameworks. It is therefore the authority's responsibility to approve the competency framework used by the operator's program. Article 30 of the ICAO Convention puts in place the need of mutual recognition of licenses. Moving from a prescriptive to a competency-based system should be done with an equivalent level of responsibility of ICAO states.

An **adapted competency framework** is the DNA of an EBT program. The complexity of the task – i.e. of setting up such a competency framework and adapting it to the operational environment of the respective operator / ATO – is high enough to justify the authorities' commitment, starting by defining what such framework means and entails.

Licenses validities are based on delivery and revalidation processes. As EBT will introduce a new way to revalidate licenses and Class or Type rating – with the use of CBT – the revised ICAO PANS training[2] should be the base line for EASA's implementation and taking into account ICAO's work on CBT.

- **EBT program and license validation**

Only instructors who are enrolled and thoroughly trained in the operators' EBT program can be at the right level of knowledge for both the operational environment and the ATO specific competency model, and with the relevant experience[3].

ECA opposes the proposed concept of license revalidation[4] allowing for a delegation of signature to someone who has not done the final competency assessment (or has not even been involved in the assessment at all). In other words: The examiner (TRE) conducting the respective EBT module must be the person signing the revalidation.

- **Instructors and examiners**

Integral and key part of any operator's training corpse are the **instructors and examiners**.
One of the rationales as introduced in the NPA is that EASA foresees monitoring only for examiners[5] however wants to include *qualified commanders* and *SFI* in crucial parts of the program without any regulatory quality monitoring being required.

An **EBT instructor must be enrolled in the operators' EBT program** and have successfully completed the Operator's recurrent program[6]. This will ensure that the instructors providing EBT are flying the line for this designated EBT operator which is essential as this is a <u>recurrent training scheme</u>, not a qualification program.

Air operations are evolving very quickly, as technology is in permanent evolution. Therefore, **only regular exposure to normal operation will allow instructors to maintain a strong link between line experience and training** – which is a fundamental pillar of the EBT concept.
Line operations are under the privileges of TRI/TRE[7] as it is required to hold a valid licence to train or check. Hence, only TRI/TRE are relevant for operational assessment in an EBT program.

- **SFI and the issue of competence and currency**
  ECA opposes the use of SFI without adequate training & experience in the context of EBT. No practical assessment in competencies can be delegated to SFI in the context of EBT.
  According to NPA 2018-07, EBT is only considered for recurrent training for pilots already type qualified, and it is also used to validate the operational proficiency check. SFIs do not have any requirement to have line experience (1500 hours in a multi-pilot airplane) and even less to have recent experience of line flying in the airline. Therefore, they do not possess the competence to assess a pilot during a Line Orientated Exercise (LOE) or Scenario Based Training (SBT). This assessment can only be done by a TRE-EBT or a TRI-EBT.

[2] Amendment 5 to be published
[3] As specified in ARO.OPS.226 (c) (2) (iv)
[4] Page 207 of the NPA 2018-07, referring to Annex 1 (Part FCL) to Regulation (EU) No 1178/2011
[5] AMC2 ARA.FCL.205 and GM to AMC2 ARA.FCL205(b)
[6] as per ORO.FCL.231
[7] TRE = Type Rating Examiner / TRI = Type Rating Instructor

> The above comes from the definition of competency[8] and shows that to be able to observe a competency the instructor must have a **practical knowledge of the line flying** activity.

In addition to the above, **instructors must be trained in, or hold, CRM-I** in order to become an EBT instructor. Without a deep understanding of human factors and CRM, it is impossible for an instructor (regardless of the type and/or experience) to be able to identify, train and assess all competencies.

The minimum level of instructor for EBT is TRI. As the validation of a module is giving credits against ICAO Annex 6 on one hand and allowing less frequent line checks on the other hand, the validation of one module cannot be done by less than a trained, standardised TRI.

Moreover, having the **ability to accurately apply the principles of *fault analysis*** should be a major determinant in the selection process of an instructor who will be expected to conduct a competency-based training program such as EBT.

Finally, ECA **cannot support that FCL training is provided by pilots not being FCL instructors** at all. This would not only create a legal loophole as those EBT instructors could potentially be trained by persons not proficient, but also not entitled to deliver FCL assessment.

- **Renewal of type-rating**

ECA is opposed to the possibility of renewal of type rating within EBT programme. As EBT is a new way of training for recurrent training, it is not mature enough to deliver or renew a licence, class or type rating. Renewal should remain under the existing training scheme.

- **Data collection and training data monitoring programme**

EBT is data driven. It is therefore of utmost importance that data collection and the protection of data are at an adequate level. This is not only relevant for protection of the system but also of the individual personal data.

The operator must therefore establish and maintain a training data monitoring programme, of a non-punitive nature, containing adequate safeguards to protect the source(s) of the data.

Flight data (as well as any other data collected) must be deindividualized, before it can be used for training purposes.

- **Assessment of non-technical skills & non-verbal communication**

Assessment of Non-Technical Skills requires a high level of training and standardization amongst the instructor corpse. Even for highly trained human factors specialists and psychologists it is almost impossible to correctly assess non-verbal communication, therefore behavioral indicators like "correctly interprets body language" should not be used towards a final competency assessment.

- **Mind change for the examiners & a need for a change of thinking**

Especially for scenario-based evaluation and training the range and variety of possible scenarios will increase and possibly differ from current LOFT scenarios through including other operational aspects than purely technical ones (e.g. including incidents in the cabin, on ground, Dangerous Goods issues and other external threats). This will require different (e.g. role play) qualities amongst the instructor corpse, which will need to be addressed in instructor training/recurrent training.

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[8] NPA page 16

Appendix

Definitions - CBT vs EBT

There seems to be, many times, confusion about the terms CBT and EBT, with some experts even using these terms interchangeability. We have therefore identified a need for a simple terminology clarification:

Competency based training (CBT) is an underpinning concept, concentrating on the output of training. Teaching and learning using this approach aims at developing and strengthening concrete skills rather than learning abstract concepts. In CBTA - training and assessment are oriented at performance, with an emphasis on the standards of performance and their measurement. That on the other hand requires properly defined competencies and competence standards.
Moreover, in CBTA focus is placed on the training and developing of competencies rather than on the pure assessment. Some competencies will have to develop over time and cannot be taught as such. The assessment as such must focus on the enhancement of the competency rather than just following a fail/pass concept. CBTA can exist independently from EBT. One example where that is the case – is MPL which shifted focus from prescriptive requirements to competency training and assessment.

Evidence based training (EBT), on the contrary, relies on the concept of CBTA. According to the EBT methodology, as the name suggests, the curriculum/program for recurrent training is built on evidence, using the underpinning concept of CBT. In EBT, the development of the curriculum is data driven, synthesizing information from e.g. flight data records, training data, audit observations, accidents and incidents[9].
The approval of the program should be focused on the process and validation of developing the curriculum rather than on the contents itself.[10]

New approach to pilot training

Implementation of Evidence Based Training (EBT) by the operators means a paradigm shift. It cannot be simply understood as replacement of sometimes-outdated *set of critical events* with a new set. Rather, the scenario-based events should be used as a vehicle and a means to develop and assess crew performance across a range of required defined competencies.
There are many elements that are crucial for the right EBT development. With EBT being based on 'evidence', one of these preconditions is a thorough data analysis capability within an operator, in order to evaluate all the available data. Such analysis must be conducted by a knowledgeable team of instructors and must rely on the data from multiple training sessions.
In EBT programs – a 'refocusing' of the instructor is necessary. That includes putting focus on the root causes analysis of unsuccessfully flown maneuvers rather than simply asking the pilot to repeat a maneuver with no real understanding as to why it was not successfully flown in the first place. Within such an EBT session - the instructor needs to analyze where and why the maneuver was unsuccessful and come up with appropriate mitigating measures.
E.g. an unstable approach is quite often caused by a bad descent planning in the first place, therefore a reposition on 6 miles final will not address the root cause of the problem. However, that analysis is not related to data as such, but is rather an observation.

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[9] ICAO Doc 9555
[10] As stated in ICAO Doc 9555 3.4.1.
It is necessary to collect real world data from accidents, incidents, flight operations and training to feed and validate course development. Data collection as described in this manual has been used to construct the baseline EBT programme and will be reviewed and updated on a continual basis. The enhanced EBT programme described in Chapter 5 of this Part is intended to create an improvement to the baseline programme, utilizing operator-specific data.